73 AMATEUR RADIO

APRIL 1977
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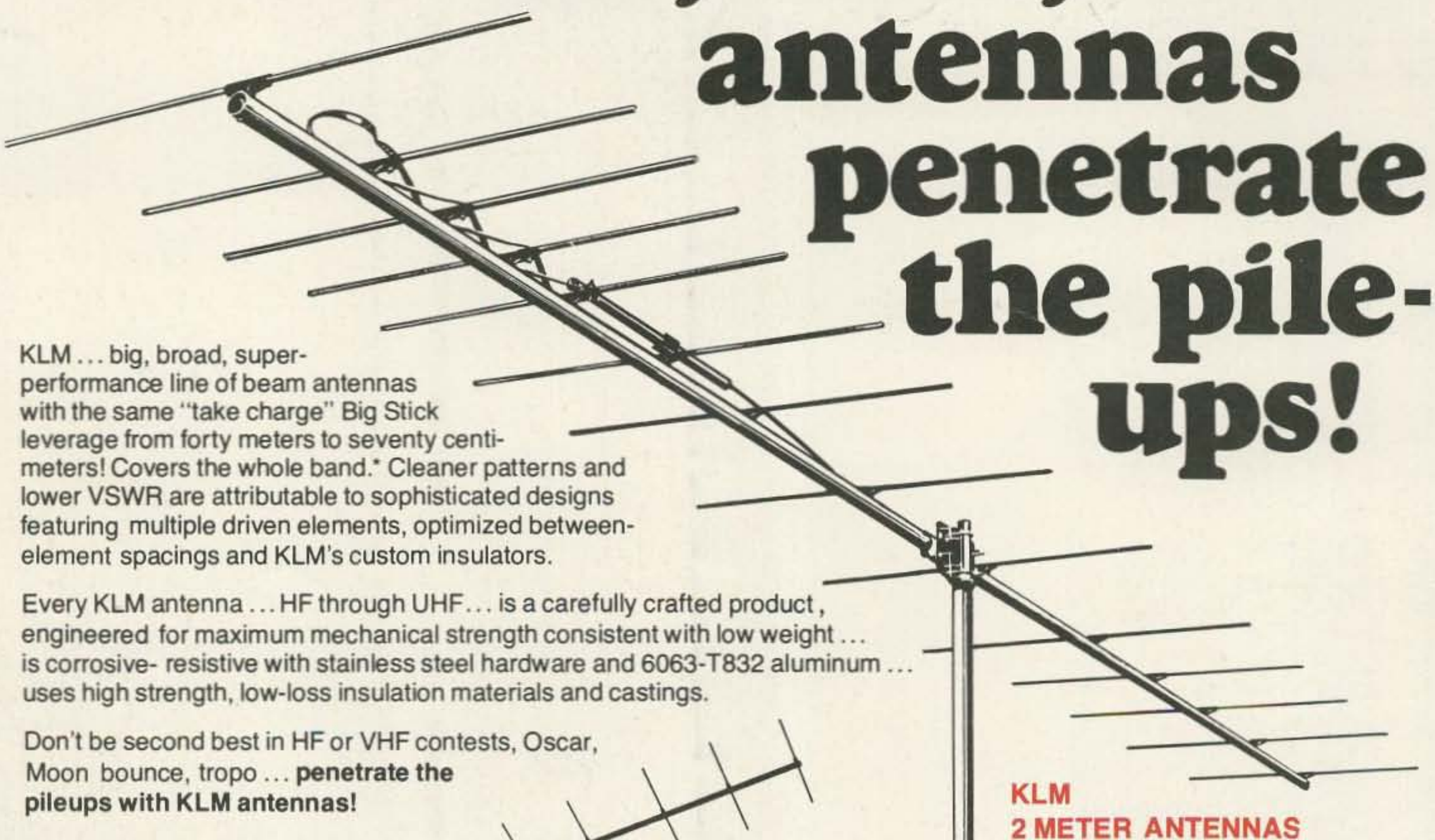

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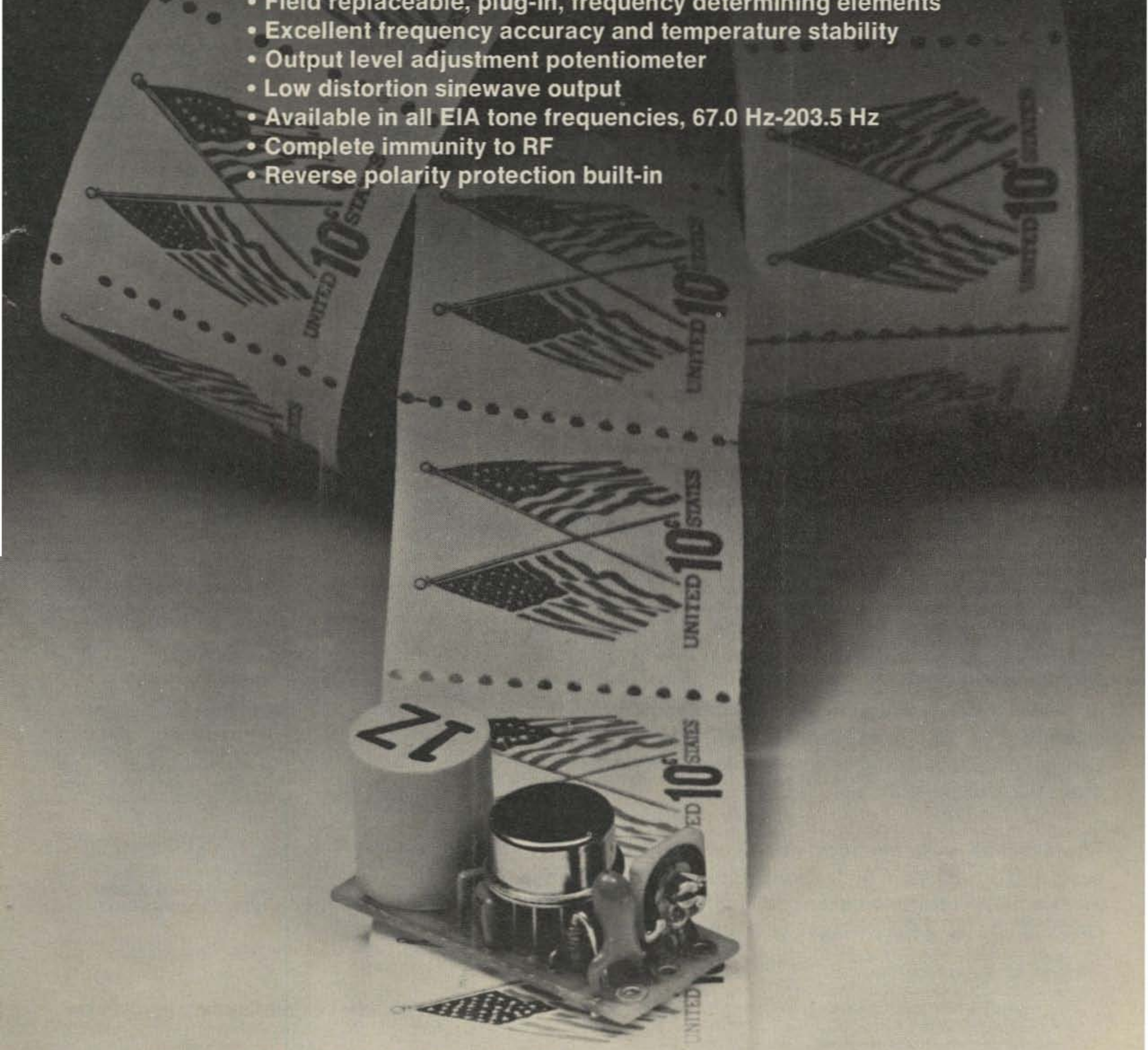

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Buffalo's Worst Winter

Paragraph A of the FCC Rules and Regulations part 97.1 says that one of the fundamental purposes of the amateur radio service is "Recognition and enhancement of the value of the amateur service to the public as a voluntary non-commercial communication service, particularly with respect to providing emergency communications."

During the snow disaster in Buffalo NY at the end of January, amateurs proved their worth by taking over the job of emergency coordination of medical, food, and fuel supplies to the stricken city. The WR2ABU 31/91 repeater located in Buffalo was the focal point organized at the outset of the snow emergency on January 28. Repeater director Gilbert Boelke W2EUP, in a *73* interview, said that the week before the blizzard, the group had installed an emergency power system at the site. The new system received a test when it kept the repeater on at reduced power during four extended power failures. In another coincidence, the simulated emergency test scheduled for that weekend turned into the real thing.

Two other repeaters of the Buffalo Amateur Repeater Association were also used for coordination during the emergency: WR2ADR on 13/73 and WR2ACA on 40/00. WR2ACA is powered completely by a wind-driven generator. Gusts of up to 65 miles per hour during the blizzard kept it going at full capacity.

W2EUP said that over a hundred Buffalo area hams were involved in the emergency net, many of them on the air for over twenty hours a day. In the worst winter in the Buffalo area in 80 years, the area received over fifteen feet of snow in a three week period, prompting the city's 56 year old weatherman to give up and take early retirement. Driving in the downtown area was banned for over two weeks, and delivery of emergency supplies was undertaken by snowmobile.

Last fall, the Buffalo Amateur Repeater Association joined the local CB REACT group (Radio Emergency Associated Citizens Band Teams) in a cooperative effort aimed at keeping area motorists informed of traffic emergencies. The idea was the brainchild of a group of amateurs employed by radio station WBEN in Buffalo. The station received permission from the FCC to tape and rebroadcast repeater transmissions. They set up an emergency control center in the studio building. At the center, members of the REACT group and amateurs continually monitor CB channels and repeaters. When a traffic accident or hazard is reported, the message is immediately relayed to the announcer on duty via a video terminal. The police are also notified. Tapes of amateur transmissions are used when time and the situation warrants.

WBEN technical director Jerry Klebunde said he's happy with the results of the setup and feels that the station has been successful in reaching motorists without the capability of receiving hazard reports via amateur or CB radio.

Stan Miastkowski WA1UMV
Associate Editor

The Ban Moves Closer

Drastic changes are in the works concerning the way amateur equipment is manufactured and sold. At deadline, the FCC was releasing two notices of proposed rule making that would make a 180 degree turn-about in the current trend towards deregulation. At issue is the plague of interference complaints (see "C'mone Texas Salt Rat" in guest editorials, March, '77) and unprecedented pressures on the FCC to do something to stop it.

One of the dockets would completely ban the manufacture and sale of linear amplifiers that operate in the 24 through 35 MHz range. It is a direct result of widespread violations of the CB power limit, use of amateur equipment out of band by CBers, and the use of broadband amps made only for the CB market under the guise of 80 through 10 meter coverage. (Input power required by the bogus amps is usually only 4 Watts.) Many of the so-called "black boxes," when tested in the FCC lab, showed incredible amounts of spurs. Several makes actually couple raw ac into the power meter circuit, in an attempt to raise indicated output!

The FCC has tried several approaches to slow down the distribution and use of the illegal amps, but the complaints have only intensified. That leaves the Commission with little choice: Unable to control their use, the FCC has decided to turn off the pipeline. In throwing the switch, however, amateurs everywhere will begin to feel the pinch.

No matter who you talk to, there is strong feeling at the FCC that they don't want to hurt the amateur. But the bottom line, in face of growing political pressure to do something about interference, is that the situation leaves the FCC no choice – limits on linears and type acceptance of *all* amateur equipment are soon to be reality.

There are some loopholes in the FCC proposals. For one thing, home brewing will be allowed for. The linear ban proposes that any licensed amateur may build *one* linear amplifier covering 24-35 MHz for use at a licensed amateur station. The linear can then be sold, but only to another licensed amateur. Here again, the FCC appears to be relying on the amateur community's long standing ability to be self-policing in terms of enforcement.

The second proposal will have an even greater impact on amateur radio as we know it. The FCC wants to make all amateur transmitting equipment and amplifiers subject to type acceptance. The proposed guidelines would roughly follow the same specifications applied to the land mobile service. The means the formula $43 + 10\log$ of mean power is used to determine the permissible level of spurs. For a 10 Watt transmitter, spurs would have to be 53 dB below the output. For a 100 Watt rig, 63 dB; 73 dB for a 1000 Watt transmitter. This, in effect, puts a 50 uW limit on spurs at 100 Watts output. To put it another way, at the 53 dB figure, it would take nearly *two million* Watts for the spurs to equal 10 Watts. As for home brewing, the FCC proposal would allow any licensed amateur to modify commercial equipment, or build his own, which would not be subject to specs.

The reaction to all this was slow in coming at deadline. One of the first groups to react was ARMA, the newly formed Amateur Radio Manufacturer's Association. ARMA had attempted to derail the linear ban (see guest editorials, March, '77), but succeeded only in delaying it. Comments on the proposal will undoubtedly push for alternative methods of limiting illegal use of amplifiers and amateur equipment, but the FCC seems most reluctant to consider anything but a blanket ban. As ARMA spokesman Dennis Had of Dentron Radio put it in a *73* interview, "We have an incredible task ahead of us . . . first there is the need for our comments on the proposals . . . and then counterproposals. There is also the problem of existing production runs, and how to decide when the new measures must take effect." Had estimates that if type acceptance becomes law, it will up the cost of commercial equipment somewhere between $150 and $300 per rig.

There is strong feeling among manufacturers and amateurs alike that the amateur community is being made to pay for the past mistakes of both the FCC and "black box" manufacturers. Our hobby, they point out, has never been fully represented in Washington, because of the ARRL's tax exempt status (which prevents the League from being an effective lobby). ARMA is representing us now, but is facing off against some of the most powerful "money" lobbies in Washington – the broadcasters (who share an attorney with the ARRL) and the TV manufacturers.

The NAB (National Association of Broadcasters), represented by ARRL General Counsel Robert Booth W3PS, is putting strong pressure on Congress to do something about TVI. NAB says too many stations are losing viewers because of the interference . . . people

switching from TVI-prone channel 5 or 2 to some other ... while the industry types are arguing against anything that might force more stringent design regulations (low pass filters in every set and so on), and the higher prices that go with them. Amateur radio doesn't have any of the big money or influence NAB or EIA (Electronics Industry Association) have, so it looks like we may get to foot much of the bill through manufacturing and sale constraints.

Another issue is the FCC's perspective on the technical capabilities of the average amateur. Some sources indicate the Commission is likely to have its doubts after reading the ARRL comments on Docket 20777, the now defunct bandwidth proposal. The League was making strong arguments against the docket, and relying heavily on the question of the need for spectrum analyzers to insure compliance with the proposed limitations. The League reply pointed out that each amateur would need a spectrum analyzer to constantly measure bandwidth, and that the estimated $12,000 expense of such an item would put it out of reach for most amateurs. The ARRL argument was so strong, in the view of some, that it could be construed to cast doubt on our individual abilities to measure anything ... whether it be bandwidth, harmonics, or even power output. It must be said that since many FCC staffers are amateurs themselves, it is unlikely that doubts about the amateur community's technical competence would fester very long. But, on the other hand, in the current context of linear amplifier bans and Capitol Hill pressure, a little misinterpretation could go a long way. It is important to remember that although ham radio does have many representatives working at the FCC, their interest could turn on them, decreasing their ability to speak for us.

So, what can amateurs do? For one thing, we can be more cooperative when it comes to TVI and RFI complaints. It won't kill anybody to stay off the air for a week and try to cure an interference problem. We have to remember that just as we have a right to operate our stations, the guy next door has a right to watch "Hogan's Heroes" or whatever. Our clubs have to revive TVI committees, call them interference committees, and rekindle the interference fight. Point is – we've done a great job attracting new amateurs (just look at what the clubs have been doing with Novice classes), but now it's time to put the same effort into improving our public image. And the best way to do that is not necessarily more shopping plaza exhibits or being there in times of emergency – it's probably more important to clean up our act interference-wise.

The magazines can help, too. We here at *73* are looking for some good articles on harmonic suppression and

TVI. It is time to show the public (and the FCC) that hams really are a cut above ... to show them we are capable of cleaning up *our own* interference problems. Otherwise, the RFI-TVI steamroller may run us over.

Warren Elly WA1GUD
Stan Miastkowski WA1UMV
Associate Editors

The Latest on WARC

February 7th was the big day – the deadline for comments on the FCC's WARC proposals. Two days later, an FCC spokesman went over the high points in a *73* interview, describing the response as nothing short of immense – a seven foot high stack of comments from sources ranging from the Utilities Telecommunications Council (UTC) to the ARRL. It will take 20 man-months to sort out the comments, and figuring that the Commission has 5 staffers working on the WARC proposal, that adds up to about 3 to 4 months work ahead.

To begin with, the Commission had already extended the deadline to February 7th in answer to a petition from the National Association of Broadcasters (NAB had requested a 90 day extension). Then the comments went into the public record for inspection, with a reply comments deadline of February 25th. The bottom line is that the actual US proposal for the WARC meeting set for 1979 will not be final until late spring or early summer.

Meanwhile, the Canadian DOC was about to make its WARC plan public at press time, but there were still no signs of activity abroad. It looks more and more like the bulk of the WARC delegations won't even see their country's final proposals until the eleventh hour. That doesn't leave much room for strategy.

Here at home, the conference staff office at the FCC in Washington is a busy place these days; the five staffers do not have a secretary, but they do have hundreds of comments to pore over, evaluate, and pass along to the full Commission. By and large, as one staffer put it, the comments are predictable. Among the adverse ones (from amateur radio's point of view): The Utilities Council is critical of the FCC proposal to open up 160-190 kHz to amateurs. UTC complains that its member utilities, who use portions of the 160 kHz band for power grid transmissions, will suffer interference from amateur operations there. The E.F. Johnson Company, which used to be a major manufacturer of ham gear but now makes CB equipment, is pushing for 220 MHz mobile allocations, arguing that the door "ought to be kept open" for future domestic CB use. Also supporting the 220 MHz mobile allocation is the Citizen's Radio Service working group. One surprise was the Electronic Industries Association (EIA) advisory group on consumer electronics, which *opposed* 220 MHz CB, on the grounds it would force the factor installation of high pass filters on TV sets!

Further opposition to amateur allocations came from the radiolocation industry, which is strongly against expansion of 160m. They argue that 1800 kHz and below is used for offshore location (a non-emergency service according to the regulations). The radiolocators say interference from amateurs would render their installations less reliable, but amateur sources counter they are already sharing 160m with the much more crucial radio direction finding services, which are emergency oriented.

As for the ARRL, Newington's prime thrust seems to be a push for additional ham bands at 10, 18, and 24 MHz, possibly on a 300 kHz sharing basis with fixed services. ARRL wrote the FCC that the new HF allocations proposed by the amateur service working groups were not adequately considered. Then the League goes on to argue that fixed point-to-point HF is dying anyway. That may be true so far as North America, Europe, the USSR, and Australia are concerned, but in Africa and South America the League assessment may be in trouble. The poorer nations are more interested in cheap, uncomplicated HF circuits than multi-million dollar satellie earth stations and overland phone lines. It is, of course, far cheaper to buy fixed channel SSB transceivers.

The League proposal calls for a modified sharing arrangement with fixed HF services at 10, 18, and 24 MHz, and will probably gain support from the track record on 80m, where fixed services have shared frequencies with amateurs for years. An interesting argument advanced by ARRL is that the FCC, in calling for fixed allocations at HF, may be violating the ITU (International Telecommunications Union) regulations – article 6, section 413. That article says, in essence, "members of the ITU recognize that long distance propagation is prevalent between 5 and 30 MHz and agree that those frequencies should therefore be used for long distance communications, leaving short haul circuits to other means ..." The League seems to be saying that the ITU's own regulations would force fixed operators to seek frequencies elsewhere, but whether that argument will stand the pressure of the third world nations at WARC remains to be seen.

Over 50 pages in length, the League WARC reply goes on to suggest a new solution to the 40m short wave broadcast problem. Complaining that the FCC plan did not address the 40m situation, ARRL proposes moving the broadcasters above 7.3 MHz, up to 7.5 MHz. (That would again cut into the fixed services allocations.) The League also calls for reduced sharing on 75m, while backing the rest of the HF FCC proposals, with one exception – 15m.

The FCC plan called for moving 15m down in frequency, running from 20.7 through 21.2 MHz. The League called that unnecessary and undesirable and worthy of reconsideration. ARRL wants to retain the current 15m allocation from 21.0 through 21.450 MHz, the compromise being that maritime allocations would be moved below 21 MHz, again taking from the fixed allocation that already exists.

A theme of the League reply then seems to be another assault on the new HF bands, opposition to inclusion of any 220 MHz mobile (CB) allocations, decreased sharing of the ham bands with broadcasters, but increased sharing with fixed services. The League position is apparently that hams can share bands with fixed services (as on 80m) or radiolocation, but not with CB or mobile services, which in the League view would justify separate allocations within any band allocated to both services. One major stumbling block, come 1979 (and provided the FCC sees things ARRL's way), will be the League proposal's apparent reliance on the fixed services' willingness to share with hams. If our sources have the correct interpretation of the third world's plans for HF (plus feedback from manufacturers who are selling African and South American countries thousands of fixed channel HF transceivers), it would be safe to say new HF ham bands may be hard to come by at WARC. On the other hand, ARRL may well succeed in gaining FCC support with the sharing argument.

Warren Elly WA1GUD
Associate Editor

Continued

New Life?

In his editorial entitled, "The 75 Meter Follies" (Holiday, 1976), WA6ITF demonstrates a misconception, or folly if you will, about a certain type of operation that many amateurs enjoy not only on 75 meters, but on any frequency where amateurs join together to communicate, in the true sense of the word. This style of operation is based on the discussion of topics of interest which deal with problems of today's world. It seems that Mr. Pasternak doesn't realize that there are a significant number of amateurs who choose not to participate in the chatty repeater style of operation in which he feels comfortable and secure. This, in itself, is nothing unusual. Even the embarrassment he and others like him feel when they stumble across people who "spew forth their personal and sociological ideals" (sic) isn't really unusual. What is, to me, extraordinary, is that Mr. Pasternak has the audacity to claim that this style of operation is an embarrassment to amateur radio in general. This is simply incredible.

First of all, in the third paragraph, Mr. Pasternak recognizes that, from a legal point of view, those who "spew forth their rhetoric" are not committing any unlawful acts by merely doing so. Thus, it follows from his argument that the fact that amateurs discuss sociology, politics, and other issues not directly relating to amateur radio makes them guilty of some nebulous crime, and further, brands them as being undesirable. I wonder how any American, whether an amateur or not, can accept this reasoning and, worst of all, its conclusions.

My own personal opinion is almost the complete opposite of Mr. Pasternak's. In these days of a dwindling amateur population and an increasing demand on the frequencies we now hold, some kind of revamping of amateur radio is obviously needed. This is necessary not only as a defense against other services desiring our frequencies, but also as a kind of enrichment to keep those who are already amateurs interested and active in their hobby. Also, incentives are needed to attract newcomers and to motivate them into getting a license. I believe that by expanding the range of "acceptable" topics of conversation and encouraging the discussion of topics that are important in view of today's world, the number of amateurs who allow their licenses to lapse because they "just plain lost interest" would decrease dramatically. The policy towards more permissiveness in the accepted and encouraged modes of transmission, i.e., FM, SSTV, 2M SSB, etc., has already proven to have caused a noticeable flurry of activity on the amateur bands and has caused many non-active hams to become active again. In general, I believe that what ham radio vitally needs is a push in a direction that encourages individual expression, both technical and expressive. What Mr. Pasternak is advocating will only result in making amateur radio more sterile and lifeless than it already is.

John Forrest WB6EDM
Isla Vista CA

Too Late

Some time ago, the FCC banned the sale of the linear amplifiers designed specifically for the 11 meter CB band. Some, of course, were "25 to 50 MHz" and carried a statement "Illegal for CB," but everyone knew what they were for. That didn't stop the manufacturers and stores. Now they are broadband, 3 to 30 MHz jobs, designed for AM and SSB with 4 Watts input. That got them around the law.

Now the FCC sees no other good alternative than banning linear amplifiers altogether.

What will this do to ham radio? Well, it will obviously raise the price of equipment. Since there will be no way for someone to raise the power of his transmitter (a Ten-Tec Transceiver for example), he will have to buy a higher power transmitter to start with. The used value of low power equipment will fall off, as very few will want it. Newcomers to our hobby will also tend to have to buy a high power rig, whether they want to or not, since they will want to plan for the future. Only the avid QRP enthusiast may benefit from this ruling, as prices on low power equipment drops.

This type of rule making will really do little good to stop the illegal high power operation on 11 meters. Linear amplifiers are now passé. Ten years ago was when the rule should have been considered. Now, buying the SSB transceiver for CB is the only way to go. Some say for every 10 Yaesu FT-101s sold, 9 are purchased by non-amateurs for 11 meter use.

Most of you who are reading this were not licensed in 1958 when there was an 11 meter ham band. If you were, you probably, like most, never used the band anyway. So the FCC said 11 meters will become a band for small businesses to set up inexpensive two-way radio systems. Great for the small businessmen, but someone found out it was like a party line, and you can chat among yourselves. WOW! By the time the FCC reacted, as usual, it was too late. Now the band is useless for any serious business use, but nevertheless it serves a useful purpose for many. The emergency reporting of highway emergencies alone has justified the existence of CB.

But the offshoot of CB has been punishment for the amateur. Our rigs get stolen because the crooks think they're CB rigs. The insurance companies don't know much better, so they increase our insurance rates. TVI complaints are high, so the hams get the blame. When the hams do perform some good public service, the CBers get the credit. When a CBer misbehaves, the press calls him a "ham operator."

One small ray of hope is seen glimmering, however. The newly formed Amateur Radio Manufacturer's Association is trying to do something. They appear to have made some progress already. For many years the Electronics Industry Association (EIA) has been the spokesperson for all. But their "standards" are getting tarnished.

Maybe they can exert some force not only at the FCC, but also to help get some of these "money-hungry" merchants squared away and teach them right from wrong. I suggest they start right here in Milwaukee!

Dave Barquist K9PAK
Hartland WI

Ham I/O

When the integrated circuit microprocessors first came out, they caused quite a flurry because they promised to allow the hobbyist to have his own computer (with capability that would have cost thousands of dollars not many years ago) for a few hundred dollars. Up to now, the main emphasis in the hobbyist field has been on building computers; however, the professional journals lean much more toward the use of microprocessors as controllers and not as computers. In fact, the use of microprocessors as controllers is usually given as their primary use in these circles.

I recently heard a prediction that untimately there will be several microprocessors in the country for every citizen. The basis for this prediction is that many things we will own, from automobiles to dishwashers, will be controlled by a microprocessor.

This concept seemed strange to me at first. I was used to thinking of a microprocessor as primarily a computer for solving mathematical problems and the idea of using it as a controller didn't make much sense.

While at the ARRL National Convention in Denver this past summer, I started to get the idea while attending the microcomputer seminars where they demonstrated several applications for microcomputers in amateur radio. Programs for both sending and receiving both Morse and RTTY were demonstrated.

These programs had provisions for storing messages such as "CQ" and could be quickly reprogrammed to allow changing the function of the computer so that it operated as if it were a completely different device. One particularly interesting program converted slow scan TV into a TTY picture such as they transmit on 20 meters on Saturday morning. Several persons had their pictures taken that way.

An important thing to notice about these applications is that none of them are primarily for the solution of mathematical problems, but are really for producing a particular function that traditionally would have been done using a hardwired device. It was stated at this seminar that a microcomputer that cost several hundred dollars could replace hardware devices costing more than two thousand dollars. The replaced equipment would be a CW keyboard, a CW decoding system, a RTTY system and perhaps parts at least of a slow scan system. Another important thing to notice is that all these programs were implemented using a general purpose microcomputer with a CRT terminal.

Even though the computer was used to simulate hardware devices, this still was not the same thing the professionals are talking about when they say the microprocessor will be used to control a dishwasher; they obviously are not going to build a complete computer just to control a dishwasher!

The way it will be done is that the microprocessor will be instructed to execute a particular sequence by a program stored in a read only memory. The microprocessor chip will be connected to some sort of interface that will allow it to control the operation of the dishwasher by turning on the hot water, the heating element, etc., and to receive inputs such as temperature sensors, water

level, etc. This type of system is not designed to be a general purpose computer, but is dedicated to doing the logic required for a particular job.

I have recently been thinking of ways to build something related to amateur radio using a microprocessor as the heart of the device, but with the idea of not building a computer. A very logical candidate for me is a keyboard keyer. I have done some designing and programming of such a keyer using the 8080 as the microprocessor. This keyboard keyer would use about 12 ICs and would cost less than $70 to build. The microprocessor would do everything from scanning and decoding the keyboard to generating the Morse characters. The memory would be used to store messages such as "CQ FD DE W5PAG." Because the device is programmable, it could be used in several ways with little additional effort.

These are several of the possible programmable modes of operation that occur to me:

1. Normal CW keyboard where the operator types in the text and the keyboard converts the text to CW. A buffer could be easily implemented to allow the operator to type faster than the CW was being transmitted.

2. A code practice mode where the operator types in the text but CW would not be generated immediately. A long text could be loaded into memory and edited. When ready, the text could be dumped onto mag tape or transmitted on the air. The code speed and spacing between letters and words could be easily programmed to make the CW sound like W1AW if desired.

3. A code teaching machine that could operate in several modes: The keyboard would be programmed to send a set of characters at random to the operator. When the operator hits the key corresponding to the letter being sent, the device would go on to the next letter, or text would be loaded into memory from the keyboard. Whole words would be sent and repeated until the operator signals he has received the word. The next word would then be sent. This mode would be good code practice for high speed CW.

In addition to the CW modes, the keyboard could be programmed to be a RTTY keyboard and send Baudot or even ASCII code.

While a microprocessor controlled keyboard has a lot of applications and would be interesting to build, I probably won't have time until next fall. When I build it, I will let you know how it works!

Roy Gould W5PAG
El Paso TX

Reprinted from The Beam, *bulletin of the Sun City ARC, El Paso TX.*

Rated "R"

While it is not this writer's intent to in any way limit anyone's inalienable right to freedom of expression, it does seem to me that said freedom has become somewhat strained in recent months on Denver-area repeaters. It may be that street language has its place on the street, but I don't agree with some amateurs' proclivity in transferring these phrases to the amateur radio bands. Prude I am not, nor have I led such a sheltered existence that I am unaware of the meaning of these outbursts which have graced our repeater systems in the later hours of the evening, but doesn't it make sense to keep "R" rated material in "R" rated movies? At least those attending such fare are prepared for stronger language than might be encountered in polite conversation – and those of tender age are not admitted. While the Federal Communications Commission speaks clearly as to the use of "doubtful" language on the public air, it admits that there is some question as to what is profane and what is obscene by popular judicial interpretation.

I wonder how much doubt exists in the minds of most amateurs as to what is what. Of course, we always have the excuse that some repeaters in other areas of the country are "far worse than we are." And we can say that the FCC does little or nothing about those. But haven't radio amateurs always been proud of their ability to self-police, as compared to other services? And haven't we done so most effectively in the past? If so, why don't we address ourselves to this problem? "Well, it doesn't bother me," many say, and perhaps that's true, but it does bother others. I have heard several complaints from husbands and fathers of potential amateurs that their wife or child has been "turned off" by some of the things which they have heard on the two meter band . . . some to the extent that they no longer wish to become radio amateurs. Is this an example of our vaunted recruiting effort? Is this the way we convert citizens banders to amateur radio? Is mine a lone voice, or are there others who share my concern? If so, can we do some thing? WHAT?

Harry Landon WØJGL
Castle Rock CO

Reprinted from Grid Leak, *publication of the Pueblo CO Ham Club.*

European DXpedition

DC-8 Charter Flight 1832, Overseas National Airlines, left Detroit at 1820, destined for Frankfurt, Germany. The flight itself was uneventful, except for the two meals that were served. My Wilson HT was lying underneath the seat ahead of me, along with an Imperial quart of vodka given to me when I boarded the airship. I lugged the bottle all over Germany and Austria only to find, when I returned, that customs in Detroit was going to charge me four or five dollars duty to bring it back into the US. I told them to keep it; I don't drink the stuff anyway.

The flight went quite well – airspeed over 600 mph, at 37,000 feet. A good jet stream had us touching down in Frankfurt in 8 hours. Coming in over Scotland made me wonder if my Wilson could be picking up any Scottish repeaters. But I refrained from turning the rig on, for fear of disrupting the airship's navigational system.

We landed at Frankfurt's main airport, and in a few minutes I was standing on level II in the arrival terminal, in a 90 degree plus temperature. I set the luggage down, screwed in the rubber duck, and turned on the transceiver. The needle on the S-meter pinned and a loud voice in German came booming over the little speaker. No time to talk, so I listened.

I made reservations for a hotel room and grabbed a cab for the city of Frankfurt. The airport is about 15 miles from the city. My hotel was eight blocks from the main banhof – ten dollars a day, including breakfast. The room was small, but comfortable. No air conditioning in Germany, so it was quite warm. I ordered a large lemonade (a sweet sour drink, a little like Fresca) and turned on the Wilson. I set the crystal selector switch to 145.15/.75 and heard a conversation in German. I listened for a while, and in about ten minutes they signed off.

Now, my turn. I "kerchunked" the repeater and brought it up. "W8WLQ/DL in Frankfurt listening on .15/.75." Dead silence. I listened for about five minutes and the repeater came to life. In a couple of minutes, several DLs were talking to each other. They were talking about me. "Did you hear the W-W on the frequency?" They had heard me, but hadn't answered. At first I didn't know why they called me the W-W. But I guessed it was because of the two Ws in my call, and it was hard to include the 8 due to pronunciation. When being talked about, I was called the W-W numerous times in Germany and Austria.

A little while later, I "kerchunked" the repeater and got a reply from Fred DK8ZF. Fred spoke perfect English and was associated with the repeater operation and the Frankfurt Radio Club. He was very congenial, and invited me to the Frankfurt Radio Club meeting. He told me that the repeater was located at one of the railroad stations. Their repeater was strong and had clean audio. There wasn't any timer on it. It was COR and had a W.W. identifier. The identifiers on it were set very fast. I found out that the members of the repeater groups like fast identifiers and no timers, so that they have more time to talk, with little or no interruptions. The repeater activity is heavier during the day and early evening hours.

While in Frankfurt, I talked to several English-speaking stations. Some of them spoke fluent English and others broken English. At times I did speak German, but only if absolutely necessary. DL8MG, Fred Number 2, was a TV engineer for the Frankfurt station. At the time, he was working on programming the Olympics via satellite. The last time I talked to him, he was sitting in his backyard, trying to beat the heat by drinking a tall glass of cold beer.

The first night in Frankfurt, I talked to a number of stations, including a YL. Her name was Lonnie DB5UW. She was located about 40 kilometers from Frankfurt and was a real ardent QSL collector. She broke in on one of my QSOs and requested a QSL. Everyone collects 2 meter QSLs in Europe. It doesn't make any difference whether it's through a repeater or not. I expect a deluge of cards from the QSL bureau one of these days.

Button-pushers: If you "kerchunk" a repeater in Frankfurt and don't say anything, you are apt to get told about it. The standard statement to button-pushers is, "The repeater works. If you don't want to talk, don't push the button." The call CQ is used universally and frequently on repeaters in Europe as well as some English words such as "Break," "portable or mobile," "OK," "cheerio,"

Continued on page 30

Looking West

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SCRRBA DEMANDS EQUAL TIME – ARRL GIVES PAPER BOX

While the "equal time" provision no longer seems to bother most politicians looking for office, another new demand for "equal time" (equal time to give the nation what they feel is a far more technically competent approach to advanced relay communication band planning) is being sought by the Southern California Repeater and Remote Base Association. It is the feeling within this group (an organization composed of amateurs who lie at the very foundation of amateur relay communication) that in adopting the band plans they have for 10 meters, six meters, and 450 MHz, the ARRL has reacted to pressure rather than providing the proper technically competent leadership necessary. SCRRBA feels that the ARRL judges all forms of relay communication from the narrow viewpoint perceived in Newington, and is willing to make decisions affecting vast numbers of amateurs based on this limited input.

SCRRBA feels that it is a far more competent organization to aid in making such decisions. They cite the fact that, while they have been around and organized since the late 50's, first as the California Amateur Relay Council and now as a regional subdivision of that organization representing every aspect of advanced format amateur relay communication, the ARRL is a latecomer to FM and does not possess, even within the structure of VRAC (VHF Repater Advisory Committee), the necessary and diverse talent to accurately make determinations that affect so many on such a wide scope. Since numerous attempts at educating those in the ARRL have to date failed, SCRRBA has decided to take a new approach and take their ideas directly to the amateur populace to be judged by all, based upon technological competence rather than upon what League leaders feel is the easiest road to follow.

This decision was reached at a general membership meeting held January 22, 1977, in Burbank, California, and attended by about 120 concerned members. During the course of the meeting, a poll was taken that revealed the following figures. 90% of the membership present had been involved in advanced format relay communication for at least three years, with over 50% being involved more than five years, and at least 25% having ten or more years of experience behind them. At least 75% of those present hold a 1st or 2nd class radiotelephone license, and at least 50% of the membership is directly involved in some facet of commercial radio communications, with representatives from all major manufacturers of such equipment. Based on this background and overall experience, it is the feeling that there is an obligation within the ARRL to be responsive to the needs and concerns of those amateurs who feel there is far more to relay communication than running down to the local radio emporium to purchase a multi-channel two meter radio or packaged repeater all ready to go on the air. Their concern is with the future, the proper controlled growth of 10, 6, 450, and the microwave spectrum. They feel that these bands must be developed on a technological level that will negate and avoid the problems faced on two. They also feel that to accomplish this, some basic changes in attitude and structure will be necessitated both back in Newington and within the VRAC. One proposal is that the VRAC be expanded to one representative per division, elected by the coordinating councils rather than appointed by the league from within. In this way, a far higher level of technological leadership can be achieved and a greater base can be established upon which such decisions of this high a magnitude can be made.

You will be hearing a lot more from SCRRBA; do not be surprised to see them at various conventions and the like running booths explaining who they are, what they stand for, and what their goals and the goals of advanced relay communication are. For the first time, there is an open and direct challenge to the ARRL in FM and FM relay communication leadership. For more information write to: SCRRBA, P.O. Box 5967, Pasadena CA 91109.

TWO METERS FALLS SILENT IN LOS ANGELES

At 4 pm on New Year's Day, 1977, a rather bizarre event took place in the vicinity of the "City of Angels." At that hour, the majority of this area's open two meter repeaters went silent to oberve a five day hiatus billed as "Repeater Appreciation Week." The purpose of the action, while simple in nature, did reflect an undercurrent of discontentment on the part of a group of concerned amateurs for the way operating practices had decayed on our many VHF repeater systems. A simple question had to be answered: Was a repeater, any repeater, the property of the person or persons who built, licensed, and owned it (and, therefore, was it their right to object to the rather poor operating procedures of many amateurs), or was a repeater, by virtue of its accessibility to the general amateur populace, a public utility? Further, was it within the province of amateurs who had great and total respect for the rules and regulations that guide the amateur service to take direct action to try and stem the tide of deterioration before it infested every nook and cranny of open format amateur relay communication in this area? In short, it was a case of those who cared about the future survival of the amateur service saying to all, "It must stop here," and organizing direct action toward that end.

Those of you who have followed this column the past few months are aware of a rather interesting experiment in ."users attitude adjustment" undertaken by Mr. Bob Thornberg WB6JPI to clean up operation on WR6ABE, now WR6AMD. I devoted my last column to publishing the entire set of guidelines that users of WR6AMD are forced to adhere to. At this time, some three weeks after WR6AMD returned to full time service under its new callsign and licensee, the AMD experiment seems to be fairly successful. However, during ABE/AMD's off period, the "garbage" started to spread like butter melting in a hot frying pan. Even the private systems were not safe from the attack. For years, ABE had acted as the "friendly jail," but now that was gone and the sick abusive minds needed a new home. Worst hit by these attacks of jamming and vulgarity seemed to be WR6ABB, the Palisades Amateur Radio Club repeater, WR6ABN, and WR6ABQ, though no system seemed safe from "attack."

Perhaps this is the reason that the "Ad Hoc Committee For Open Repeater Appreciation" was able to get the cooperation it did in bringing this event off. You see, this is a case where repeater users organized and requested the assistance of system owners in what might be considered "a last stand" against those who would abuse the privilege of operating a repeater and maybe instill enough anger into the majority of good but apathetic users to take a strong and vocal stand against those doing harm to the survival and utility of our repeaters. While small in number, the committee was able to garner the necessary support among the owners/-licensees/trustees to make Repeater Appreciation Week at least 80% successful.

Listening in, it was amazing how many people discovered that it was not necessary to use a repeater 40 miles away to talk between autos that were less than a hundred feet apart on the freeway. It was also funny (but pathetic) to hear some of the comments, such as the following from 146.52: "There must be something wrong with the repeater part of my radio. I can't reach any of the repeaters." While a sad commentary on some of today's amateurs, this is in itself a part of the problem that those who care are fighting – apathy, lack of education, unwillingness to take an active part in policing repeaters, jamming, and at times even foul language. These are the crux of the issues that led to the rather drastic action we have already described.

Results: What, if anything, did this experiment accomplish? One of the prime objectives was indeed made crystal clear to all. The fact that a repeater is the responsibility of the one who holds its license and that that person has the legal right to determine how his repeater will operate, and to what standard, has now been established. I think that we all learned a valuable lesson to the end that 1) Repeaters are a privilege that we must never take for granted because nothing, even open amateur relay systems, lasts forever, and, if abused, they can easily disappear; 2) The purchase of a radio, regardless of how much we might spend for it, does not bring with it "a right to use any repeater at any time and in any way we may see fit"; and 3) Repeaters are in effect a gift from other members of the amateur community, a gift that we must cherish, respect, and support, perhaps not financially but, more importantly, morally and sociologically. We all learned that to permit the lowest common denominator in operating procedures to prosper only leads to decay, which in turn leads to chaos and anarchy. I think that in the end, we all learned a valuable lesson about the responsibility that deregulation imposes upon all of us.

However, while there was much on the positive side of the ledger, it would be unfair not to discuss the negative aspects and reaction. To the latter, there were more than a few amateurs who felt that "the cleanup was not worth the imposition" and have vowed to use, but never again support, any repeater, either morally or financially. Also, an obvious "cold war" has developed between those who habitually abuse repeater operation and those who have proper respect in that quarter. While most of the habitual abusers still hog repeater time and stand upon "their right to use," they no longer go unchallenged. Many of those who were once apathetic are now challenging this so-called "right," and for the first time are standing up and being counted. I say a "cold war" in that it's one of those things that you can't put your finger directly on. It's in the tone of voice, the inflection, and in the very nature of the fact that many people who had disappeared from two, people who had given up the fight in total disgust, are now back and are vocal.

Another obvious negative aspect of this has been a polarization of owners and users. There are still a lot of vocal amateurs running around yelling "user rights." This to be interpreted as, "Since I regularly use this repeater, you must give me a voice in the way you, its owner, will run it." This in itself brings with it a Pandora's Box of where responsibility of an owner to his users begins and ends, if such exists at all. It is my personal feeling that the only time a user has any legal right to demand anything is when he or she operates as a user on a repeater owned by a club or organization that is a legal corporation, and then only when such a person is a paid up dues-paying member of said organization, thereby becoming a legal stockholder or shareholder in the corporate structure. Even this, though, is dependent upon the particular state in which one resides and the corporate law of that state. Since I am an electronics technician and not a lawyer by profession, I will cut this here and again state that this is my opinion, not meant to set any form of legal precedent. However, this ques-

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tion of user rights is starting to surface out here where I live, and where it will lead is anyone's guess. It would be interesting to hear from you on this topic.

Finally, there was a lot of complaining that "it was impossible to handle emergencies and was unfair to transients." On the latter, I agree only in part. I feel that our prime responsibility is to clean our own house so that we can provide high quality relay communication to visiting amateurs. What good is having as many open repeaters as we do if they become useless due to constant harassment and abuse? What kind of an impression will that visitor get if he is greeted with a barrage of garbage rather than a warm welcome? Our first responsibility was to ourselves, and to anyone visiting who suffered any inconvenience, I can only hope you understand the reasons. As to emergencies: It was well announced which major systems had remote/base facilities and would be handling emergency calls using that mode. All one had to do was call on the input of a number of systems, declare an emergency, and he would receive an answer on the output. A control station would handle his traffic, but he would not be repeated to the output. Though not confirmed, my information sources have told me that a good number of such occurrences were handled that way and expedited with greater speed and efficiency than when one normally requests another station to handle such traffic during normal repeater operation.

Now, where did the SCRA stand in all this? Officially, as an organization, it did not take part in this operation, although it is obvious that individual systems/members within the organization did take part. SCRA, being an organization formed as a body to handle technical frequency coordination and as a political forum for repeater owners to interact within, is not at this time geared to tackling user problems, as this has traditionally been the province of the individual licensee. They, therefore, took a wait and see attitude and neither condoned nor condemned the action, since at this time it is not their province to do either. Again, remember this was a "concerned user action," not the action of any single system owner. System owners cooperated in this venture, but did not organize it. For obvious reasons, it is best that I do not divulge the names of the individuals who put the whole kettle of wax together and made it a good if somewhat limited success; however, if you have any comments for them, they can be sent to me and I will forward them. Please mark any correspondence on this topic "Attention: Repeater Appreciation Week Committee."

Well, that's the story as of today — January 21, 1977. No one ever thought it could ever happen, that 80% of this area's amateurs would lose the use of repeaters, if only for a while. Then again, very few people last fall ever thought that California's most liberal open repeater WR6ABE would disappear and then reappear in the form of WR6AMD as possibly the most tightly controlled open system in the nation. Then again, many of us hoped that action such as this and other things that are yet to come would never have to come to pass. At least one group of people stopped saying "we have to do something," and went out to do it. In this alone a new precedent has been set.

THE ROAD UP NORTH

"Hey there, Lightnin' Rider . . . You got a copy on the 73 Man KKU4645 . . . come on." Not exactly the lingo I am used to using via a two way radio, but it was proper for the situation at the moment. We were on highway 101 at about 8 pm. It was just dripping California winter sunshine and we still were about a hundred and fifty miles from home, but heading in that general direction. Road conditions were far from good and, as one might guess, there was not a repeater to be had though my Denshi CL-144-FMCAX had 10 repeater pairs and two simplex channels in it. It was one of those times when having a CB radio along can be a godsend. The quick QSO I was looking for brought more than just road conditions. We chatted for a while and I caught up with this 18 wheeler (tractor-trailer) and asked if he minded if I passed him. He gave me a go-ahead and as I did, he called and asked what all the antennas were for (my car now has antennas for 11, 6, 2, and 220 and looks like a pincushion). I explained I was an amateur and was surprised when he asked if I had 147.57. Told him no, but I did have .52 and .94. We went to .52 and I found that my newfound CB friend was actually a "1" out of Connecticut and licensed for almost a year. We QSOed all the way into Santa Barbara and one of the things I discovered was that, according to my new ham/CB friend, quite a few truckers are getting disillusioned with CB and all its problems and are turning to amateur radio, specifically two meter FM. In fact, do not be too shocked to be driving along an interstate some day and hear activity on 147.57 out in the boonies. Seems that .57 is fast becoming the unofficial truckers' intercom channel for ham truckers. Best of all, if the guy I ran into is any example, they are far and away some of the best operators I have run into. None of this "10-4 good buddy" stuff like on 11. They seem to have a lot more respect for amateur radio than perhaps any other new group coming into it. According to what I learned, the handles and southern accents are gone, while clean operation is in. They value repeaters as a link to the outside world, and therefore the overall respect level is high. After all, most of the time they are the transient guest and want to be made welcome the next time through town. I wanted to learn more about this new phenomenon, but Sharon was hungry, the car needed fuel, and he had a schedule to keep. We parted when we reached Santa Barbara, but I was a lot richer for the knowledge I had gained. This was but one of the interesting encounters I had as we headed north to San Francisco.

Radiowise, I think I had set up the car pretty well. Normally, around town the car carries a trunk-mounted Motorola two channel plus slide mounts that accommodate a variety of radios. The fine piece of Motorola equipment was augmented this trip with the Denshi on two, a Clegg FM-21 for 220, and an Audiovox CB-2000 which is self-explanatory. We therefore carried 10 standard repeater pairs plus 2 simplex for two, augmented by the two L.A. channels in the Motorola, one simplex and five repeaters for 220, and channels 1 through 23 on 11 meters. Between radios, luggage, gifts, Sharon, and myself, the car was well loaded for the trip. It was noon Monday when we got on the road. Since this was to be a fact-finding mission as well as a vacation, I had installed a Panasonic RQ309S portable cassette recorder to take notes. This was possibly my best move, for as I listen to the tapes, I not only have the information I need, but a lasting memory of new friendships we made as the miles rolled on.

There was one question specifically that I wanted answered. It has been claimed that since we have reserved a number of common repeater pairs for simplex use, the transient visitor with his 12 channel radio does not really have a chance. The transceiver I had along carried the following channel pairs: .01/.61, .07/.67, .13/.73, .16/.76, .22/.82, .25/.85, .28/.88, .34/.94, .84/.24, and .72/.12, plus both .52 and .94 simplex, remembering that in and around L.A. and environs both .76 and .94 are reserved for simplex and that one must travel a good distance in any direction to find a repeating machine on these channel pairs. While it's true then that both these channel pairs are indeed useless in and around L.A., and that only a traveling ham residing in this area ever bothers to procure them, once out of this area and into the Central Valley .34/.94 especially begins to hold forth as a major channel. So, if you are planning to visit L.A. only, I still suggest that you pull both .16/.76 and .34/.94 to make way for a couple of far more useful pairs for this area, such as WR6ABN on .84/.24 or WR6ADH on .72/.12. On the other hand, if you plan to drive elsewhere, especially to the North, then carry both the .76 and .94 repeater pairs with you.

Next month I will get into the specifics of the trip. I will explain which repeater is where, what it covers, and tell you about some of the interesting people we ran into, but for this moment I'll just make a few rather general statements about repeater operation north of Los Angeles and in the Bay Area. First, while friendly, operation is tightly controlled and, with little exception, there is usually a full time control operator around when a repeater is on the air, or the repeater is just not on the air. This seems to hold especially true for the Bay Area. I found only one exception to this rule. Another thing I noted was that the Bay Area has no 24 hour a day open system on any of the channel pairs I had with me. Around midnight, most of the systems seem to go to sleep till the dawn's early light. Maybe this has changed since November, but during Thanksgiving week, this is what I found on the channels available to me.

Another aspect of Bay Area operation is very tight user control and guidance. The user is not permitted to take a repeater for granted and therefore the problems of both user abuse and user apathy seem much lower than in L.A. Operation in general is far more conservative and it's not uncommon to hear a user sign off by thanking the repeater for the use of the system and its time. In fact, I was told, though I never confirmed the fact, that on a few of that area's systems, such acknowledgements are mandatory. In short, once north of L.A., operation seems to be far more conservative, extremely tightly controlled, and problems (where they exist) are less pronounced. One thing was evident: "Right to use" on the part of the average ham seemed to hold no precedence whatever. Wherever I went, I noted that both repeaters and the people who ran them were treated with more than just respect; in some places, is was close to reverence. Yet, as a transient, everyone I met, owners and users alike, went out of their way to make me feel welcome. I came away with the feeling that with proper education and guidance, problems of repeater abuse, malicious interference, and the whole gamut of repeater-oriented problems can be conquered. They need not exist.

Now, a few notes on how the WR6AKG school repeater is doing and on a convention that failed. Keith WA6TFD and company planned to make February 20 the ribbon-cutting day. At around noon that date, his dream of a tie between school-aged amateurs should have become a reality. You know, with all the current furor about busing children, integration, and the like, I have to ask myself what better way to achieve the true purpose of integration — the interaction of peoples of different race, ethnic, and socio-economic backgrounds — than by radio. Rf does not know such bounds, and I have come to wonder if through technology we can more easily accomplish the goals of the directive of our Supreme Court than by forcing physical travel upon the children of the nation. In a city with as diverse an ethnic makeup as Los Angeles, WR6AKG may be a first step in that direction. Now, that's one to ponder.

I have looked for a nice way to say it, have analyzed all aspects of this year's Las Vegas get-together, but keep coming up with the same conclusion: SAROC this year was a bust. Now I speak specifically of the convention itself, and not the peripherals such as the hotel, the accommodations therein, the hospitality centers (for which the effort put on by Wayne Maynard WB6BFN and Shelly Chelsey WB6KED for the Palisades Amateur Radio Club has got to get the blue ribbon), or the fun that a trip to the "Live Entertainment Capital of the World — Las Vegas" brings with it. All

this was great, but SAROC itself was just not worth the cost of registration.

However, I suspect that I can give you the reason. In the past, SAROC has, at least on the surface, been a non-political, let's have fun get-together. This year, however, the politicians from Newington made sure to place themselves in full view of the world and were verbose enough so as to be sure that all in attendance were aware of their presence. There was a lot of surface politicking and, combined with what I feel was a poorly organized convention effort overall, I find it hard to give SAROC '77 anything other than a poor rating.

There were a few bright spots, however, including a booth run by the FCC and staffed by a bunch of knowledgeable people who were willing to listen to questions and give concise, to-the-point answers wherever possible. The brightest spot of all was a seminar on hidden transmission direction finding sponsored by the Happy Flyers organization in Northern California. I have intentions of devoting at least a full column to the work of this fine organization in the very near future, in that I feel they hold the key to something big for amateur radio's future. In general, though, SAROC just was not SAROC this year.

Our closing story for this month deals with a band that is not normally thought of as being VHF; however, a new form of activity that is growing like wildfire brings it into the limelight. The band is 10 meters and the activity is a widespread revival of Amplitude Modulation at low power. It seems that the latest craze to hit Southern California is based upon the easy conversion of inexpensive CB transceivers to channelized 10 meter operation. At this writing, there are already a few hundred area amateurs either operating already or busy at work converting their $29.95 Publicom I CB sets to 10.

According to Norm Lefcourt W6IRT, one of the pioneers of this project, the plans are to establish 16 national channel pairs starting at 28.760 and then every 10 kHz on up through 28.960 kHz. It is felt that this is a good low cost substitute to 2 meter FM, and as it grows, it is hoped that some of the pressure now on two due to excessive channel loading will be alleviated. So if you happen to be tuning across 10 meters one of these days and hear some AM, bet you dollars to donuts it will be about five Watts emanating from anyplace from San Luis Obispo to San Diego. Thanks to the FCC expanding CB to 40 channels, thus making the current crop of 23 channel jobs obsolete to a great extent, and to the willingness of the mass merchandizers to part with

them for next to nothing, a new "old" rage is taking hold at a rate to rival the growth of two meter FM relay communication. If you want more info on this event, I suggest you write to Norm W6IRT, who is in the callbook. "AM lives on 10."

Corrections

I am quite pleased with the way you handled my articles, "Give that Professional Look to Your Home Brew Equipment," and "DVMs Get Simpler and Simpler." Quite a difference from the treatment I get from *EE, PE, RE,* and the rest. Would you believe that a creative soul at *PE* took a fairly complex digital circuit I designed and changed all the IC part numbers?!? I guess he didn't like the CMOS I used.

There are few things I would like to point out to the readers. In "Give that Professional Look to Your Home Brew Equipment," a series of photos were left out which illustrated the steps in building the power supply. Also, part of the first paragraph under "Select the Cabinet" was transposed, so reading is a little confusing at this point.

A few errors cropped up in "DVMs Get Simpler and Simpler." Chalk it up to the wrong set of notes! Move C3 (0.01 uF) over to pin 9 of IC2, then switch pins 1 and 2 on IC3. You see, pin 1 is the MSD and pin 2 is the LSD. Nothing seriously wrong with Fig. 1, but operating the circuit without these mods will cause confusion during calibration! In Fig. 3, the 9k, 0.1% resistor should be 10k, 0.1% for proper calibration. That's it!

Gary McClellan
La Habra CA

Reading the article "See Yourself Talk" brought back a lot of memories, because I used a monitor like this with almost exactly the same setup for many years, until I built me a scope.

Reading the article and looking at the schematic diagram, I discovered two errors in the last.

First, the line coming from the RX connector running to the 455 kHz coil should cross the line coming from contact 5 of S2A and thus not be connected.

Second, the capacitor (.01 uF) which is shunting the 220k resistor in the first grid circuit of the CRT should be grounded at one side in such a manner that the wiper of the intensity pot will be at ground potential for ac. As it is now, the amount of flyback suppression is depending upon the position of the wiper, because in a lower position of that wiper, the flyback pulses are more or less ac grounded via both 8 uF capacitors in the power supply circuit.

For the benefit of the American hams, here are the equivalents for some items: EF91 = 6AM6; 800 piv/1 A = 1N4006 or 1N4007, eventually 1N521B or 1N5214; OA81 = 1N38, 1N98A, or 1N270; OA210 = 1N3194 or 1N4004.

Further, I'd like to give some hints. When using an old i-f transformer for the 455 kHz coil, do not short the second coil! This will lower the Q of the coil in use considerably, so remove it completely.

The two capacitors in series, via which the flyback suppression pulse is supplied to the first grid of the CRT, can better be replaced by one capacitor with a value of something like .01 uF, 1 kV. Two capacitors in series practically always have unequal charges, and if one becomes leaky due to overvoltage, the other will follow too. I found out too late and I ought to buy me a new CRT because the tube didn't like a positive grid voltage of around 400 volts.

Be aware of the very high potential difference between the filament and ground. Most filament transformers cannot withstand 800 volts. So better use a transformer with a very good isolation layer between primary and secondary windings. I did remove the original filament winding, put some extra layers of isolation material of PVC wrap over the primary, and rewound the secondary. The splattering was gone. It is very handy to add an i-f outlet on any receiver you have. To prevent loading or detuning the i-f transformers, a simple cathode, emitter, or source follower should be added to the receiver.

Anyway, the monitor scope is a very useful and cheap instrument and sure worth it to build!

J. J. de Looff PAØPFU
Br. Hogardstraat 10
Boekel 4274
The Netherlands

CARF

Canadian Amateur Radio Federation, Inc.

The Canadian Amateur Radio Federation Inc. is pleased to announce the following awards available to all radio amateurs worldwide.

CANADAWARD: A colorful certificate will be issued to any amateur who confirms two-way QSOs with all Canadian Provinces and Territories. All QSOs to be on one band only. This certificate is endorsed as to band. Separate awards are issued for each band on which the applicant qualifies (12 cards per band).

A mode endorsement is available if all QSOs are made on the same mode (CW, SSB, RTTY, SSTV). Contacts made after July 1, 1977, only will count for this award. Submit the 12 cards with one dollar ($1.00) Canadian or U.S. funds or 10 IRCs plus sufficient funds for return postage. CARF members need send only funds for return postage.

5 Band CANADAWARD: A special plaque will be issued to any amateur who confirms two-way QSOs with all Canadian Provinces and Territories on each of five separate bands (total of 60 cards — 12 cards per band).

Contacts made after July 1, 1977, only will count for this award. Submit the 60 cards with seven dollars ($7.00) Canadian or U.S. funds or 70 IRCs plus sufficient funds for return postage. All CARF awards are free to CARF members. CARF members need send only funds for return postage.

6 Band CANADAWARD, 7 Band CANADAWARD, ETC.: Special endorsements to the basic 5 band CANADAWARD will be issued to any amateur who confirms two-way QSOs with all Canadian Provinces and Territories on more than 5 bands. Submit the additional cards with sufficient funds for return postage.

All amateur bands may be used. Each distinct satellite mode (432 in/144 out, 144 in/29 out, 144 in/432 out, etc.) will count as a separate band.

NOTE: These awards do not conflict with the WAVE and WACAN awards sponsored by the Nortown Amateur Radio Club.

Mail all applications for the CANADAWARDs to: P.O. Box 76752, Vancouver, B.C., Canada V5R 5S7.

Tracking the Hamburglar

RIPPED OFF: Clegg FM-DX 2 meter FM transceiver, s/n HM-298 and microphone were stolen from the van of WA3BGN on Feb. 5, 1977, in downtown Bridgeport CT. Anyone with information please contact Jon P. Zaimes WA3BGN, 681 Longhill Ave., Shelton CT 06484 (phone 203 929-4659) or the Bridgeport police department, file no. 6856.

LETTERS

AR73L?

Just a short letter to commend your fine effort in the area of amateur radio. In my opinion, *73* is the best magazine on the market. You always have up to the minute news on what's happening in our hobby. You also solicit people to write guest editorials if they disagree with you, and unlike other magazines, you even print them.

If there was one thing to be changed in *73*, it would be the computer I/O section. Though it is the up and coming trend in amateur radio, and although I have a great interest in the subject as a beginner, I feel the computer articles should be reserved for your new magazine, *Kilobaud*. I think there is nothing wrong with material about computers; I just believe construction and programming should be kept in the magazine that was designed for the specialist – *Kilobaud*. Computers just aren't everybody's bag of capacitors.

These are just my own personal feelings and I thought it might do some good to let you know where I stand. In all other areas, Wayne, just keep up the excellent work, and in the future we just may have the AR73L for the betterment of our hobby. Thanks for listening and for a super magazine.

Neil Kelly VE6CFI/W4
Temple Terrace FL

SPREAD THE WORD

I am in FULL accord with your opinions about Docket 20282 (and those numbers sound like the last mile). Did it ever occur to anyone (I know you caught it) that the individual who will apply for a freebie Communicator license – and pays his money – must *first* be interested in amateur radio? Therefore, and accordingly, someone MUST interest him! Without that interest nothing happens to the grand idea of the amateur cup running over. There is where the League has consistently dropped the hot potato – public relations. This little item requires pros and real ones. The Podunk Valley Radio Club cannot possibly get amateur radio into the media, but with all the affluence of the ARRL, it can do it – *if* it will set up the proper department and hire pros. Every other national organization I have heard of and joined spends money on just that! Nevertheless, the boys in the back room have hidden themselves in their Newington digs and repeatedly ask the young outsiders to spread the word. It cannot be done effectively in that manner. This I have written, discussed, and informed the Director and everyone I meet. I have received no solid reply except that it is a good idea.

If you interest the students, the Boy Scouts, the Girl Scouts, the Sunday schools, and even the stamp clubs, then and only then will there be a run for the licenses.

One minor comment: I have spoken before Ruritans, Kiwanis, Rotary, et al, and shown the much touted "Ham's Wide World." It's an interesting movie but *not* a movie to interest new hams. As I tried to tell some friends the other day: My shack is open any time you have someone you would like to exhibit ham radio to. However, if you show a youngster all the gear that has been accumulated in 35 years, you will immediately scare him away. He will either be so awed or so confused that he will immediately conceive the idea that the hobby is for the rich and the mighty. What really has to be done is to simulate the old 6L6 and oatmeal box and show them how it works.

Gay Milius, Jr.
Virginia Beach VA

LEARNING

This letter should really go to Peter Kendall WN3ZRG (Letters, Jan. issue, p.154), because it is for people like him that I am writing it. Pete, I completely disagree with your views, and actually take offense with your criticism of *73*. It seems as though you are *still* a neophyte to ham radio – not in the technical sense, but in the fraternal sense. You are selfish. Just because *you* have no interest in computers, you think they should not have a section in *73*. In thinking this way, you are depriving others that *do* have an interest in them the opportunity to learn more about them. If you ". . . see no need for (a computer) . . ." in your shack, fine – don't buy one. But there are others, with a little more upstairs than you or me, that *find* a need for one. I, too, don't need a computer in my shack (yet), but that doesn't mean I want to hack every I/O article in *73* to pieces with a meat cleaver. I'm a Tech and don't want a low band rig in my shack. I prefer VHF, but I don't want to sit in front of a fire and burn articles on keyers and CW filters. I want to read articles on the low bands – maybe I'll find some facet of operating that I'll be interested in. Enough of this self-glorification.

My point is that I don't think we should deprive others of something that they enjoy just as much as you enjoy the "distant station," or something I enjoy as much as bringing an old taxi radio to life on six meter FM. If terms like byte, ROM, RAM, etc., leave you in the dust, get up and try to learn them. If you don't want to, then lie there and be trampled by others who are not "conventional hams."

Please do write some articles on code speed, observations on the ham bands, etc. I'd enjoy reading them. Not because I care about operating at 40+ wpm, but for the same reason that I read the I/O articles – I want to learn.

Jim Heid WB3CWY
Pittsburgh PA

THE MENTAL BLOCK

Yesterday's arrival of *73* was a pleasant surprise, what with the mail tie-up during the holidays. As usual, it was interesting and informative. Read the Letters section; I used to agree with W5GOS about I/O articles. It took a tech talk by WA2PJS at the Dec ARATS (W2SEX – listen for us during FD '77) meeting to kindle a keen interest. By the way, took a digital course at college recently, found it easy and interesting, got a "B". Anyway, I/O is more interesting to me nowadays, but not enough to cause me to subscribe to a new magazine. I will, however, purchase the "Bugbooks" when time and finances warrant.

Having heard all the arguments for and against CW, I'd like to say that CW is just plain enjoyable operating. I like it. The *73* tape was a great assist in qualifying at 20 wpm at Rochester this spring. I'm an Extra now. Those who cry about the code probably have a mental block (they have programmed themselves *not* to learn it by thinking to themselves that it is impossible; I've been through *that* myself on occasion).

Whatever happened to SSTV? Editorials rambled on about it at length some time back, and now – nothing. Granted, there are many subjects to write about, and SSTV probably won't come up for some time again. Oh well.

Steered two CBers toward their ham tickets this summer and fall. One is an avid DXer; when he learned that several hundred mile QSOs are possible daily on the ham bands, he dug in and studied, attended an ARATS-sponsored ten week class. The other fellow always knew about ham radio, finally found the time and the help, and is nearly ready to try his code test. Met him in a barroom where he tried to pick my mind for antenna info. He's built several CB antennas so far, will grow into the HF ham bands soon. It's a good feeling, helping these guys. They'll still keep their CBs for utilitarian communications, though. The darn things *do* have a practical value.

Having recently passed my FCC Second Class Radiotelephone ticket and my Extra, and not having time for hamming, I'm still volunteering myself to help anyone in the Honeymoon Capital area toward obtaining a ticket.

Jeffry Blackmon WB2UYI
7714 Lindbergh Ave.
Niagara Falls NY 14304

BUS-MOBILE

Thank you for a most interesting issue, #195, Holiday, 1976.

Enclosed is a photo which I hope will be of interest to you, depicting as it does how readily one can adapt amateur radio to one's job given enough imagination! Working mainly night runs ("owls"), I found my Standard hand-held to be a welcome diversion during my layovers, as well as a convenient supplementary communications means in event of an emergency.

This photo was taken for a QSL card I am designing. Unfortunately, my having to be at the business end of a 1950 Exakta with a cantankerous self-timer precluded my being photographed in the bus with the Standard.

I would be most interested in hearing from other radio amateurs who may be similarly involved in the transportation industry.

In this area, "Locomotive Mobile" is also known!

Thank you for a very stimulating year one of my three year subcription. I read both *73* and *HR*, and find they complement each other nicely.

E. G. (Ernie) Kenward VE7BYK
North Vancouver BC

NAG MOBILE

I thought you might be interested in my system of mobile communication: Nag Mobile. In a world of machines, electronics, and computers, the west is still able to blend modern technology with the traditional western mode of travel – the horse. The Appaloosa pictured is able to differentiate between an antenna and a whip and is undisturbed by my mobile communication. There is no ignition noise or alternator whine – just an occasional whinny.

The transceiver, a Drake TR-22, is secured to the saddle horn, the coax is run under the saddle, and the antenna is a Larsen Mag (Nag) Mount secured to a metal strip which is affixed to the back of the saddle. In flat desert areas, the system is ideal, with no brush or trees to entangle the antenna – and it helps to have a cooperative horse. Long live the west!

Horse mobile is not unusual here in the west. The local repeater group helps with parades, and most trail rides utilize handie-talkies, but I have never seen a horse-mounted antenna. Hope you enjoy the photos.

Carol Sears WB7CUF
Phoenix AZ

P.S. My father, Stan Sears, (W2PQG) suggested your magazine, as it has a better reputation for printing articles than *QST* or other ham magazines.

Beats walking! – Ed.

WARC

I read the writeup on the proposals for the WARC conference with considerable interest. I'm glad you went into detail on it in the February issue. I don't think the analysis went far enough, though; in the case of all but the HF bands, it didn't say much about the implications of the proposed changes, or the pros and cons. I hope there will be space in the future to educate us about bands we don't work, or haven't worked in the past. One question that comes to mind is: What's the purpose of satellite allocations in the HF bands?

Now, several comments. First, if it's argued that we need some spectrum space at in-between places to get reliable propagation when the present bands are out, for such jobs as handling the traffic arising out of the Nicaragua earthquake, maybe we don't need whole bands. As accurate as ham gear is getting, a few spot frequencies might be enough. Making them open only to traffic nets would keep them quiet most of the time, so high-priority traffic could get through, and letting the nets on would get them listened to periodically. Naturally, any ham should be able to declare an emergency and call. Next, I think it would be helpful all around if there were a few spot frequencies shared with other users. How about a common emergency frequency for hams, aircraft, inshore boats, and land mobile? FM on 144.000 MHz would be an obvious choice. Putting all the crash beacons on that frequency would free up 121.5 for urgent voice calling, as well as simplify WB6CQW's proposal for equipping 2m repeaters to detect ELTs. Now, a really radical suggestion, as wild as anything that ever came out of Peterborough. Has anyone considered the idea of trying to steer the EIA's grabby mitts away from 220 by suggesting that CB expand into 6 meters? Being right next door to channel 2, the TVI potential makes any significant amount of power a nearly hopeless proposition except for those who live far from cities. So 6 meter DX, while sometimes possible when propagation is right, is never going to be a workhorse. I've never heard more than half a dozen stations on the band, and none above 51 MHz. Meanwhile, as 2m fills up, the next logical place to put repeaters is 220, so we're likely to want it very soon. From the CBers' viewpoint, 6m would make a much better mobile band than 220, because the longer wavelength gets around obstructions better, and being closer to 11m, it would be easier and cheaper to make one transceiver cover both – probably as one continuous series of channels. By the same argument, ham gear could treat 2m and 220 almost as one band. Shared use of some low end channels on 6m could be a really cool idea, too. We could end up with a common emergency channel with direct input to police departments, and the chance to both demonstrate superior operating practices and rub noses in the benefits of such ham privileges as equipment modification and high power. Incidentally, I think any new CB channels should be sideband only, and not just to save spectrum. With all the benefits of having radio in everything that moves, carrier heterodynes make channel 19 pretty hard on the ears.

John A. Carroll K6HKB/1
Bedford MA

LONESOME SAILORS

I am a Coast Guard radioman, stationed onboard the *USCGC Ingham*. I have noticed that *73* has brought up some good suggestions for things to keep a sharp lookout for at the next ITU conference coming up shortly. Here is another one: the expansion of the use of present amateur bands in international waters, especially region 2.

There are a lot of things that us poor lonesome sailors miss out on, as far as I know, for no good reason at all. It would be great, for instance, if we could make use of the local area nets on 75 meters during the evenings, as a source of available operators for phone patches in our home port towns. 40 meters in the evening is too crowded with broadcast stations; even if the skip were short enough, that only leaves the 20 meter band, which gets expensive. (Do you suppose that could be the reason we can't use 75 meters? Hummm!)

In addition to this, it would be nice to be able to use all modes of OSCAR; presently we are restricted to inputs below 148 MHz.

Then there is that 1600 meter band the FCC has proposed. Experimentation from international waters on 1600m would be severely limited by the /mm limitation. The Navy has been using this band for a long time now for maritime (submarine mostly) workings, and I believe it would be a very dependable maritime amateur band.

Yes, there is a problem with LORAN on 160 meters, but with today's receiving gear, and a reasonable power limit (say 50 or 100 Watts), there is no reason to completely forbid working on that band either. Most of the other bands we are talking about are exclusively amateur, and would bother no one.

Enough criticism. I just want to say thanks for publishing the best, most open, and outright honest amateur magazine going, and I mean that from the heart. Keep up the good work; it is appreciated.

Mike Warner WA7LZQ/4
Portsmouth VA

ASCII

Radio hams have used teletype machines to communicate for many years, adapting the 32 character, 5 level machines that became readily available after World War II. Teletype communication was formally written into the FCC amateur regulations in 1953, specifying the 5 level Baudot code and standard speeds of 60 words per minute. Hams were not satisfied with the mechanical contraptions and paper tape storage, and with the advent of ASCII code, CRT terminals at low cost, and the 8-bit microprocessor, we look to modernize these ancient FCC regulations that encumber our development of the communications arts and sciences (if you want to use ASCII legally on the air, you can obtain a special temporary permit, but the process is slow and difficult). Hams have already established data transfer links between minicomputers in two different countries via the amateur radio satellite OSCAR 7, under special FCC permit using ASCII. Other computerized hams make regular schedules of cross-country data links by the kluge method of converting their ASCII computer output to Morse code, transmitting at more than 100 wpm, and converting back to ASCII at the other end.

Changes in radio regulations to reflect the current technology are long overdue, and a formal petition numbered RM-2771 has been entered requesting the allowance of ASCII 8 level code on the amateur bands. If the FCC hears support on this from the public, there will be a set of proposed rules made up and published for public comment. If comment is favorable, the rules could be changed in a year. Or the feds could just sit on ASCII forever if they don't hear from anybody. You can help by sending a simple comment (6 copies required by law) encouraging the FCC to act on RM-2771. Just take a note pad and a pencil and write six times: "I support RM-2771 allowing the use of ASCII code on the amateur radio frequencies." Add your name and address, and mail them to the Federal Communications Commission, Washington DC 20554. If you have access to a cheap copier, you may wish to elaborate on why ASCII radio transmission is desirable in your opinion, but a simple statement will do, as numbers seems to count more than eloquence at federal agencies. Be sure to mention RM-2771 by number.

J. R. Johnson WA5RON
Austin TX

SMOKEY

I read with interest your letter dated January 1, 1977. This letter, you may recall, was in response to a letter I wrote regarding the article "A Mobile Smokey Detector" in the Holiday issue.

As you pointed out, the United States of America celebrated a very glorious achievement last year. We celebrated the anniversary of a break

with a government that had, as Thomas Jefferson put it in the Declaration of Independence, "a long train of abuses and usurpations," one of these usurpations being "the abolishing of the free system of English laws."

Americans in 1776 were justified in doing what they did because, as noted earlier, the rule of law had broken down in the then American colonies. Today a free system of American laws is alive and well despite the best efforts of some. In fact, the rule of law is very strong, as recent political events have demonstrated. This is also something we celebrated the 200th birthday of last year.

This last achievement is perhaps the greatest of all. For in this system Americans can and do daily change the laws by both judicial and legislative action. But until a law is changed, Americans are duty bound to abide by it. For no man is above the law and no man is below it, nor do we ask any man's permission when we require him to obey it.

To the heart of the matter: I agree with you in that a discussion of the pros and cons of the 55 mph speed limit is beyond a letter such as this. In fact, such a discussion is not needed. What is needed is a recognition of the fact that murder, bribery, not using a valid callsign on the ham bands, and yes, speeding, to name a few, are against the law. Not as some people feel, just a good idea you can take or leave.

I, like you, am very proud of people who have the guts to stand up against what is wrong in our society. That is the only way change is accomplished and wrongs righted. This has held true from the patriots at Valley Forge to those who attack social injustice today.

But unlike those at Valley Forge, we do not have to resort to arms and violating the law. Instead, Americans seek to change the law through established legislative and judicial channels. This can range from an individual petition to the FCC, or a judicial challenge to the state Blue Laws, to a legislator down here in Texas trying to *legally* change the speed limit.

I have, however, absolutely no pride in an individual who attempts to either change or enforce the law by breaking it. In fact, I have only pity, for these people are the ones who have missed completely the spirit of the revolution and indeed the nation. Good examples of these folks who, as you say, did their own thing, are the HF bootleggers who have recently been apprehended by the FCC. I am quite sure those arrested think those laws are bum and will do what they can to break them down and get rid of them. But, may I ask, what will happen to radio should they and others continue operating as they were?

It is easy to see the chaos and disorder that would erupt if people only obeyed laws they personally liked. It would not only be the demise of ham radio, order, and justice – it would be the demise of the country.

I am aware, in regards to the WARC, of the one country, one vote rule. I have thought what we as a hobby have needed is a representative to spread the amateur radio cause officially. I also believe, however, that anti-ham feelings could hardly get better by selling one amateur frequency for the purpose of breaking the law. It only adds to the list of excuses available to cast a negative vote regarding amateur appropriations.

For were I a delegate who had read "The Mobile Smokey Detector," I wonder how law-abiding hams were. The case of WR6ABE is a timely, sad, and scary example. Again, those involved with causing the shutdown of that repeater probably were disregarding laws they felt were unnecessary and felt no duty to obey.

In closing, I believe *73 Magazine* has and will always be a leader in the field of ham radio. I am hoping that your code tapes will help me hang a 2nd Telegraph next to my First Telephone (with Radar Endorsement) and replace my Advanced with an Extra. I just hope that in the attempt to lure CBers to a very exciting hobby, we stress good and legal operating procedure, and not another way to beat Smokey. If not, we need not worry about WARC in 1979, for ham radio is finished.

Robert Oler WB5MZO
College Station TX

I disagree with your comments concerning "The Mobile Smokey Detector," Bob. Based on the amount of mail we have received, there are a great number of people using the Smoke Detector for what it is, a microwave receiver. Have you seen any easier method of getting started in amateur microwave communication lately? I doubt it. – Ed.

MUFON

The January issue of *73* with the article titled "The UFO Connection" by David L. Dobbs K8NQN indicates that you still maintain an interest in the UFO phenomenon, even though it may be secondary to your current hobby. Everyone enjoyed the humor of the article, but some thought it was perhaps a fictitious case due to the "spoof" address used in the "open letter" concept. As you probably noted, David simply made minor changes for literary purposes. Amateur radio friends quickly recognized the addressee, especially since Texas and the zip code were correct. Needless to say, it did confuse the post office department in some cities. However, David's address was correct and correspondence will be forwarded to MUFON (Mutual UFO Network, Inc.).

MUFON presently has two active UFO nets operating weekly. The 75 meter net on 3975 kHz meets each Saturday morning at 0800 CST with Marshall Goins WA9ARG in Quincy IL as net control. A 40 meter phone net also meets on Saturday mornings on 7231 kHz with Joe Santangelo W1NXY, in Waltham MA as net control. We invite ham operators interested in the UFO phenomenon to check into these nets not only to share their own UFO sighting experiences, but also to obtain the latest newsworthy UFO events occurring around the United States. Many of the ham operators participating in these nets are also state directors, state section directors, and field investigators for the MUFON.

We publish a 20 page monthly magazine titled *The MUFON UFO Journal*, which covers UFO sighting cases from all over the world. MUFON has members in all fifty states and in thirty-five foreign countries.

We have received, through David Dobbs, several personal UFO sighting reports made by your readers in response to this fine article. I am confident that many of the subscribers to *73* would like to have our correct address; therefore, we would appreciate having this letter published in a subsequent issue.

Walter H. Andrus, Jr. W5VRN
International Director
MUFON
103 Oldtowne Rd.
Seguin TX 78155

HILLBILLY NOVICE

I just received my first copy of your fine magazine and, wonder of wonders, it took me over an hour to just thumb through it. What a delight it was for me, a hillbilly Novice, to find all the variety of information and subjects. I even found some I could understand! Hi! It seems that someone must remember what it was like to be a unlearned, untrained, but willing *Novice* when they wrote some of your articles. Please include as many illustrations and pictures on your construction projects as possible as many of us (notice my pride) hams have no experience but want to start someplace.

I certainly got fired up when I read about "A Vest Pocket QRP Rig" by K5JRN in the January issue. When I read that he had just worked Tennessee, 500 miles with a 569 signal report, you know what I did? Yes, I checked my log, but it wasn't me he worked.

As a Novice on 40 meters, one of my best remembered QSOs was with Milt W8TZ in Columbus, Ohio, 70 years young, QRP 3 Watts on a home brew rig he made 30 years ago. QSL said it was in a 3 x 5 card file box and consisted of 117L7 tube and crystal. For me, that was some fun talking to a ham with 56 years experience and wisdom. What progress those "ex-sparkers" must have seen!

So, Wayne, hook up the old key and drift down on the Novice bands sometime and encourage others to do the same. We sure do have a big time there.

Mike Wechsler WA4SPX
Kingsport TN

I'll look for you. – Ed.

MIAMI

We did it one more time: The 17th Annual Miami Hamboree had an attendance of more than five thousand with 64 display booths. The chairperson of the Hamboree was Evelyn Gauzens W4WYR and the sponsor was the Dade County Radio Club.

Guest speaker was Armin H. Meyer W3ACE, Ambassador to Iran and Japan.

Bill Halligan W4AK/W9AC, former owner of Hallicrafters, was on hand to greet some friends from up north.

Of course *73 Magazine* had an excellent display and was one of the most busy booths in the Hamboree.

Larry Price W4RA delivered a couple of speeches representing his position as Southeast Director for the ARRL. The ARRL booth was manned by Terry Williams W1UED and Ellen White W1YL.

The computers booth monopolized a great part of the attention, having unusual coverage by the local TV stations. I am afraid I'm hooked for good and my personal budget is going to suffer great loss this year.

One of the parking lots was open to enlarge the swap meet and fortunately we had some of the best weather of the season.

Albert H. Coya WB4SNC
Miami FL

The Miami Bayfront Park Auditorium had wall to wall hams.

THE 10M SOLUTION

Over the past few months, prices of CB radios have been falling like a rock. It seemed like now was as good a time as any to take advantage of some good cheap radios and put them to some practical ham use. WBØMZD and myself looked over several units and decided on one type for conversion. It is here where we would like to pass on a few suggestions. First, a frequency scheme.

We decided on a scheme which would allow use of as much coverage around the frequencies of 28.6, 28.65, and 28.8 MHz as possible. These areas appear to be the most popular on 10 meters at the present. Our channel versus frequency selection is as follows:

Channel #1 28.550
Channel #2 28.560
Channel #3 28.570
Channel #4 28.590
Channel #5 28.600
Channel #6 28.610
Channel #7 28.620
Channel #8 28.640
Channel #9 28.650
Channel #10 28.660
Channel #11 28.670
Channel #12 28.690
Channel #13 28.700
Channel #14 28.710
Channel #15 28.720
Channel #16 28.740
Channel #17 28.750
Channel #18 28.760
Channel #19 28.770
Channel #20 28.790
Channel #21 28.800
Channel #22 28.810
Channel #22B 28.820
Channel #23 28.840

Those who research this scheme will note that the original CB channel spacings have not been tampered with, which leads us to our second suggestion. We modified *only* the injection or offset oscillators and not the synthesizer. First of all, it is the easiest, cheapest, and most electrically sound way. Secondly, if modification of the synthesizer is done, several problems might occur (depending on type of unit and synthesizer scheme) with the offset oscillators or traps used for filtering of synthesizer products. By converting the offset oscillators only, you have several other important things to gain. You might incorporate diode switching of these crystals with two other crystals to extend coverage in other areas, or, how about modifying these with a varicap to slide in between channels? Note: Not to be confused with sliders, delta tuners, or clarifiers.

We are submitting this frequency scheme to as many of our local clubs as possible. It would appear this is the beginning of something big for 10 meters; local interest is very high. Now would be the time for frequency coordination so we do not have gangland wars similar to some in the beginning of 2 meter repeater days.

Present plans are for breadboarding a scanner similar to the types used on public service monitors and a solid state amplifier for mobile use, although most hams would be surprised to find out just what 5 Watts can really do on a clean frequency.

WBØMZD and myself would like to receive any other plans by individuals or clubs. All letters will be answered. Get on ten cheap and have some fun! Remember: use it or lose it!

Tim Haake WAØTSY
128 Lake Point Drive
St. Peters MO 63376
Ken Lowrance WBØMZD
11569 Tivoli Lane
Creve Coeur MO 63141

Well? — Ed.

10-4?

I've been reading your articles since the days of *CQ*. I probably wouldn't like you if I met you since anyone that drives sports cars and endorses no code licensing has got to have long hair too! But you do have a CB, so you're probably just a native Texan who went "astray."

Most important, however, is your ability to create the best ham rag around. Congratulations to you and the staff of *73* for selecting *useful* construction articles and opening a forum for any idea or opinion — independent of advertiser pressure. Those companies who boycott *73* should also be boycotted. May we see the complete list? Moreover, any decent ad man employed by these firms should quit in protest. After all, since when did advertising policy win out over editorial policy? Other magazines in various fields which allowed their advertisers to dictate their editorial policy soon were out of business!

I buy all the ham mags and hope ol' *CQ* does stay in the game. I don't agree with everything the ARRL promotes and — gosh — I wish they'd change some of the construction articles that refer to parts that are no longer available. Also, I wish *Ham Radio* would hire a rewrite man to modify the construction articles to make them more readily understandable.

Lately, *73* has had the best range of construction articles. The Ham-M modification article was super simple and accomplishes the same thing that other published modifications set out to do, only at half the time and 25% of the cost! The TR22/15 amplifier article was great and *even mine* works. And believe me, if I can build it, anyone can! And I mean anyone!

Keep up the good work. And remember, Wayne, I probably wouldn't like you at all, but tell your advertisers I'm reading every single page — ads included. 10-4?

Don Peak WB5OZZ
Spring TX

THE SHEMYA BLUES

I'm writing *73* because I'll never get an answer from the ARRL. I'm currently on a 2 mile by 4 mile rock 1400 miles west of Alaska and country status is not offered to the hams on this island. How can they give country status to a stilt shack on a reef where the operators have to man boats upon leaving the ham shack? I'd like to see some readers ask the ARRL why one group can get country status and not another. By the way, the QTH is Shemya Island, 176° 10' E, 52° N on the other side of the 180th meridian.

There are many future hams on the island, but because of recent FCC ruling, the only test I can administer is the Novice. Unless someone wants to spend $600 for plane fare to go to Anchorage, it's impossible to upgrade. Quite a price for anyone to take a test to enjoy a hobby. This means that at best all you can get on this island if you want to be a ham is a Novice. That means no OSCAR, no 20 meters, no VHF, no personal 2m FM with hand-helds, and a very small spectrum filled with foreign broadcast and jammers. With little else to do at this satellite tracking station, you would think many people would like to advance into amateur radio as the only outlet off the Black Pearl of the Aleutian. Alas, alas. There is, however, a Novice course — only a Novice course, though.

Larry Macionski WA2AJQ/KL7
Elsworth Warmouth WB9LGG
Frank Yatko KL7HAM
Shemya ARC KL7FBI
Shemya Island

80 CHARACTERS

In your Holiday, 1976, I/O Editorial, page 74, you mentioned visiting Southwest Technical Products in San Antonio where you had heard about a couple of fellows who have worked up an 80 character modification of the SWTPC PR-40 Alphanumeric Printer. I've just purchased the whole SWTPC system, less the GT-61 Graphics Terminal and the Printer, and am now looking for an 80 character printer.

Are you planning to publish their modification and if so, when? If not, do you have the names and addresses of these people? Or should I write to Mr. Dan Meyer at SWTPC for more information?

Richard Gay
South Harpswell ME

I'd love to publish an article on such a modification. — John Craig.

OUCH!

I thought *73* readers would like to see the latest advance in space conservation. This shack requires no shelf space, no table, and causes no problems with the YL. All you need is a power plug. Try it!

James Brodsky WB6JXB
Santa Barbara CA

MORE WARC

VE3CYC's personal observations on the future of the 420-450 MHz band ("More WARC," page 9, January *73*) are useful if they cause more hams to think seriously about the preparations for the 1979 WARC.

However, I would like to remove any impression readers may have gained from that letter that the Canadian Radio Technical Planning Board has recommended the 420-450 band be radically changed from its present pattern of use in North America. As a matter of fact, the committee (which was referred to in the letter) did not recommend any changes whatsoever in allocation status between 420 and 450 MHz, despite the near-crisis situation in UHF frequency requirements in other services.

It is worthwhile considering how much of the band in question can at present be "called our own."

In Region 2 of ITU, which includes the US and Canada, the primary allocation is to radiolocation, with secondary allocation to amateur. In the US, the domestic allocation is to government and non-government, with secondary allocation to amateur and amateur-satellite. There are US footnotes which impose a power limitation on amateur use in certain areas, and reinforce protection for radiolocation against interference from hams. In the small segment authorized for amateur-satellite, there is a provision that any harmful interference from hams to other services "must be immediately eliminated."

Where is the part we can call our own?

The Canadian Amateur Radio Federation, in its proposals for WARC 79 preparation, has recommended that 420-430 remain as it is, 430-440 be

assigned worldwide exclusively to amateur, and 440-450 stay shared. This would be an improvement over the present situation, and it would be unrealistic to press for more.

I think it is dangerous to use as proof of need the fact that "an amateur TV repeater takes up more than 12 MHz," especially at a time when a commercial lab has released information about a system for transmitting moving TV images using a fraction of the usual 6 MHz. Haven't we always argued that hams are in the forefront of technical advance?

Bob Eldridge VE7BS
Burnaby BC

Yes. – Ed.

THE I/O DEBATE

I wish to add my tuppence worth along with WN2DYU and W5GOS. I feel that there has been too much emphasis on computer articles and also articles which assume the wealth of the amateur reading the article. Yes – yes, I know, not all the articles are like this, but it is still pretty bad.

Computers are fine, and I hope to get into them someday, when I can understand them. But with all the jargon printed in *73*, *Byte*, and in *Kilobaud*, how can a newcomer learn anything?

You say computers are closely related to hamming. Well, so is the automobile, especially for two meters. However, I have yet to see an article on how to tune up a car. After all, cars and mobile work *are* related. How about some wood-working articles for those of us who build antennas and radio benches? And how many hams drink tea or coffee when on the air during contests? Where's the article on brewing that ultimate cup of coffee? They ARE related . . . (Sorry, I seem to be stretching a point . . .)

And finally, what is the constant knocking of *CQ Magazine*? I will grant that in the past it was not very good, but in recent months they have been making what looks to me like a considerable effort to print a good magazine. I have subscribed, and I find the articles both interesting and informative. I am not a contest buff nor do I much care about DX-peditions. However, their articles about such things are well-presented and interesting. Finally, they seem to devote a good deal of space to amateur radio in general. So, before casting stones at *CQ*, Wayne, why not read one of their latest issues. No computers, but you still might get something from it.

If it will serve to identify my position a bit further, I no longer subscribe to *QST*, because it is so rankly dull. I am also too young for the ARRL, being that I am under age 87. So, you can see that I have at least some agreement with my Uncle Wayne. But, if *73* keeps being a rich man's ham mag/computer mag, I will drop my subscription to *73* as well. I know nothing about computers, but would *like* to know. However, NOT ONE publication explains computers without using jargon and buzzwords.

David J. ("Walrus") Mann WA6MHD
Redwood City CA

AFD '77

The members of the 143 Communications Flight (Spt), Rhode Island Air National Guard, plan to be operating on Armed Forces Day, May 21, 1977.

Anyone working our club station, K1FCO, will receive a commemorative certificate from our unit provided an SASE and QSL card are sent to us. Our mailing address is: K1FCO, 143 Communications Flight, Rhode Island Air National Guard, T. F. Green Airport, Warwick RI 02886.

We will be operating on the following frequencies: 21.385 MHz – 1400Z to 1800Z; 14.330 MHz – 1400Z to 1800Z; 7.280 MHz – 1400Z to 1800Z; 50.700 MHz – 1400Z to 1800Z.

TSgt Raymond A. Allard K1MFZ
Warwick RI

NØPPI

In October I organized a special events station, NØPPI, for the 2nd annual worldwide conference of People-to-People International. With fantastic amounts of help from several hams and lots of loaned equipment, we had a very successful demonstration and operation. We made several hundred contacts and requested SASEs for QSLs. As yet, I haven't sent out the QSLs because I'm trying to get them printed for little or nothing – I'm the original cheapskate ham and I hate to ask P-PI or the local ham clubs to foot the bill.

So, if you would please tell your readers who worked NØPPI and sent SASEs to please be patient a little while longer, I will soon have a source (hopefully) and will get that special prefix off to them as soon as possible.

Oh – also enclosed is a 3 yr sub (renewal) to your fine mag. Keep up the good work. Thanks much.

Neil Preston WBØDOW
Kansas City MO

YASME

This is a report on our successful YASME DXpedition operation as PJ8KG, Philipsburg, Dutch Sint Maarten, Netherlands Antilles.

Some 7,500 QSOs were made with amateurs in 121 countries. There is a system to the way calls are issued here that is not well known outside the immediate area. There are two DXCC countries in the group. One consists of Sint Maarten (PJ7), Saba (PJ6), and St. Eustatius (PJ5). For these countries, all *visiting* foreign hams are assigned PJ8 calls (usually of their choice). The other DXCC country consists of all the remaining islands: Curacao (PJ2), Aruba (PJ3), and Bonaire (PJ4). For these countries, all visiting foreign hams are usually assigned PJ9 calls of their choice. It normally takes two months for the processing of an application for an amateur license, which must be made on their official form.

People sometimes ask, "What does the YASME Foundation do?" We had a good example at PJ8KG of how the YASME organization (all officers and directors are avid DXers) can help a YASME DXpedition in the field. Three condensers in our transmitter burned out. We managed to get word of our plight to Frank Campbell W5IGJ, an ex-publicity director for YASME. He got replacement condensers off to us by air mail immediately. Within a few days, the defective condensers were replaced and we were back in operation. There have been a number of similar incidents where YASME officers have helped in the licensing and operation of YASME DXpeditions in the field.

Lloyd Colvin W6KG
Iris Colvin W6QL
Netherlands Antilles

BAUDOT TO ASCII

I am sure that you receive hundreds of letters telling you how good your magazine is. And, it really is spectacular. Let the other magazines try to work their way up to the top, if they can. If *73* is an inspiration, the ham fraternity will gain a lot. Amongst several projects I built from *73* articles, I picked my last one, the keyboard project by K7YZZ, for sending you some photos.

Despite the warning from Mr. Hutton on availability of the 5220 BL/N chip, I chose to build the Baudot to ASCII converter using that ROM, as I saw it advertised by some of the companies in the USA. At this writing, I had not yet received the ROM ordered from Tri Tek more than a month ago. So the ASCII part of the keyboard is not yet working.

To build an electronic project in Brazil can be very frustrating, as you don't easily find (if you can find at all) many of the necessary components. So, some imagination and adaptation is usually necessary. As I had only a small piece of double-sided PC board for the encoder matrix, I chose to locate it on the top of the main board. Under it you can see the UART and the Molex pins that will receive the 5220 BL/N. Since I am a "beginner" in putting projects together, you can see that I had to use some jump wires.

Underneath the main board you can see another small board. That is the parallel ASCII to serial ASCII project from another *73* article: W8LNY's. Some small modifications had to be made on both boards to suit my own needs.

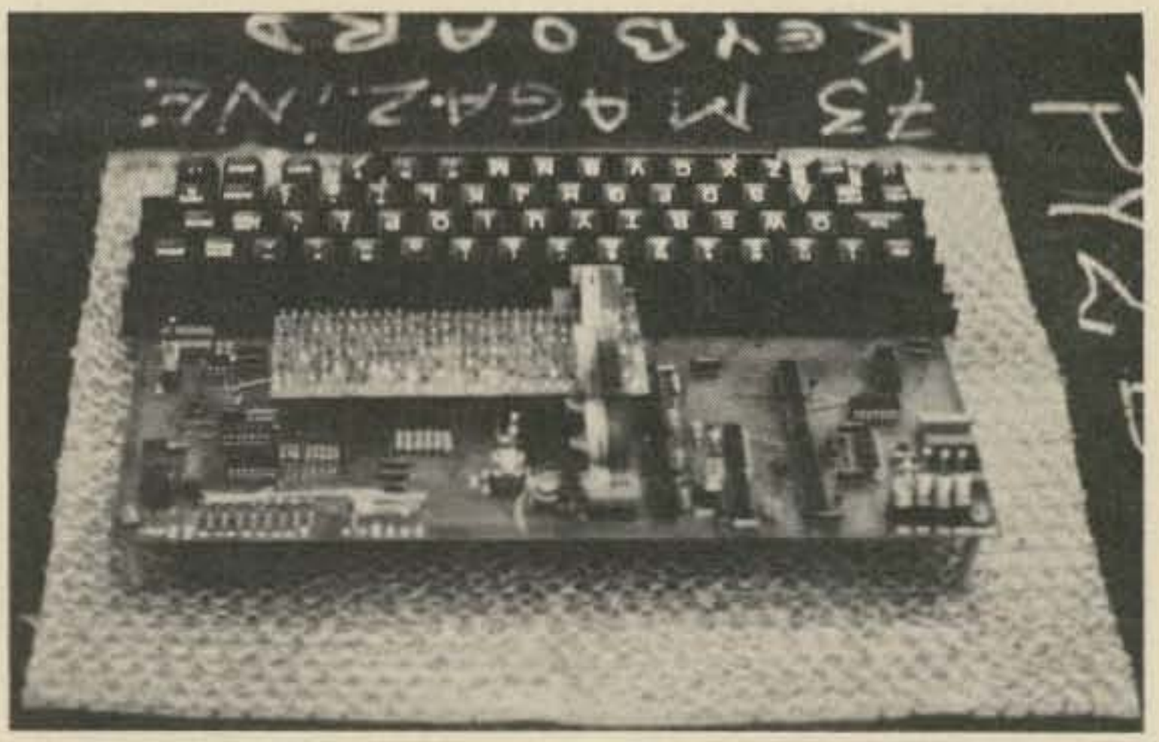
Thank you very much for such an excellent magazine.

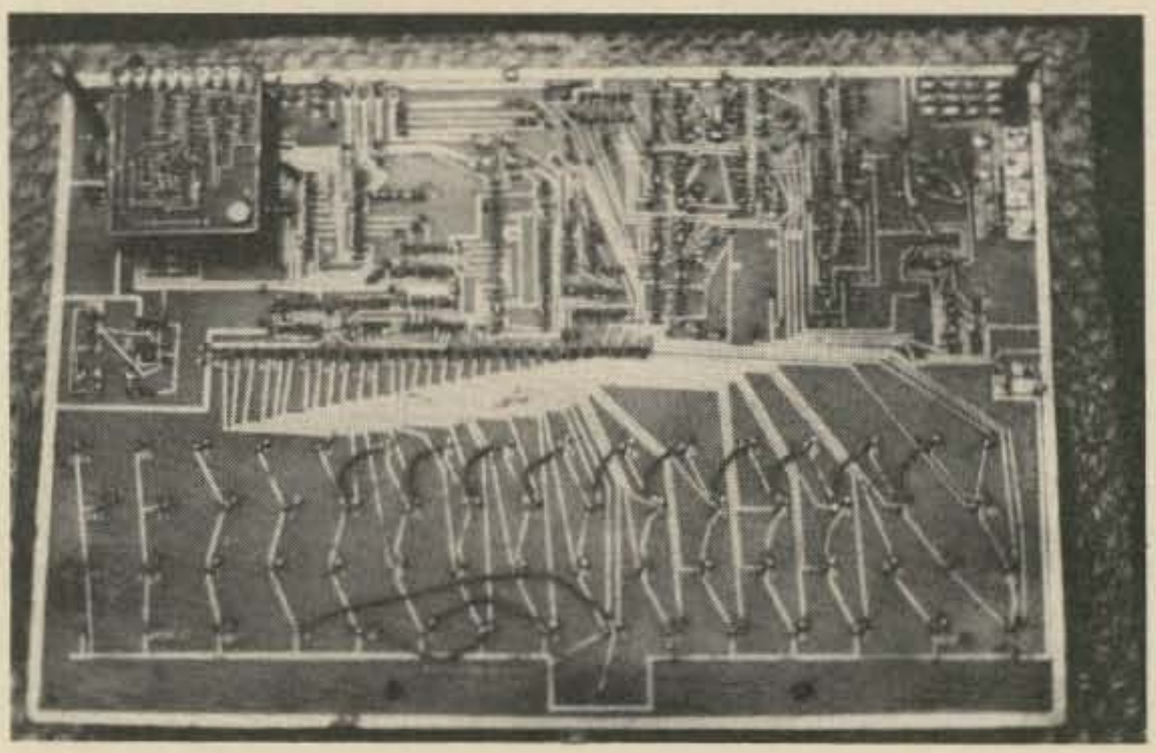
Roberio Dias PY2BLA
Sao Paulo, Brazil

HB 1089

We enjoy your magazine and the point you make of speaking out on the issues. I think that if more amateurs would do the same, amateur radio would be (and continue to be) in good shape. Keep up the good work.

In our Oklahoma state legislature at present is HB 1089, "prohibiting the





use of devices to detect radar." I haven't seen a copy of the bill yet, so I don't know what type of microwaves they are talking about, but I assume it's traffic radar.

Some of the amateurs in the area have expressed concern over the principle of state government trying to regulate reception of radio waves, as well as other possible side effects of a bill like this. Here in Tulsa, the amateur and CB community has just had a taste of city government regulations in towers and antennas and is sensitive about the issue.

We would welcome your opinion on the issue. The bill is still in house committee, so there is still time for action.

Charles Frentzel WB5EUK
2704 N. Norwood
Tulsa OK 74115

MA BELL – AGAIN!

The new "Bell bill" in Congress is a threat to phone patches. Each ham should realize the many undesirable consequences including the threat to phone patches in this bill that is now being considered by Congress.

After many years of illegal phone patches, hams can now in various ways legally attach phone patches, telephone answering equipment, tape recorders, computers, and other communication devices to the telephone lines. This may be a short-lived benefit if this new bill is passed.

A very good description of the undesirable effects of the new bill is contained in the January, 1977, issue of *Consumer Reports*. In this article it mentions, "Another section of the Bell bill, as already noted, would strip the FCC of power to regulate terminal equipment; regulation would be turned over to the states. In some states, that shift would wipe away any chance for consumers and businesses to buy and attach equipment without need for the unnecessary and expensive protective module previously required by state regulators at the insistence of phone companies."

It is very important that each ham and all his friends and acquaintances contact their congressman and mobilize influence against the "Bell bill." As in so many cases, we must fight for our rights to have them.

C.W. Tazewell W2GTV
Syracuse NY

BATTING .400

Bravo to Tom Carney WB9RXJ for his letter in Jan., '77, *73*. Nothing is more frustrating for someone new to CW work on the low bands than to establish a QSO and have someone call CQ on top of it. In all the CQs that I have heard, only about 1% even think to ask if the frequency is in use. It should be a requirement for every amateur to memorize chapter 24 of *The Radio Amateur's Handbook*.

As long as I'm on my soapbox: Bull to you die-hards who insist that you aren't a true ham unless you can tap out umpty-ump words per minute CW in order to upgrade. When a baseball player tries out for a team, he doesn't have to hit x number of home runs or strike out x number of batters simply in order to be a left fielder.

I agree with the Advanced theory test and 5 wpm as brought up by WB2BJH. From the way I've heard many Generals and Advanced hams talk on the phone bands, it seems that they spent so much time learning how to tap out the alphabet on a key that they forgot how to speak.

I've heard every ham I know say that in ham radio there's something for everybody. Well, you're wrong, gentlemen. How about certain HF phone privileges for those of us who like to talk rather than tap?

Finally, I am sick and tired of hearing those who knock *QST* and the ARRL. I don't like them either. What's the solution? Mine is: Wayne Green for president in 1980!!

Mark Camp WB6QHZ
Santa Ana CA

THE HUSTLER

OK, Wayne. You are a transparent but crafty hustler. I hereby doff my hat to you.

Here I had tried and failed to get the code mastered, built and tested (and then sold for less than it cost) a complete top-grade station, and let my *73* subscription expire. So just after my oldest son gets assigned to Germany and my buddies start talking about setting up a sked for me to talk to him, you decide to spend a few bucks sending the current tantalizing issue of *73* to selected ex-subscribers. You are a fiend, and I know I am going to learn some new reasons to hate you, because I hereby fall for the bait. Enclosed please find my check for a bunch of code tapes and study guides, and also for another year of *73*.

When I start finding out how dang tough it is to learn the #$%&* code, despite your overtures to the contrary, and start spending money like a drunken sailor to get the ham shack "properly" fitted with gear and the necessary outside wires and sticks, you can expect to start receiving some more hate mail. You will probably deserve it.

Bill Sill
Tunkhannock PA

THE IVORY TOWER

Regarding the letter by Bob Welsh (reprinted from *LERC*), page 13 in the January, 1977, *73*, paragraph three: I think it is a bit unfair to say the ARRL has been duped into helping the FCC clean up the CB mess because of the following considerations. First, the CBers who are potential hams are generally the more serious practitioners of the hobby and also the least likely to participate in the childishness that occurs on 11 meters (especially channel 19). Removing these people from the CB fold is not likely to clean up the mess. CBers interested in amateur radio are usually the more technically minded members of the group and in that regard would be an asset to amateur radio. Finally, amateur radio is also not without its impolite, even childish members – for instance, see the note in January, 1977, *73*, page 208. entitled "Tragedy on Mt. Wilson."

I think it is time for hams to abandon the ivory tower. A first step might be to acknowledge that everyone is human and every group, society, whatever, has its mavericks.

Bruce Ott VE7BOT
Port Coquitlam BC

ON BEING HUMAN

It is great to know there is still at least one organization that has *humans* in it!

I like *73* so much I ordered a subscription for my son WBØVEZ, with instructions that the bill be sent to me. Some time later, I got a second copy of the Holiday issue with a handwritten mailing label on it. Figuring that my instructions had been misunderstood, I wrote, explaining the whole situation. A short time later a friendly note came.

Nowadays, it seems, the usual response to a letter of complaint or inquiry is either (1) a pre-printed form which leaves doubt that the letter was ever read, or (2) a letter which has been dictated, transcribed, and typed on a fancy letterhead (and cost a bunch of money).

I like your way best. It's not very elegant, but it is refreshingly personal, to the point, and very effective. Keep up the good service and personal attention!

Donald Inbody WAØPBQ
Overland Park KS

MORE 10M

Interesting note: While talking on 20m about 10m CBers, a fellow on the east coast said his club submitted a proposal to *QST*. The answer was, "We don't want anything to do with it!!"

The more I think of it, what other answer (from *QST*) would he get?

73 and *Kilobaud* are the best!

Ken Lowrance WRØMZD
Tim Haake WAØTSY
St. Charles MO

We are receiving many proposals for a 10 meter band plan based upon converted CB transceivers. Watch for them. I'm expecting your comments. – Ed.

REASSESSMENT

Today I took and passed my amateur Extra exam, thanks in part to the *73* 20+ wpm code tape. In answer to your question, I figure I spent about 10 hours with the tape. Since I last took a code exam for my General some 20 years ago, I don't know what my "starting speed" was, but probably around 18, since that is what most hams seem to use.

I have but one suggestion for improving the code tape: put in some longer strings, perhaps 8-12 characters long. The exam I took had words like "disaster" and "shield" which are (a) relatively long, and (b) have an effective speed around 28 wpm for the 8 character burst. (I was afraid I'd have to copy "reassessment," but they didn't put it in – or if they did, I missed it!)

Thanks for a whole bunch of super stuff in general, and the code tapes in particular.

Frank Bates W6IPB
San Jose CA

A REAL WINNER

My son Robert, who is a specialist in microcomputer programming and who works with a local computer firm, just brought home issue #1 of *Kilobaud*. I must say that I am impressed! I have seen *73* grow from a small beginning into the most prestigious ham publication by far, but *Kilobaud* seems to be well up the ladder with its very first issue. I'm too old a canine to understand all of its intricacies (or too lazy to learn?), but my son, who was fortunate to have had a very smart mother, says it's a real winner. I am sure it will enjoy fully as great a success as *73*.

Keith Berens W6CWU
Orange CA

MORE 80M FOLLIES

Thought I'd drop you a line and let you know how much I enjoy your magazine. I wish I had known about it a year ago so I could have saved myself a lot of money and messing around with store purchased antennas. I don't know if any other people have heard some of the garbage I've heard on 80m or not, but I thought I was back on 11m again. I don't know if they were hams or not because no call letters were being used. I would like to let you know of a super amateur radio shop in the midwest – it is Burghardt Amateur Center, Box 73, Watertown SD 57201. Keep up the fine work on the magazine and the articles.

Robert W. Todd WBØTWN
Jamestown ND

Special Report

by Bill Pasternak WA6ITF

The first time I commented on SAROC in Looking West, I stated that this convention was unlike any other, in that it was not the convention but rather the atmosphere of Las Vegas that was the real drawing card. When compared to a convention such as Dayton, it can't compete. It is different from any other convention that I have ever attended, and the only fair way to judge SAROC '77 is against previous years. Based on that criterion, I found myself disappointed this year.

Las Vegas, Nevada, is known worldwide as the "Live Entertainment Capital of the World." Twenty-four hours a day, "Vegas," as its friends call it, is a gold mine of entertainment, with some of the most lavishly staged extravaganzas to be found anywhere. There are few well-known club entertainers who have not played there, because playing "Vegas" means that an entertainer has indeed "made it."

Not that this is the only lure of Las Vegas. Gambling is legal and open to all of legal age twenty-four hours a day. Put these two factors together, and you can see why a trip to Las Vegas has the appeal it does – and why this city has become one of the world's most visited vacation spots.

Sharon and I like to go to Vegas when a good excuse such as SAROC comes up. Therefore, in my opinion, it is Las Vegas that makes this convention. Were there a less exciting environment, I doubt if it would go.

This year, despite a reported record registration, more exhibitors than last year, a record number of portable repeater and remote-base systems, and more hospitality rooms, the overall attitude of the attendees seemed very subdued. While many seemed to be enjoying themselves, there was an "air of apprehension" permeating things. It was definitely a lot quieter than it has been the last two years.

Since I am one person and cannot be everywhere at once, I try to have either a friend, my cassette tape recorder, or both, to help cover things. This year the assistance came not only from my Panasonic RQ-309 and RE-15 microphone, but also from a lot of fellow amateurs. (Thanks.)

Although the overall number of companies exhibiting was up a bit, it was interesting to note that a number of regulars were missing. The most notable change this year was the larger participation by those offering computer-related hardware applicable to amateur radio – and the share of the crowd that they were drawing.

In that department, the most interesting and attention-getting display was the booth operated by HAL Communications (staffed by their highly knowledgeable sales manager Ken Sartain and his associates). If you have been around for any length of time, you realize that HAL (Urbana, Illinois) pioneered the interface of DP hardware to amateur radio. HAL is one of the new breed of companies that has found that keeping an ear open to what amateurs want and need leads to success. Needless to say, their video display units and peripherals attracted a lot of attention.

So did the new Curtis System 4000 Ham Computer, a device that is definitely going to open up a whole new era in amateur operation. Not only does it have the ability to send CW using an integral keyboard, but it also will read and display on a screen received CW at a rate of up to 250 words per minute. It also tells you just how fast the other guy is sending, to boot. If that were not enough, the keyboard also functions as an ASCII terminal, either half or full duplex. Still not satisfied? Well, Curtis intends to have a few software goodies available: storage (for the 4000) for 10 fifty to one hundred character CW messages, complete contest station management, automatic beam direction based on the other guy's callsign, DX forecasting, Oscar and other satellite orbit predictions, and lots more. Computers are an interesting hobby and are applicable to amateur radio ... hmmmm ... a note to Curtis Electro Devices at PO Box 4090, Mountain View CA will bring more info.

In the basic ham hardware department, the new all solid state Century 21 CW transceiver really attracted my fancy. Maybe it's because, after 15 years as a ham (most of the time spent in the world above 50 MHz), all of a sudden the challenge of low band CW has hit me. The size, price, and features of the Century 21 sure caught my eye. At a first glance it looks like just about any other HF SSB transceiver, and you have to get in really close to realize that there is no mike jack or phone provision. It's a complete 70 Watt, all solid state, 80 through 10 meter CW station – and "complete" means built-in power supply and speaker. Suffice it to say that for $289 the features contained in this box (backed by a company whose guarantee of quality is unsurpassed) are well worth the investment. Write Ten-Tec, Sevierville TN 37862 for more info. This has got to be the perfect setup for a Novice or the Technician who wants to make use of his newfound low band privileges.

In VHF, Midland not only showed its complete line of two and 220 radios, but also drummed up a lot of interest in its new line of VHF marine equipment. If I were to single out one manufacturer that has helped in the overall development of 220, I would have to pick Midland. I'll bet that the majority of 220 repeaters these days are built from the guts of the famed 13-509, and that says a heck of a lot for both the radio and the people selling it. Not that it stops there. How many repeaters have come into being thanks to Midland's RSVP program? How many companies are willing to take part of their profit and donate it directly back to the amateur service with no middle man? That's the kind of manufacturer support that amateur radio needs. Needless to say, their new synthesized radio for "two" captured the eye of many of us. A note to Midland at PO Box 1903, Kansas City MO 64141 will bring a complete catalog and the name of your closest dealer. If you do write, please don't forget to say thanks for the direct support that they are showing us.

How would you like to be able to pump 200 Watts into a window screen in Las Vegas and work Long Island, New York, on 20 meters? This was actually done at SAROC by one of the visitors who passed by the SST Electronics booth and purchased one of their $29.95 Model SST-T-1 random wire antenna tuners. One of these is just a little green box, 3" x 4-1/4" x 2-3/8", that I have found will load my old Globe Scout Deluxe into almost anything. I saw it there, but it was not until a week later that I got one for myself – I now understand why this little unit is becoming so popular. Eleven states on 40 CW in two days is nothing to sneeze at when your antenna is the feedline to a six meter vertical. No wonder SST did such a brisk business at SAROC. For the Tech who wants to make use of his Novice privileges without putting up a new low band antenna, or for the ham who can't put up a really good antenna, the SST-T-1 can be a godsend. It has been to me. SST Electronics is at PO Box 1, Lawndale CA 90260, in case you are interested in more info on this product.

Not all the new goodies were to be found on the exhibit floor, however. In fact, one new radio that I predict you will be hearing a lot more about real soon was not publically shown. However, we were able to get a sneak preview and a few photos. The radio is called the FM-144-DX, and the man behind it is none other than the foremost pioneer of amateur VHF communication, Mr. Ed Clegg W3LOY. Ed, who helped sponsor this year's Mt. Wilson Repeater Association Aloha Hospitality Center, not only brought along his inexpensive crystal-controlled 12 channel two meter radio, the Mark 3 (which was on operational display in the MWRA room), but had the FM-144-DX with him as well.

This little gem is fully synthesized, and has LED readout, concentric knob quick change channel selection, standard plus/minus 600 kHz offset, and provision for other offsets that are switch-selected (not to mention a host of other features that will make it a hard radio to beat). Best of all, Ed tells me he hopes to market it at a price that will make it affordable to most amateurs. Keeping in mind the track record of Ed Clegg, the fact he was building and marketing VHF equipment before most companies thought of going in that direction, the fact that his equipment is usually a bit ahead of the competition, and the knowledge that a fellow amateur stands behind the equipment and its guarantee, I'll be willing to bet that when the FM-144-DX hits the market, it will gain quick and widespread acceptance throughout the amateur community. I know that I plan to buy one to replace a dying T-43-GGV in the '71 Torino, and this decision is based on the few minutes I had to play with it in Ed's room at the Sahara. It's the personal confidence that I have developed over the years in "the man and his radios," starting in the very early '60s when I bought my first '99er – a very personal thing on my part.

The convention peripherals, such as hotel service, rooms, hospitality rooms, and portable repeaters, are what make or break any convention. I heard the usual number of complaints about rooms that had been paid for not being ready, and in some cases not available; about poor service on the part of the hotel; about people being turned away. If this is true, it sure didn't happen to any of our group. Our block of about 30 reservations was not handled through the SAROC convention committee, but rather as a direct group reservation through the Hotel Sahara. Not one person in our group was turned away, and in every case the rooms were available when our contingent arrived. Moral: Sometimes it pays to do one's own legwork. In my case, arrival was at 1 am on Friday morning; we were in our room by 1:20 am. Not bad for

"More Computers for Hams": IMSAI's interface to amateur radio.

"midnight service." Based on that, I find it rather hard to place the blame for any snafus on the hotel, and I am interested in knowing where the problem really lies. The people running the Hotel Sahara always seem to go out of their way for us when we are in Vegas, and I guess that's one reason we keep going back. If you had a problem, drop me a letter with full details and I will see that it's forwarded to the proper people at the Sahara. I've had the chance to talk with people in management there, and I get the distinct impression that if something is awry, they would like to know about it so that it won't happen again. They have a lot of pride in their place.

There were a few new hospitality rooms this year and a lot more portable repeaters. One even showed up on 220! I would estimate that there were about 25 portable repeaters. Again this year, the best portable repeater award goes to Kirk Nemzer WB6EGR and his crew for their 147.435/146.40 system. It had a coverage of over 70 miles, and turned out to be the most heavily used of all the portable systems. A good number of the portable systems were on 450 and were kept low key.

One of the criteria that you should use to judge the level of fun at SAROC is to listen to 146.94 in the evenings — especially Friday and Saturday nights. There has always seemed to be a direct correlation between .94 activity and the enjoyment level at the convention. Unlike past years, .94 was quiet. Again, the overall temperament of the crowd was down considerably from the past. Many of the people I talked with during my rounds of the various hospitality rooms complained that there was nothing really new here that they couldn't see at their local radio store. And the bargain hunters found no bargains whatsoever.

At SAROC, anything free, such as technical sessions and seminars, is kept to an absolute minimum. Too bad. It would be a great place to really get into VHF/UHF developments, such as the use of circular polarization to minimize path loss, computers for remote control procedures on repeaters and remote bases, etc. SAROC has few technical sessions.

I did enjoy a talk given by Mr. Hartley Postlethwaite WA6CQW, founder and director of the HAPPY FLYERS organization.

Hart spoke on a subject near and dear to every repeater owner's heart these days: direction finding technique as applied to tracking down a device known as an ELT, or Emergency Location Transmitter. ELTs are carried aboard every aircraft. They are designed to trigger on impact and emit a signal so that a downed aircraft can be located. As a pilot, Hart has been involved in ELT location for a few years. The techniques he has developed have appreciably speeded up location of these devices and thereby saved many lives. As he explained, while the hardware and technique were specifically developed to aid in ELT location, the same hardware techniques do find repeater jammers. Drop a note and SASE to the HAPPY FLYERS, 1811 Hillman Avenue, Belmont CA 94002.

Dick Everett, Assistant Chief of Safety and Special Services of the FCC, was on hand to answer questions, such as:

Q. "Would the elimination of the repeater subbands mean that 15 could be repeated to 20?"

A. "Yes."

Q. "How do you rationalize a closed repeater?"

A. "There is nothing in the rules that says that one amateur *has* to provide a repeater for another."

The main speaker at the ARRL Forum was from an organization known as the Personal Communications Foundation. Its Director/President is one of my valley neighbors, Mr. Jon J. Gallo WA6PTM. You will note that the "6s" seem to be taking the bull by the horns, going out and getting things done.

With over 7,000 legal matters involving amateur radio in 1976 alone, and with the average cost per matter being around $3500 (and going up), it is easy to see how even the simplest of such legal proceedings can give instant grey hair to any ham who might become involved.

The concept of PCF is to do the hard job, that of legal background and documentation work, so that an attorney in need of such input can be provided with the data. This will thereby cut the overall cost to the amateur substantially. An estimate given was that a legal action that now would cost $1000 might drop to as low as $300, with PCF aid. PCF, however, states that while it will provide such material, it will not act to represent an amateur in court. Its function is to provide advice and research.

All this does not come cheap. There will be a WATS telephone, and office and secreterial costs, plus what it costs to reproduce the documentation packages and get them mailed. If one out of every three amateurs were to donate a dollar, all costs of the PCF could be met. How about it, readers? Here is your chance to act directly and do your part.

This nonprofit corporation is headed by a 24-member Board of Directors, made up of judges, attorneys and legal professors who also are devoted amateurs like you and me. The least we can do is support their work by kicking in a few bucks. The address is Personal Communications Foundation, c/o Carl Markov K6RLP, 915 Lancaster Boulevard, Lancaster CA 93534.

I mentioned that there were more than the usual number of hospitality rooms this year. Last year, the MWRA's (with Bill Orenstein at the helm) won overall acclaim by having most in attendance. Both MWRA and Bill were back again this year, with a format that not only featured a quiet relaxing spot, but also such added features as an "Amateur Radio Theatre" that showed regular screenings of Dave Bell's "Moving Up To Amateur Radio" and an operational exhibit of some of the Clegg VHF line (with Ed Clegg himself as special guest). It was never jammed, never noisy, and the most relaxing spot at SAROC this year — just as it was last year. Bill gives a lot of the credit for the success of the room to the staff that runs the Sahara.

The Curtis System 4000 Ham Computer.

The Palisades Amateur Radio Club (PARC), of Culver City, California, pulled off a big surprise: the PARC hospitality center. This was an after-arrival idea of Wayne Maynard WB6BFN, Shelley Chelsey WB6KED and Don Root WA6HJW. Pooling their collective resources, they came up with a convention get-together spot that was hard to beat. I never noted a moment when it was empty or when anyone was not having a good time.

The Spectronics FM hospitality room is always worth a visit. Spectronics' Art Householder was ill and unable to make the trip. Captain Dick McKay K6VGP, who visited Art recently, said that he is recovering, but still must take it easy for a while. Not that Art wasn't well represented. Well armed with his famed "Drinkie Talkie," "Squeak" Porray K7RBM took the reins this year and put out the kind of hospitality that this room is famed for. It's not uncommon to find people there whom you will see nowhere else at SAROC. True-blue FMers will travel from all over just to spend a few hours in this particular hospitality suite.

I was not alone with my feeling about SAROC. Wherever I went throughout the three days I spent at the convention, amateurs kept coming to me to say that there was "something lacking this year," that "things were just too political," that they had come for a good time and not to have the ARRL preach to them. One guy came to me up in the MWRA suite and told me that he had been to many conventions including Dayton. He said he had always liked SAROC because it was different than the rest, but if it were going to become like another ARRL Division Convention, he would not return. I do feel that the politics should be left to the politicians, so that the majority of attendees can accomplish what they came for: a Las Vegas vacation shared with a lot of their fellow amateurs. While I do not challenge the right of the ARRL to take part in this convention, I do feel that if they had left their "New England Formal" attitudes back home and picked up a bit on "Southwest Casual," they might have accomplished a lot more for the ARRL image and alienated fewer of this area's VHF/UHF-minded amateurs. Excepting shows or formal dinners, Las Vegas is not a formal town. Most of the Southwest isn't. When one is super-formal out here, one stands out like the proverbial sore thumb. A casual friendly approach goes far in winning both friends and support in the Southwest.

Well, there you have it: SAROC '77 in no way matched its own past. Bigger does not always mean better and numbers in attendance are not the real material that makes for an outstanding amateur radio get-together. In my opinion, based upon the three years I have personally attended, I do feel that SAROC needs a bit of changing. It should bury the surface politics. It needs a lot more emphasis placed on technical presentations, so as to interest technically-minded amateurs. Amateurs enjoy exploring new concepts and new ideas. By making sure to have experts and time made available for them to be heard, we can look to the future of communication and explore these new frontiers.

I am not an expert on conventions, but I do know when I am having a good time. In the past, SAROC has offered that to me. This year I was disappointed.

Ed Clegg gives 73 a preview of his FM-144-DX 2m synthesized FM unit.

CONTESTS

Editor:
Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

WISCONSIN STATE QSO PARTY
Starts: 0001 UTC Sunday, April 3, 1977
Ends: 2359 UTC Sunday, April 3, 1977

Please note that the dates originally submitted (March, *73*) were incorrect.

SIX METER GROUND WAVE CONTEST
Starts: 0300 GMT Sunday, April 2
Ends: 0700 GMT Sunday, April 2

The second annual contest is sponsored by Global Research and is open to all amateurs worldwide on all modes: SSB, CW, FM, AM, SSTV, RTTY, and FAX. Any six meter contact is valid. Skip stations do count in the event the band is open, but they only count ½ point each no matter where the station is located.

SCORING:

For scoring purposes, there are four zones defined by the distance between your QTH and the station contacted. Zone definitions and QSO points for contacts with each zone are as follows: Zone 1, stations within 25 miles of your QTH — 1 point/QSO; Zone 2, stations 25 to 50 miles from your QTH — 2 points/QSO; Zone 3, stations 50 to 75 miles from your QTH — 3 points/QSO; Zone 4, stations over 75 miles from your QTH — 4 points/QSO.

LOGS:

Show your name, call, address, ARRL section, and input power. Mobiles and portables must show actual locations. For each station worked, show: call, ARRL section, zone (as defined above), time, and points scored. Show your total score, sign the log, and submit to: Phil Caruso K9DTB, c/o Global Research, Contest Chairman, PO Box 271, Lombard IL 60148. Logs must be postmarked by May 3.

TENNESSEE QSO PARTY
April 2-3

7th annual party sponsored by Tennessee Council of Amateur Radio Clubs.

PERIODS:

Saturday, April 2, 2100Z, to 0500Z, Sunday, April 3.

Sunday, April 3, 1400Z to 2200Z.

Bonus period April 3 from 0500Z to 0600Z for out of state stations only to work Tennessee mobile and portable stations only on 75 meters.

EXCHANGE:

Tenn stations send signal report and county. Out of state stations send signal report and state, province, or country. Work same station different bands or county if mobile or portable.

SCORING:

Separate CW and phone contests (one point each contact). Tennessee stations — QSO points times sum of (different state including Tennessee plus different provinces plus different Tenn counties).

Out of state stations — QSO points times number of different Tenn counties.

Bonus points — 200 extra points to mobiles and portables for each county operated outside home county.

FREQUENCIES:

3550, 7050, 14050, 21050, 28050, 3725, 21125, 28125, 3980, 7280, 14280, 21380, 28580.

LOGS:

Date/time in GMT, station worked, band, mode, exchange, and score. Use separate log sheet for each band over 25 contacts; contestants with 100 contacts or more must submit cross check sheet similar to ARRL operating aid No. 6. Logs must be legible to avoid disqualification.

AWARDS:

Plaques to top phone and CW scores in Tennessee, to winning mobile, to winning portable, and top score out of state. Certificates to every station sending log with 15 contacts. Repeater contacts not allowed. Mobiles compete against mobiles, portables against portables. Minimum 10 contacts each county to earn bonus points.

Tennessee stations on phone call "CQ Tenn QSO Party," on CW "CQ Tenn" or "TEST" — variations to encourage contacts from non-contestants will result in disqualification.

Mailing deadline May 1, 1977. Send self-addressed stamped envelope if eligible for certificate to Dave Goggio W4OGG, 1419 Favell Dr., Memphis, Tenn 38116. Every entry will receive summary along with certificate if eligible.

COMMON MARKET DX CONTEST
CW
0600 GMT to 2400 GMT
Saturday, April 2
Phone
0600 GMT to 2400 GMT
Sunday, April 3

The purpose of this contest is to increase the activity of radio amateurs in the Common Market of Europe and to establish as many contacts as possible during the contest periods between stations of the Common Market of Europe and the rest of the world. All bands 80 to 10 meters may be used on the appropriate mode. Contest call is "CQ CM" or "CQ Common Market." Entries may be in either of the following classes: Single op, all bands; Single op, low bands (80 + 40); Single op, high bands (20-10); Multi-op, single TX, all bands only (also club stations).

EXCHANGE:

RS(T) and QSO number from 001.

SCORING:

Non-Common Market stations: QSO with CM = 5 points; any other EU station = 2 points. Common Market stations: QSO with CM = 1 point; non-CM, EU = 2 points; non-CM outside EU = 5 points; QSO with own country = 0 points but ok for multiplier.

Multipliers: One point for each band. For non-CM, CM countries = Belgium, W. Germany, Italy, Denmark, Great Britain, Luxembourg, Ireland, the Netherlands, and France. For Common Market stations: each country in the world, following DXCC list. Claimed scores is total QSO points times total multiplier as usual.

ENTRIES:

Separate logs for each band; show date/time in GMT, exchange, points, and multipliers. Summary sheet must include signed usually-used declaration that all rules/regulations observed. Mail by April 30th to contest committee: Michel Le Bon ON4GO, Chee de Wavre 1349, B-1160 Brussels, Belgium. Certificates to highest scoring single op in the CM on each mode and to highest scoring single op outside CM on each mode.

ZERO DISTRICT QSO PARTY
Starts: 2000 GMT Saturday, April 2
Ends: 0200 GMT Monday, April 4

Organized by the Mississippi Valley Radio Club, this contest covers a lot of territory and should create a lot of activity. Stations outside of Zero district will work Zero district stations only, but Zeros may work both in and out of district stations. The same station may be worked once on each band and each mode.

EXCHANGE:

QSO number, RS(T), and QTH. QTH is county and ARRL section for Zeros, ARRL section only for all others.

SCORING:

For Zeros — total QSOs multiplied by (ARRL sections + Zero counties + DX counties) worked. Others — total QSOs multiplied by (Zero counties + Zero sections).

FREQUENCIES:

3560, 7060, 14060, 21060, 28060,

CALENDAR

Apr 2 - 3	Common Market DX Contest
Apr 2	Six Meter Ground Wave Contest
Apr 2 - 3	Tennessee QSO Party
Apr 2 - 4	Zero District QSO Party
Apr 2 - 4	Annual April QRP QSO Party
Apr 12 - 13	YLRL DX-YL to Stateside YL Contest — CW
Apr 16 - 17	County Hunters SSB Contest
Apr 16 - 17	Florida QSO Party
Apr 16 - 17	Bermuda Contest
Apr 16 - 17	CD Party — CW
Apr 23 - 24	PACC
Apr 23 - 24	H22 Contest
Apr 23 - 24	CD Party — Phone
Apr 26 - 27	YLRL DX-YL to Stateside YL Contest — Phone
Apr 30 - May 2	Connecticut QSO Party
May 7 - 8	Triple Letter QSO Party
May 7 - 9	Georgia QSO Party
May 7 - 9	Vermont QSO Party
May 14 - 15	Kansas QSO Party
May 14 - 15	Massachusetts QSO Party
May 14 - 16	Michigan QSO Party
May 15	World Telecommunications Day — Phone
May 22	World Telecommunications Day — CW
June 11 - 12	ARRL VHF QSO Party
June 18 - 19	West Virginia QSO Party
June 25 - 26	ARRL Field Day
July 2 - 3	QRP — Summer — Contest
July 4	ARRL Straight Key Night
July 9 - 10	Bicentennial Celebration Plus One
July 16 - 17	10-10 Net Summer QSO Party
July 16 - 17	Apollo II 8th Anniversary Contest
Aug 20 - 21	New Jersey QSO Party
Aug 20 - 21	Worldwide SARTG RTTY Contest
Sept 10 - 11	ARRL VHF QSO Party
Oct 1 - 2	Open CD Party — CW
Oct 15 - 16	Open CD Party — Phone
Nov 5 - 6	ARRL Sweepstakes — CW
Nov 19 - 20	ARRL Sweepstakes — Phone
Dec 3 - 4	ARRL 160 Meter Contest
Dec 10 - 11	ARRL 10 Meter Contest

3900, 7270, 14300, 21370, 28570, 3725, 7125, 21125, 28125.

ENTRIES & AWARDS:

Beautiful four color certificates will be presented to the General class section high scorer and to the Novice/Tech class section high scorer. Mailing deadline for entries is May 15th, to: Mississippi Valley RC, 3518 W. Columbia, Davenport, Iowa 52804. Include an SASE for results.

ANNUAL APRIL QRP QSO PARTY

Starts: 2000 GMT
Saturday, April 2
Ends: 0200 GMT
Monday, April 4

The contest is open to all amateurs and is sponsored by the QRP Amateur Radio Club International, Inc.

Stations may be worked once per band for QSO and multiplier credits. Each member QSO counts 3 points, non-member QSOs 2 points. Stations other than W/VE count as 4 points per QSO. Multipliers are as follows: More than 100 Watts input power – x1; 25 to 100 Watts – x1.5; 5 to 25 Watts – x2.0; 1 to 5 Watts – x3.0; less than 1 Watt power – x5.0.

Final score is QSO points times total number of states/provinces/countries *per band* times power multiplier.

EXCHANGE:

Members – RS(T), state/province/country, QRP number.

Non-Members – RS(T), state/province/country, power.

FREQUENCIES:

CW – 3540, 7040, 14065, 21040, 28040.

SSB – 3855, 7260, 14260, 28600, 21300.

Novice – 3720, 7120, 21120, 28040.

All freq's +/- 5 kHz.

ENTRIES:

Send full log data, including full name, address, and bands used. Indicate equipment, antennas, and power used. Include a #10 SASE for results. Logs must be received by May 30, 1977 to qualify. Send logs to: E. V. Sandy Blaize, W5TVW, 417 Ridgewood Drive, Metairie LA 70001.

Certificates will be awarded to the highest scoring station in each state/province/country. Other places depending on activity. One certificate for the station showing three "skip" contacts using the lowest power.

COUNTY HUNTERS SSB CONTEST

Contest Periods:
0001 GMT Saturday, April 16 to 0800 Saturday, April 16
1200 GMT Saturday, April 16 to 0800 Sunday, April 17
1200 GMT Sunday, April 17 to 2400 GMT Sunday, April 17

Please note two four hour rest periods!

This is the 6th annual contest sponsored by the Mobile Amateur Radio Awards Club, Inc. Mobile stations may be worked each time they change counties or bands, but if worked again from the same county on a different band count for point credit only. Mobile stations contacted on a county line count as one contact but two multipliers. Portable stations that change counties during the contest may be worked for both point and multiplier credit from each new county. Fixed stations may be worked by other fixed stations only once during the contest regardless of bands. Repeat contacts between fixed stations on other bands are not permitted! Fixed stations may be worked by mobile/portable stations each time they change counties or bands. Repeat contacts between mobile/portable stations are permitted provided they are on a different band or county.

EXCHANGE:

Signal report, county, and state (country for DX). Mixed code contacts are permitted provided that one station is on SSB. (Mobiles please keep an ear for CW county hunters calling!)

FREQUENCIES:

3920-3940, 7220-7240, 14275-14295, 21375-21395, 28575-28595.

Please note: This year there will be a "mobile/portable window" of 10 kHz on the following frequencies: 3925-35, 7225-35, 14280-90. Mobiles/portables will be in this 10 kHz segment and fixed stations are asked to refrain from calling "CQ Contest" in this segment. After working mobile/portable stations in the "window," fixed stations are requested to tune and work other mobile/portable stations or QSY to the outer edges of the suggested frequencies to call CQ or work other fixed stations in the contest. This will allow the mobile/portables running lower power a chance to be heard and worked in the contest.

SCORING:

Contact with a fixed US or Canadian station = 1 point. Contact with DX stations (including KL7 & KH6) = 5 points. Contact with mobile/portable stations = 10 points. Portable stations are defined as operating from another temporary location for contest purpose. Multiplier is total number of US counties plus Canadian stations worked; take credit for a county only the 1st time it is worked. A Canadian station counts each time it is worked. Final score is total number of QSO points times total number of different counties and VE stations worked.

ENTRIES:

Logs should show date/time in GMT, station worked, report exchanged, county, state, band, claimed points (1, 5, or 10), and each new multiplier numbered. Official log sheets and summary sheets are free for a #10 SASE or SAE and appropriate IRCs from John Ferguson WØQWS, 3820 Stonewall Ct., Independence MO 64055. Submit all entries to the same address no later than June 1st to be eligible for awards; DX should use air mail.

AWARDS:

Plaques to highest scoring fixed US or VE, DX, mobile, and 2nd mobile certificates to top 10 fixed and mobile stations in US and VE and to the highest scoring DX in each country. Only single operator stations are eligible for these awards, but multi-op certificates may be issued if merited. A station may enter as both fixed and mobile, but separate scores are required.

Continued

RESULTS

RESULTS OF THE 1976 YL ANNIVERSARY PARTY (OCT/NOV 1976)

Winners

CW:

DJØEK	860 points
I3MQ	817
VE1AMB	646
WA2DMK	585
OK2BBI	580

PHONE:

YN1KG	12,717 points
HC2YL	12,152
FG7XL	8,910
K6KCI	8,845
W2GLB	8,680

COMBINED:

HC2YL	12,385.75
DJØEK	8,510
DJ1TE	6,447.5
VE7DTO	5,648.75
K6DLL	4,955

RESULTS OF 1976 CARTG ANNUAL W/W RTTY DX SWEEPSTAKES (OCT 1976)

Following is a list of the top 10 places that each received plaques donated by various groups:

I1PYS	1,955,244 points
W3EKT	1,584,380
CT1EQ	1,562,660
W4CQI	988,612
CE3MA	928,988
K8JUG	794,928
KH6AG	794,015
WD8CPU	787,695
W1GKJ	739,344
KØJWX/6	699,900

W3EKT won top US plaque while VE2JR won top Canadian plaque. VK3SG won "Green" RTTY high score for his first time in. Paul Menadier of USA won top SWL printer plaque. W1MX won top multi-op score.

Many other certificates were awarded to the top scores in each USA and Canadian district, and each DX country.

103 logs were received from 49 countries with 25 stations working WAC during the contest period. Looked like a good showing from the USA!

RESULTS

RESULTS OF 1976 DELAWARE QSO PARTY (NOV 1976)

High scoring DEL station – K3YHR with 20,605 points.
High scoring out of state station – AC7UIC with 450 points.

Out of State Scores:

ARIZ	AB7BQN	225	
CA	AA6MQS	25	
CONN	AA1UAX	175	
FLA	K4KMA	200	
GA	WAØDGL/4	150	
ILL	K9DDA	105	
IND	WB9THY	120	
IOWA	ACØBQ	200	
LA	W5WG	325	
NJ	AB2VWW (QRP)	105	– tie
	AA2ZWH (QRP)	105	
NY	W2EY	105	
OHIO	WB8NTY	90	
OREG	AC7UIC	450	
TENN	AB4WHE	60	
TEXAS	WA5KGW	200	
VA	W4ZRJ	5	
CANADA	VE3EJK	150	

DEL Winners:

New Castle	K3YHR	20,605
Sussex	WA3WIY	5,635

BERMUDA AMATEUR RADIO CONTEST

Starts: 0001 GMT April 16
Ends: 2400 GMT April 17

Sponsored by the Radio Society of Bermuda. Operate no more than 36 hours of the 48 hour contest period. Off periods to be clearly logged and each period to be of not less than 3 consecutive hours. All stations shall be single operator only and must be operated from their own private residence or property. Each station may be worked only once per band regardless of mode. Use all bands 80 to 10 meters, but no cross band or cross mode contacts permitted.

EXCHANGES:

All stations exchange RS(T) and following: UK — county, US — state, VE — province, Bermuda — parish.

US and VE stations must exchange reports with UK and Bermuda stations only. UK stations must exchange reports with US, VE, and Bermuda only.

SCORING:

Each QSO = 5 points. Multiplier for all stations outside Bermuda is the total number of VP9s worked on each band. The same VP9 can be worked on all bands. For Bermuda stations, it is the total number of states, provinces, and counties worked on each band.

AWARDS:

Top scorer in each state, province, and county shall receive a certificate. Trophy to top scorer in VE, US, and UK. Round trip air transportation plus accommodation will be provided to overseas winners to enable them to receive their awards.

ENTRIES:

All dates and times in GMT. All contestants to check for duplicates and to compute their own scores. Sign a statement that all rules and regulations have been observed. Each page must be clearly marked with call, name, and address, and must be received by the contest committee before June 30th. Send entries to: PO Box 275, Hamilton 5, Bermuda.

RESULTS

RESULTS OF THE 1976 DELTA QSO PARTY

Plaque Winners as follows:

High score Delta Div = WA5KQD/5 with 33,592 points.
High score outside Delta Div = WB4OGW with 10,360 points.
High club station = WB5RHX with 21,480 points.
High portable station = K4LTA/4 with 11,340 points.

First place winners in each Delta Div as follows:

ARK	WA5KQD/5	19,698
LA	WB5RHX	21,480
MISS	W5RUB/5	22,248
TENN	AD4PUZ	40,967

First place winners by sections, outside Delta Div, as follows:

CONN	AC1GNR	3,444
EMASS	AC1AQE	2,646
ME	W1UOT	770
VT	AD1ORS	1,056
ENY	W2WSS	414
NLI	W2RPZ	3,430
NNJ	AA2EJZ	234
WNY	W2NCI	1,224
EPA	W3ARK	4,263
MD	AC3RAB	4,002
WPA	W3HDH	967
GA	WB4QGN	6,141
NC	W4OMW	1,519
SFLA	WB4OGW	10,360
VA	AA4SHL	864
NMEX	W5TIL	120
NTEX	K6TEB/5	3,835
OKLA	K5DEC	154
STEX	WA5TPO	2,552
ORG	KØGJD/6	7,182
SV	W6YMH	782
SDGO	AG6JES/6	840
SBAR	W6OUL	567
MONT	W7JYW/7	1,870
ORE	AC7ULC	1,960
MICH	W8WVU	945
OHIO	K8BBH	180
ILL	W9WR	1,248
IND	W9JOO	1,269
IOWA	WØPRY	4,992
MO	ACØQWS	5,355
CANADA:		
MAR	VE1MX	1,258
ONT	VE3EJK	3,675

FLORIDA QSO PARTY

Contest Periods:
1500 to 2000 GMT
Saturday, April 16
0000 to 0500 GMT
Sunday, April 17
1400 to 2400 GMT
Sunday, April 17

This is the 12th annual QSO party sponsored by Florida Skip. Phone and CW are separate contests. The same station may be worked on each band for QSO points. FLA stations may work other FLA stations for QSO points only.

EXCHANGE:

RS(T) and QTH-county for FLA; state, province, or country for others.

FREQUENCIES:

Phone — 3970, 7270, 14317, 21370.

CW — 3570, 7070, 14070, 21070.

SCORING:

FLA stations count 1 point per QSO; multiplier is sum of states (49 max), provinces (12 max), and DX countries (12 max). Maximum multiplier is 73. FLA mobiles and portables on emergency power and running 200 W or less multiply total score by 2. All others count 2 points per FLA portable/mobile station worked; 1 point for fixed FLA QSOs. Multiplier is number of different FLA counties worked (67 max).

AWARDS:

Certificates (phone and CW) to top single operator score in each state, province, and DX country, also each FLA county. Five plaques also to be awarded to high single op in FLA and out-of-state, phone and CW, and to FLA club with highest aggregate score.

ENTRIES:

Stations may be disqualified for various reasons — improper reporting, excessive dupes, errors in multiplier lists, etc. — at discretion of the contest committee. Anyone disqualified this year will be barred from the contest next year. A summary sheet is requested showing scoring and other pertinent information. Also include your name and address in BLOCK LETTERS, and a signed declaration that all rules and regulations have been observed. Include a 13¢ stamp for results. Mailing deadline is May 30th. Mail to: Florida Skip Contest Committee, PO Box 660501, Miami Springs FL 33166.

PACC CONTEST

Starts: 1200 GMT
Saturday, April 23
Ends: 1800 GMT
Sunday, April 24

Sponsored by VERON of Nederland, the contest is open to all amateurs to help obtain their PACC award. Use all bands, 160 to 10 meters, CW or SSB, but no cross mode contacts. Categories: single or multi-operator and SWL.

EXCHANGE:

RS(T) and serial number from 001. PA/PI/PE stations will give province as well. Possible provinces are: GR, FR, DR, OV, GD, UT, YP, NH, ZH, ZL, NB, LB.

FREQUENCIES:

CW — 3525-3585, 7010-7040, 14025-14085, 21040-21100, 28050-28100.

SSB — 3650-3750, 7040-7100, 14150-14300, 21150-21300, 28200-28700.

SCORING:

Each PA/PI/PE QSO counts 1 point. Each station may be worked only once per band regardless of mode. Multiplier is number of provinces per band (max 12 per band x 6 bands = 72). Final score is then sum of QSO points times total multiplier. SWLs score same.

ENTRIES & AWARDS:

Logs must contain code group given by Dutch station and station worked with; usual score calculation is required. Please use a multiplier column and insert multiplier only first time worked. Include a signed statement that contest rules and regulations were observed. Certificates to each country, US and Canadian call district winners. Logs must be sent to: VERON Contest Manager, PAØDIN, Schoutstraat 15 Nymegen 6805, Netherlands, not later than June 15th.

Of last year's several hundred contestants, only 4 were from the US. Winners from stateside were: AC3ARK, AC10PJ, and WB5IAL. How about a little more participation from the States?

H-22 CONTEST

Starts: 1500 GMT
Saturday, April 23
Ends: 1700 GMT
Sunday, April 24

Use all bands 160 to 10 meters, CW to CW or phone to phone.

EXCHANGE:

RS(T) and 3 digit serial number from 001; Swiss stations send abbreviation of their canton as well. Abbreviations for 22 cantons are: AG, AR, BE, BS, FR, GE, GL, GR, LU, NE, NW, SG, SH, SO, SZ, TG, TI, UR, VD, VS, ZG, ZH.

SCORING:

Each contact with an HB station counts 3 points; each station can be worked once per band regardless of mode. Multiplier is sum of Swiss cantons worked on each band, 22 max per band. Final score is total QSO points times total cantons worked on all bands.

ENTRIES & AWARDS:

Certificates to highest scorer in each country, US and Canadian call areas. Logs must be postmarked not later than 30 days after the contest and sent to: TM USKA, HB9AHA, im Moos, 5707 Seengen, Switzerland.

H-22 Award is available for working all 22 cantons on CW or phone (all one mode). Send QSLs to Walter Blattner HB9ALF, Post Box 450, CH 6601 Locarno, Switzerland.

CONNECTICUT QSO PARTY

Starts: 2100 GMT April 30
Ends: 0200 GMT May 2

Sponsored by the Candlewood Amateur Radio Association, all amateurs are invited to participate. Each station may be worked once on each band and mode. W1QI, the club station, will be operating CW on odd hours and SSB on even hours and counts for 5 QSOs (each band/mode). Novice QSOs count 2 points each.

EXCHANGE:

QSO number, RS(T), and ARRL section for out of state, and Conn county for Conn stations.

SCORING:

Out of state multiply QSO points times number of Conn counties worked (8 max). Conn stations multiply total number of QSO points by number of ARRL sections and provinces; DX stations count only as one additional section total.

FREQUENCIES:

CW – 40 kHz up from bottom of band.

SSB – 3925, 7250, 14300, 21375, 28540.

Novices – 3725, 7125, 21125, 28125.

ENTRIES & AWARDS:

Certificates to top scoring stations in each Conn county and each ARRL section or province. Logs must show category, date/time in GMT, calls, numbers, bands, QSO points, and claimed scores. A Worked All Conn Counties Certificate will be awarded for anyone working all 8 counties. Enclose a large SASE for results. Logs must be postmarked no later than June 1st to: Candlewood ARA, c/o Fred Porter W1VH, 169 Carmen Hill Road Nr. 2, New Milford, Conn. 06776.

THE 18th ALL ASIAN DX CONTEST

The purpose of this contest is to increase the activity of radio amateurs in Asia and to establish as many contacts as possible during the contest periods between Asian and non-Asian stations.

CONTEST PERIOD:

Phone: 30 hours from 1000 GMT June 18, 1977, to 1600 GMT June 19, 1977.

CW: 30 hours from 1000 GMT August 27, 1977, to 1600 GMT August 28, 1977.

BANDS:

The amateur bands to 30 MHz may be used.

ENTRY CLASSIFICATIONS:

Single operator, 19 MHz band (CW only); single operator, 3.5 MHz band; single operator, 7 MHz band; single operator , 14 MHz band; single operator, 21 MHz band; single operator, 28 MHz band; single operator, multi-band; multi-operator, multi-band.

POWER, TYPE OF EMISSION, AND FREQUENCIES:

Within the limits of own station's license.

CONTEST CALL:

For Asian stations: Phone – "CQ contest"; CW – "CQ test."

For non-Asian stations: Phone – "CQ Asia"; CW – "CQ AA."

EXCHANGE:

For OM stations: RS(T) report plus two figures denoting the operator's age.

For YL stations: RS(T) report plus two figures "00 (zero zero)."

RESTRICTIONS IN THE CONTEST:

No contact on cross band.

For the participants of single operator's entry: Never transmit two signals or more at the same time (only one signal may be used).

For the participants of multi-operator's entry: Never transmit two signals or more on each band at the same time (one signal per band may be used).

POINT AND MULTIPLIER:

For Asian stations: Point – A perfect contact with non-Asian station will count one point; Multiplier – The number of different countries in the world worked on each band (according to the DXCC countries list).

For non-Asian stations: Point – A perfect contact with Asian station will count one point; Multiplier – The number of different Asian prefixes worked on each band (according to the WPX rules).

About JD1 stations: JD1 stations on Ogasawara (Bonin and Volcano) Islands belong to Asia; JD1 stations on Minamitori Shima (Marcus) Island belong to Oceania.

Contacts among Asian stations and among non-Asian stations will count neither point nor multiplier.

Contacts with KA stations are not eligible. They are considered not amateur but military.

SCORING:

(The sum of the contact points on each band) X (The sum of the multipliers on each band).

INSTRUCTIONS ON THE SUMMARY AND LOG SHEET:

Use a separate sheet for each band. Please keep all times in GMT. Please fill up the blanks of "multiplier" by the countries or prefixes only the first time on each band.

AWARDS:

Both phone and CW certificates will be awarded to the highest scores of each entry in accordance with the number of the participants of each country:

If the number of participants is under 10, awarded only the first rank.

If the number of participants is 11 to 20, awarded the second rank.

If the number of participants is 21 to 30, awarded the third rank.

If the number of participants is 31 or more, awarded the fifth rank.

The highest scorer in each continent of the single operator, multi-band entry will get a medal and certificate by the Minister for Posts and Telecommunications of Japan.

The highest scorer of the multi-operator, multi-band entry in each continent will get a medal. In addition, certificates will be awarded to the highest scorer of each call area of the United States of America, in the entry of single operator, multi-band.

REPORTING:

The log and summary sheet must arrive together at JARL P.O. Box 377, Tokyo Central, Japan, on or before the following dates: Phone – September 30, 1977; CW – November 30, 1977.

DISQUALIFICATION:

Violation of the contest rules; false statement in the report; taking points from duplicate contacts on the same band in excess of 2% by the total.

ANNOUNCEMENT OF THE RESULT:

Phone – about February, 1978; CW – about April, 1978.

You may have contest results by enclosing one IRC and SAE.

1977 CAPE TOWN FESTIVAL AWARD

This award is available to all licensed amateurs. Contacts must be made during the period starting 2200 GMT April 1st and ending 2200 GMT April 30, 1977. All DX stations (non-ZS) are required to work ZS1CTF or ZS1CTM plus 2 other ZS1 stations. QSL cards are not required for the award. Submit an extract of your log, certified as being correct by either your local awards manager or two licensed amateurs. Any band, mode, or combination may be used. Closing date for applications is July 31, 1977. Certificates will be posted after this date only. The fee is $2.00 (USA). A special endorsement will be available for VHF contacts or may be applied for as an additional award. Applications should be addressed to: Derek Siegel ZS1DP, SARL CT Branch, PO Box 5100, Cape Town 8000, South Africa.

ALL VE/VO ON RTTY

Offered by the CARTG, VE3RTT, contacts must be 2-way RTTY only, any date. Award will be a certificate, numbering from one. There is no charge for the award, but the necessary QSLs are to accompany the request. They will be returned! An official of a RTTY group or society may inspect and send in a signed list of such QSL cards, including all pertinent information (in place of sending the actual QSLs). Send all requests to: The Canadian Amateur Radio Teletype Group VE3RTT, 85 Fifeshire Road, Willowdale, Ontario M2L 2G9, Canada.

Oscar Orbits

Oscar 7 Orbital Information

Orbit	Date (Apr)	Time (GMT)	Longitude of Eq. Crossing °W
10866 A	1	0052:45	65.9
10879 B	2	0147:02	79.5
10891 A	3	0046:23	64.3
10904 BQ	4	0140:40	77.9
10916 A	5	0040:00	62.8
10929 BX	6	0134:17	76.3
10941 A	7	0033:38	61.2
10954 B	8	0127:55	74.8
10966 A	9	0027:16	59.6
10979 B	10	0121:33	73.2
10991 A	11	0020:53	58.0
11004 B	12	0115:10	71.6
11016 AX	13	0014:31	56.5
11029 B	14	0108:48	70.0
11041 A	15	0008:08	54.9
11054 B	16	0102:26	68.5
11066 A	17	0001:46	53.3
11079 BQ	18	0056:03	66.9
11092 A	19	0150:21	80.5
11104 BX	20	0049:41	65.3
11117 A	21	0143:58	78.9
11129 B	22	0043:19	63.7
11142 A	23	0137:36	77.3
11154 B	24	0036:56	62.2
11167 A	25	0131:13	75.7
11179 B	26	0030:34	60.6
11192 AX	27	0124:51	74.2
11204 B	28	0024:12	59.0
11217 A	29	0118:29	72.6
11229 B	30	0017:49	57.4

Oscar 6 Orbital Information

Orbit	Date (Apr)	Time (GMT)	Longitude of Eq. Crossing °W
NA 20391 BTN	1	0122:45	80.8
N 20403	2	0022:41	65.8
NA 20416 BTN	3	0117:37	79.5
N 20428	4	0017:33	64.5
NA 20441 BTN	5	0112:28	78.3
NA 20453 BTN	6	0012:24	63.3
N 20466	7	0107:20	77.0
NA 20478 BTN	8	0007:16	62.0
N 20491	9	0102:11	75.8
NA 20503 BTN	10	0002:07	60.8
N 20516	11	0057:03	74.5
NA 20529	12	0151:59	88.3
NA 20541 BTN	13	0051:55	73.3
N 20554	14	0146:50	87.0
NA 20566 BTN	15	0046:46	72.0
N 20579	16	0141:42	85.8
NA 20591 BTN	17	0041:38	70.8
N 20604	18	0136:34	84.5
NA 20616 BTN	19	0036:30	69.5
NA 20629 BTN	20	0131:25	83.3
N 20641	21	0031:21	68.3
NA 20654 BTN	22	0126:17	82.0
N 20666	23	0026:13	67.0
NA 20679 BTN	24	0121:00	
N 20691	25	0021:05	65.8
NA 20704 BTN	26	0116:00	79.5
NA 20716 BTN	27	0015:56	64.6
N 20729	28	0110:52	78.3
NA 20741 BTN	29	0010:48	63.3
N 20754	30	0105:43	77.1

The listed data tells you the time and place OSCAR crosses the equator in an ascending orbit for the first time each day. To calculate successive orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the first crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world, it will descend over you. To find the equatorial descending longitude, subtract 166 degrees from the ascending longitude. To find the time it passes the north pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR when it is within 45 degrees of you. The easiest way to do this is to take a globe and draw a circle with a radius of 2480 miles (4000 kilometers) from the home QTH. If it passes right overhead, you should be able to hear it for about 24 minutes total. OSCAR will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15 degrees from you, add another minute; at 30 degrees, three minutes; at 45 degrees, ten minutes.

OSCAR 6: Input 145.85-145.95 MHz; Output 145.90-146.00 MHz; Output 29.45-29.55 MHz; Telemetry beacon at 29.45 MHz.

OSCAR 7 Mode A: Input 29.40-29.50 MHz.

Mode B: Input 432.125-432.175 MHz; Output 145.925-145.975 MHz.

Orbits designated "X" are closed to general use. "ED" are for educational use. "BTN" orbits contain news bulletins. "Q" orbits have a ten Watt erp limit. "L" indicates link orbit. "N" or "S" indicates that Oscar 6 is available *only* on northbound or southbound passes. Satellites are not available to users on "NA" days.

BE MY GUEST

visiting views from around the globe

from page 13

and the word "stroke," for portable and mobile. The English phonetics are widely used. Those who speak English obviously work twenty meters a lot. Europeans work all bands, except 6 meters. That is reserved for commercial and public service use. In Germany and Austria, there is no FCC. All communications are controlled by the Postal Department (heaven forbid it here!). The Postal Department not only monitors the ham bands, but it transmits on them, too. One afternoon in Frankfurt, I gave a call and received no immediate answer. Thirty seconds later, a booming voice came over the repeater saying, "Where are you located, W8WLQ?" He gave no ID. I gave my location in Frankfurt, and he said "Thank you." I heard the Germans buzzing about how the Post and Telegraph Director was on the repeater frequency. I was told by a ham in Vienna that their FCC monitors commercial stations for entertainment and hams for laughs.

Autopatch is forbidden in Germany and Austria. The telephone companies would lose the revenue. In Germany, most communications are run by the government. Ham licenses cost more in Germany and run for only a year. The cost of a visiting license in Germany is about $5.85; it is valid for three months and cannot be renewed. The ARRL will supply all the necessary information for applying for one. I would like to commend the German government, as they are quite helpful and expedient in processing licenses for visiting hams. When you receive your license, you are also supplied with a book of rules and regulations written in English.

If you travel by train in Germany and Austria, you will find them to be very efficient. They are always on time, and speed across the countryside at 50 to 100 miles per hour. They also use overhead wires in the city and suburban areas. If you are "train mobile" like I was, the overhead wires can make it difficult for you to hit the repeaters. The express trains only stop for one minute to load and unload passengers and mail, except at the border. At the border, you have six minutes to get off the train and exchange your currency. This is a must if you expect to use the diner. The currency and menus change in the diner, when you cross the border. First class is the only way to go (by train) in Europe. Only first class can sit in the diner. The compartments are large and air conditioned. The regular class cars are crowded, warm, and the seats are hard. You can work "train mobile" and it is fun. Contacts don't last too long, because of the speed of the train. The repeaters I worked from the train included Nurnburg, Regensburg, Passau, Linz, and Wels. For information purposes, the two crystal pairs I used while in Europe were 145.15 in, 145.75 out and 145.20 in, 145.80 out. One contact on the train that I had was in Austria and the train went right by the other station's house. I never did figure out which house it was, but he saw the train. A ¼ wave whip came in handy, both on the train and in the cities. It gave me a little extra rf when I needed it.

Vienna

Vienna is a beautiful and old city. Its people are friendly and fun-loving. The food and beer are excellent. The streetcar is the KING of transportation, but Mercedes taxis are plentiful and inexpensive. Vienna is my favorite city in Europe. I arrived four days earlier in Vienna than expected and this caused considerable trouble. Hotel rooms are at a premium in July and August and I found that renting a room without reservations would cost me up to $40 a day. This was out of the question with my budget. A taxi driver and a very pleasant lady passenger located a room for me near the inner city. I stayed at the Hotel-Pension Schneider for two days, during which time I was able to extend my previously made reservations for $6 a day.

Should you ever go to Vienna, I would like to recommend tours to the palaces, the inner city tour by horse and buggy, and a visit to the Prater amusement park. In the Prater, you will find, along with the circus atmosphere, outdoor restaurants, beer gardens, and a beautiful park. There is one beer garden in the Prater that holds over a thousand people, gallon glasses of beer, a floor show, and a German band. When the band isn't playing, the lights are turned down, and a waterfall with changing patterns and colored lights is exhibited. A little old lady passes through the crowd hawking white rosette radishes, alpine hats, and colorful flowers. One of the exciting landmarks in Vienna is the Dunube Tower. On top of the spire is a wonderful restaurant which gives a fine choice of gourmet food. While eating, you are overlooking the entire city of Vienna. At night, the lights below look like thousands of stars twinkling away in the distance. For those with a sweet tooth, the pastry shops are utopias.

When I arrived at the banhof, I had already been listening to the Vienna repeater. I didn't contact anyone on it till later. Once in my hotel room, I ordered a cold drink and "kerchunked" the repeater. I received a call from Peter OE1SP. He spoke English and I later found out he had spent two years or so in North Carolina. Peter was very helpful to me while I was in Vienna. Fred OE1BMA was another English-speaking ham with whom I had several contacts.

The repeater in Vienna was a simple one. It was an old taxi radio, with two vertical half wave antennas and no duplexer, which caused periodic trouble. Pigeon deposits have to be cleaned off of the antennas periodically to insure good radiation.

As my trip to Vienna was to attend a magic convention, my ham activities were confined to talking on the repeater. But Peter OE1SP invited me to a Liars Club one evening. The Viennese version of the coffee klatch took place in a beer garden. I believe the name to be The Green Lantern. It started at 1700 and was still going on at 1930, when I left. It was an informal get-together, with about 15 or 16 hams attending. Two or three of the hams spoke English and I tried to speak to the others in my broken German. My Austrian friends were impressed by some of the features on my Wilson HT. In Europe, the Ken and Standard are sold to the amateurs, not the Wilson. The Ken is somewhat smaller and does not have a separate microphone. It also lacks the auxiliary plug on top. Peter OE1SP told me the Wilson is approved for police use in Austria, whereas the Ken is not. I passed out some bicentennial QSL cards, drank a couple cups of espresso coffee, and caught a cab back to the hotel.

The next day I received a call on the repeater from another Viennese ham. I came back to him, and he asked that I only speak English. Sometime later, I learned that our QSO had been recorded and was to be played over an international short wave station. It would be beamed toward English-speaking countries. A very nice gesture on behalf of the Austrian government.

In Austria, there are about 1200 licensed amateurs: YLs get special calls, beginning with OE1Y. You must have a permit to buy radio equipment as well as a license. It is necessary to have a license to own a TV set or a regular radio. These are paid for by the year. I checked a radio shop in the center of Vienna, and found that the TS-520 in the window cost $995. I saw a couple of used pieces of Heath equipment and some two meter rigs. No place to look for bargain prices. Licenses are issued in Austria according to power: Class A – 25 Watts, Class B – 50 Watts, Class C – 100 Watts, and Class D – 250 Watts. Power is based on the plate dissipation of the final tubes. Non-code licenses are issued for 2 meter use. Licenses are issued to visiting amateurs at a cost of a $1 per month. You must have a license for each one of the 5 states in Austria in which you intend to operate your station. In Germany, one license applies for all of Germany. If you hear music being broadcast on ham radio in Austria, don't be alarmed; it's legal. It can be used for testing purposes. Repeater IDs are set at high speeds. This is requested by repeater club members, simply because it interferes with their conversation. There are few timers and they are extra long. This is because, once again, the members resent timers. Repeater dues in Vienna are $15 a year. The Vienna Liars Club meets Tuesday night, and the regular club meeting is Thursday night. Repeater frequencies for two meters are R10 to R19. R10 is 145.00 in and 145.600 out. The inputs start at 145.00 and go up every 25 kHz. Outputs are 600 kHz up. Simplex frequencies are 145.500, 145.525, 145.550, and 145.575. The 145.500 is the most commonly used one. For anyone wanting to apply for licenses for use overseas, or in any foreign country, it is best to write the ARRL. They will supply free all the latest requirements.

With all respect to the Austrians, the Gummi-Wurst (rubber sausage) is better described in the English language as a rubber duck. Hope you enjoyed the trip, and perhaps someday you will operate portable DL, OE, or even UA.

Les Mitchell W8WLQ
Lansing MI

Reprinted from The Scope, *bulletin of the Central Michigan ARC, Lansing MI.*

Micro Future

Purchases of computers and related products for home use will increase at an average 37.2% annual rate for the period 1976-1981, according to a recent study completed by Venture Development Corp., Wellesley MA. The study, "The Home Computer," represents over seven months of effort, during which time VDC queried hundreds of users, manufacturers, retail stores, and hobby groups.

The study reveals that not all computers used in the home are so-called "hobby computers," but that some are industrial single-board prototyping systems adapted to that purpose. This year, for example, 22.5% of the 24,164 computers purchased for home use will be supplied by such established "non-hobby" manufacturers as Intel, National Semiconductor, Texas Instruments, Intersil, and MOS Technology. Conversely, one third of the total computers

Calypso SOS

Sunday morning, January 30, 1977, several radio amateurs throughout the southern U.S. were galvanized into action by a distress message that eventually was found to be false. Before it became clear that the message was a hoax, many amateurs had become involved in relaying related traffic, and the U.S. Coast Guard had initiated an air search.

At about 9:45 am CDT, amateur radio station WB5LTP/MM2, aboard a vessel located about 100 miles south of New Orleans LA, reported he had copied the following message: "The motor vessel *The Calypso* is sinking off the Texas coast between Port O'Connor and Freeport, Texas. Located at about 96 degrees west, vessel is of 332 tons, 138 feet length, twin screw, radio call is FOAE." WB5LTP/MM2, the first radio amateur to retransmit this message on 7229 kHz, relayed its content to other amateurs.

The original message was transmitted by an unknown source on 7254 kHz, a frequency also assigned to the amateur radio service. It was received on the east coast, and also by an amateur operator in Colorado. In very short order the message was relayed to the Eighth Coast Guard Headquarters, New Orleans LA. On instructions from this office, an immediate air search was begun of the area. Advisories were transmitted to marine traffic to keep a sharp lookout for survivors or evidence of the disaster.

As a matter of fact, *The Calypso*, the famous oceanographic ship of Jacques Cousteau, was nowhere in the vicinity; it was safe and sound, thousands of miles away. Cousteau himself, however, was in the Gulf Coast area, diving to study and film underwater life in the vicinity of offshore oil drilling platforms.

Although many amateurs were chagrined at having been duped, Coast Guard reaction was one of satisfaction. Lt. L. H. Smith, Public Affairs Officer, U.S. Coast Guard Air Station, Corpus Christi, Texas, advised that this was the first time in his experience that a hoax distress message had originated on an amateur frequency. Lt. Smith remarked, "Had this situation been a true distress, the hams involved would have been commended for the detailed information passed to the Coast Guard."

Of the several Coast Guard officials contacted during and after this unfortunate incident, none criticized or blamed the radio amateurs involved. In fact, they expressed surprise at the accuracy and consistency of the message input arriving from stations located throughout the southern United States. One Coast Guard officer remarked, "I was so impressed with it all that I may just become an amateur radio operator myself!"

Bill Edwards K5CN
Norval Sommers W5JOK
Corpus Christi TX

Hoodwinked?

"We are aware of no compelling reason why amateurs wishing to operate repeater, auxiliary, control, or remotely controlled stations should be continued to require the obtaining of Commission permission before beginning such operation, as they have in the past. For this reason, we propose to delete those provisions . . . requiring that licensees obtain prior approval of the Commission to operate a remotely controlled station and requiring that repeater stations, control stations, and auxiliary link stations be separately licensed. We would discontinue the issuance of station licenses with 'combined' station privileges: All amateur station licenses would convey authority to operate as repeater, control, auxiliary link, and remotely controlled stations now operate." That's a quote from the Notice of Proposed Rule Making, dated January 6, 1977.

Editorials should be short and to the point . . . so here goes. The radio amateur is proud of his hobby and his ability to regulate himself. Here's hoping the Federal Communications Commission isn't being "hoodwinked" into believing it can shirk some of its own responsibility, that of helping us help ourselves. Repeater councils have been and are doing an excellent job of coordinating. It is still relatively simple to obtain repeater authorization, when and where it is needed. Let us not deregulate what might need more regulation in the future. Instead, let us demonstrate to prospective hams that *we can operate under an existing set of responsible regulations.*

Chris Roberts WB9WXL
Ft. Wayne IN

Reprinted from The State of the 'Arts, *publication of the Allen County Amateur Radio Technical Society, Inc., Fort Wayne IN, February, 1977.*

Rig Service

1. Approach the ailing equipment in a confident manner. This will give the instrument the (often mistaken) idea that you know something. This will also impress anyone who happens to be looking, and if the equipment should suddenly begin working, you will be credited with the repair. If this step fails, proceed to Step 2.

2. Wave the *Handbook* at the instrument. This will make the equipment assume that you are at least somewhat familiar with the sources of knowledge. Should this step fail, proceed to 3.

3. In a forcible manner, recite Ohm's Law to the instrument. (Before taking this step, refer to some reliable handbook and be sure of your knowledge of Ohm's Law.) This will prove to the equipment beyond a shadow of a doubt that you do know something. This is a drastic step and should be attempted only after the first two steps.

4. Jar the equipment slightly. This may require anything from a three to a six foot drop, preferably on a concrete floor. However, you must be careful with this step because, while jarring is an approved method of repair, we must not mar the floor. Again, this is a drastic step, but if it fails, there is nothing to do but to move to step 5.

5. Add a tube, resistor, or capacitor. This will prove to the instrument that you are familiar with instrument design. Also, this step will give the piece of equipment an added load to carry and will thereby increase your advantage. If these five steps fail to work, you must proceed to the most drastic step of all. Seldom needed, it is to be used only as a last resort!

6. THINK.

Reprinted from Squelch Tail, *bulletin of the Arizona Repeater Association.*

produced this year by MITS, Inc. and IMS Manufacturing Corp., currently the two largest hobby computer suppliers, will be sold for non-home use, although the remaining two-thirds will acount for 40.7% of the home mainframe market.

The VDC study analyzed hobbyists and their applications, finding that less than one-half of all self-described computer hobbyists own computers, and that over 70% of owners use their systems for games. System utilization for this application is currently 32.8%.

VDC's analysis of distribution patterns revealed that 61.6% of home/hobby computer sales in 1977 will be made by computer stores. Over the 1976-1981 period, computer store sales of computers for home use will increase at an average 47.8% annual rate in terms of units, and at an average 46.3% rate in terms of revenues. Purchases by commercial users will account for an increasing percentage of total retail sales over this period.

Revenues from home/hobby computer submarkets (main memory, peripherals, software, miscellaneous products) will increase less rapidly than mainframe revenues between 1976 and 1981, with mainframe revenues showing an average annual increase of 42.5%, and submarket revenues growing at an average 35.1% annual rate. Software will represent the fastest-growing submarket, averaging 81%/year growth through 1981. Among the standard peripherals purchased for use by hobbyists, floppy disks will exhibit fastest growth, rising 63% annually in terms of units.

Venture Development Corp.
One Washington Street
Wellesley MA 02181

Briefs

from page 9

times. A controversy arose early in February after a New Hampshire motorist was ticketed and fined by a Massachusetts State Trooper. A Boston area legislator is mounting a drive to have the bill repealed. Massachusetts is well known for a large number of strange laws that have never been taken off the books. Keeping both hands on the wheel at all times makes it difficult to do things like turning on headlights or even shifting.

High power rf energy at 13.56 MHz is the basis of a new type of cancer therapy that is achieving a high degree of success at several hospitals throughout the United States. The therapy is based on the fact that blood flow through a cancer area is drastically decreased because the explosive growth of a tumor pinches the vessels shut.

Doctors use an rf generator with an output of 1000 Watts at 13.56 MHz, the lowest frequency approved for medical use by the FCC. The rf is transmitted from an amplifier to an impedance matching circuit via coaxial cable that is connected to electrodes in the tumor area.

When the rf is applied to the electrodes, immediate heating of tissue takes place. In normal non-cancerous tissue, the normal flow of blood cools the area so that no damage is done. However, with the constricted blood vessels of a cancer tumor limiting blood flow, that area is heated above the temperature at which the cancer cells are destroyed.

Of 21 patients treated so far, all were cured by the technique. Doctors are encouraged and plan to use the rf treatment mainly in areas where it is difficult or impossible to operate. *Reprinted from the* Journal of the American Medical Association.

What is the status of the two rf interference bills which are pending before Congress? According to Senator Barry Goldwater K7UGA, they may be in trouble. In a letter to an unidentified member of the Arizona Repeater Association, Goldwater writes:

"To put it as bluntly to you as I can, so you can pass it on to your readers, that fabulous affair we call politics has gotten into the matter of the two bills you have written to me about.

"The electronics industry in this country is a very large one and it isn't about to want to spend another dollar or two to make a receiver or a TV set immune to other frequencies. The industry has been working hard on the committees and I can assure you that I will continue to work hard on this. I really think that as the people begin to understand it as organized labor already has, we are going to get this passed either this year or probably next year." *Tnx to* Arizona Squelch Tail.

Attorneys for Offshore Navigation Incorporated, a New Orleans based radionavigation service with a subsidiary in Canada, have informed the Canadian Department of Communications of their disagreement with a WARC proposal by the Canadian Radio Relay League that 420-450 MHz be exclusively allocated to amateur service.

In the letter, the attorneys confirm that up to the present time, radiolocation operations in the band have been minimal. They add that the situation is in the process of change and that they anticipate the band will be heavily used for radiolocation in the near future due to comprehensive development of new equipment for use in this band. The equipment would replace current SHORAN equipment, which is 20-30 years old and of tube design. They point out that development work has been in progress for more than two years, with a prototype system under test for over a year. Delivery of additional systems is planned for the near future.

In conclusion, the letter urges the Department to maintain the provision for radiolocation in the 420-450 MHz band. There was no immediate comment from the Canadian Radio Relay League.

A letter from the Canadian Radio Technical Planning Board to John Van Der Ryd VE3CYC has taken issue with Van Der Ryd's letter on page 9 of the January issue of *73*. In the letter, Van Der Ryd claimed that at a meeting last fall between the Canadian Radio Television Planning Board and the DOC in Ottawa, a discussion to rearrange frequencies between 406 and 960 MHz included a suggestion to take the 440-450 MHz band away from amateurs.

Bud Punchard VE3UD, Chairman of the ad hoc committee on the band, replied that the committee has recommended that amateur bands in that band remain unchanged. Punchard added that the group is working hard to save bands for amateur use.

The Amateur Radio News Service has announced the rules for its 1977 annual contest. The contest is aimed at promoting amateur radio journalism in club publications of various sizes. Club bulletin and newsletter editors are urged to send three different issues of their publications from the year 1976 to the three judges listed below. The deadline is April 15th, according to ARNS spokesman Norm Monro. There are six categories in the competion: Class A (for publications subsidized in part by outside interests), and Class B (for publications produced solely through the resources of a club or organization), each further broken down into three divisions, depending on circulation, in multiples of 50 or more. Three copies must be mailed to each judge: Norm Monro K4FRY, 215 Brindly St., Gadsden AL 35901; Phil Sager WB4FDT, 3877 N. Abingdon, Arlington VA 22207; and Lee Knirko W9MOL, 222 S. Riverside Plaze #2400, Chicago IL 60606. Each entry must be accompanied by an official class of entry, the name and address of the editor, and the publication's average monthly readership.

According to the *West Coast DX Bulletin*, it appears that Yugoslavia has moved to give their amateurs privileges in the 160 meter band. YU1PCF was worked on the band recently and another Yugoslavian amateur, YU3EY, is also active. First reports are that their 160 band is only 10 kHz wide with activity recently heard on 1830 kHz.

The phenomenal success and growth of the "Sidewinders on Two," a two meter SSB group headquartered in Fort Worth TX, has created a money problem. In the past, an annual $2.00 fee was sufficient to mail club bulletins to all members. The February bulletin of the group, however, lists 366 members, making it necessary to charge for postage. Now a $5.00 fee will cover both membership and a subscription to the bulletin. Those who wish membership only can still join for $2.00.

More information is available from Sidewinders on Two, 1704 Glenn Drive, Fort Worth TX 76131.

Western Airlines Captain Carl Smith WØBWJ earned a "good guy" award from the mayor of Honolulu HI recently after making a perfect two-point landing of his 707 at the Honolulu airport in January. The landing was made necessary after the nose gear of the airplane failed to extend after repeated attempts. In the true tradition of amateur radio operators, Smith handled the situation coolly and professionally and said it was "not an adrenalin situation." He refused an offer of foam being spread on the runway and landed the big jet perfectly on two sets of wheels, taxiing for some distance before dropping the nose. No one was injured.

A-8 Honolulu Star-Bulletin Thursday, January 27, 1977

He Made the Best of an Emergency Situation

Safe Landing Earns Pilot a 'Good Guy' Award

Over the years, the Collins KWM-2 and KWM-2A single sideband transceivers have undergone a number of modifications, some of which were made during the period the unit was used in military service.

Available through Military Affiliated Radio Service (MARS) libraries, and the Government Printing Office, is an Air Force Technical Manual that lists over 50 modifications to the KWM-2/KWM-2A, along with expanded, fold-out diagrams of the circuitry, which are a great improvement over the amateur-style instruction manual.

The title of this technical manual (TO-31R2-4-183-3) is: *KWM-2A Transceiver*. It also covers changes to the 30L-1 and 30S-1 rf amplifiers.

A second technical manual of interest to KWM-2/KWM-2A owners is TO-31R2-4-183-2, entitled *Technical Manual (Service) KWM-2A Transceiver*. It also covers the previously mentioned amplifiers. This publication provides detailed alignment instructions for the transceiver and linear amplifiers. *Thanks to* Parking Ticket, *bulletin of The Plano Amateur Radio Klub, Inc., PO Box 435, Plano TX*.

Previously unpublished papers on all technical subjects relating to amateur radio are invited to be submitted for the 1977 ARRL Technical Symposium. The event will be held in September in Falls Church VA under the management of the Amateur Radio Research and Development Corporation and is sponsored by the Northern Virginia Amateur Radio Council.

Areas of interest include propagation, antennas, transmitting and receiving equipment, amateur applications of microprocessors, design and construction techniques, station and shop design, HF techniques, VHF/UHF repeaters, ATV, RTTY, space communications, microwave, and any other topic of technical interest to amateurs.

Prospective contributors should forward an informal summary, along with a photo and one page biographical sketch, by July 15. Manuscripts are due by August 15. For more information write Paul Rinaldo W4RI, 1524 Springvale Ave., McLean VA 22101.

While you're about it, how about submitting the article to *73*? That way you can get paid for your effort.

Australia may soon have a CB problem of its own. At present, there is no licensing system for CB radios in that country, but an increasing number being brought in from the United States are beginning to create interference problems "down under." Some estimates put the number of radios currently being used at near the quarter-million mark. Although not illegal at the moment, it is becoming clear to government authorities that they will soon have to develop legislation to regulate the units. They are currently studying alternatives. The Wireless Institute of Australia, the

country's amateur organization, has offered the government help and expressed concern that possible legislation regarding CB will adversely affect the state of amateur radio in Australia.

OSCAR 6 continues to show signs of deterioration. When launched in October, 1972, the amateur satellite had an expected life of one year. It's been going strong until recently when telemetry data showed that one of the 18 cells had failed, and there were strong indications that a second was about to. OSCAR 6 passed through the period of highest temperature at the end of January and beginning of February. During this period, the satellite is in sunlight 100% of the time and temperatures inside rise drastically. AMSAT president Perry Klein told *73* that this high temperature period is detrimental to the batteries. Both OSCAR 6 and OSCAR 7 pass through full sunlight periods twice a year. Klein added that AMSAT expects to shut down OSCAR 6 when the A-O-D satellite is launched later this year. That is, of course, if OSCAR 6 lasts that long.

Meanwhile, OSCAR 7 was continuing to have problems with overcharging of the batteries and was alternating between Mode B and Mode C on all orbits. It was theorized that a bad solar aspect angle with the sun hitting the satellite on the top only might be responsible for the problem.

On the lighter side, the International Repeater Group in New Brunswick can be thanked for the following compilation of a few categories of the infamous "thumpers":

Early Morning Thumpers: The first thing they do each morning is check to make sure the repeater is on. They usually get up between 6:15 and 7:15.

Late Night Thumpers: They give the repeater a little thump before going to bed.

73 and 88 Thumpers: After a QSO, they always have to thump the repeater a few times as a friendly way of saying goodbye.

Repeater Checker Thumpers: On an irregular basis, all repeaters in the area get a thump to find out if they are on the air.

Casual Thumpers: They check to make sure the repeater is still on the air at various times throughout the day.

Rapid Fire Thumpers: Those who like to see how many times they can push their mike button in three seconds.

Guess Who Thumpers: They always return a thump to the Casual Thumper, but don't like to give their call.

If you're looking for another certificate, why not try the Capitol Hill Amateur Radio Society? W3USS runs a kW on SSB and CW from the basement of the Old Senate Office Building in Washington. Antennas range from a vertical to a three element tri-bander up 120 feet. As Pete WA3KSQ put it, "For those in a hurry, it takes only three minutes to travel from our QTH to the Senate floor."

This year's observance of Armed Forces Day, scheduled for Saturday, May 21, marks the 28th anniversary of this annual event.

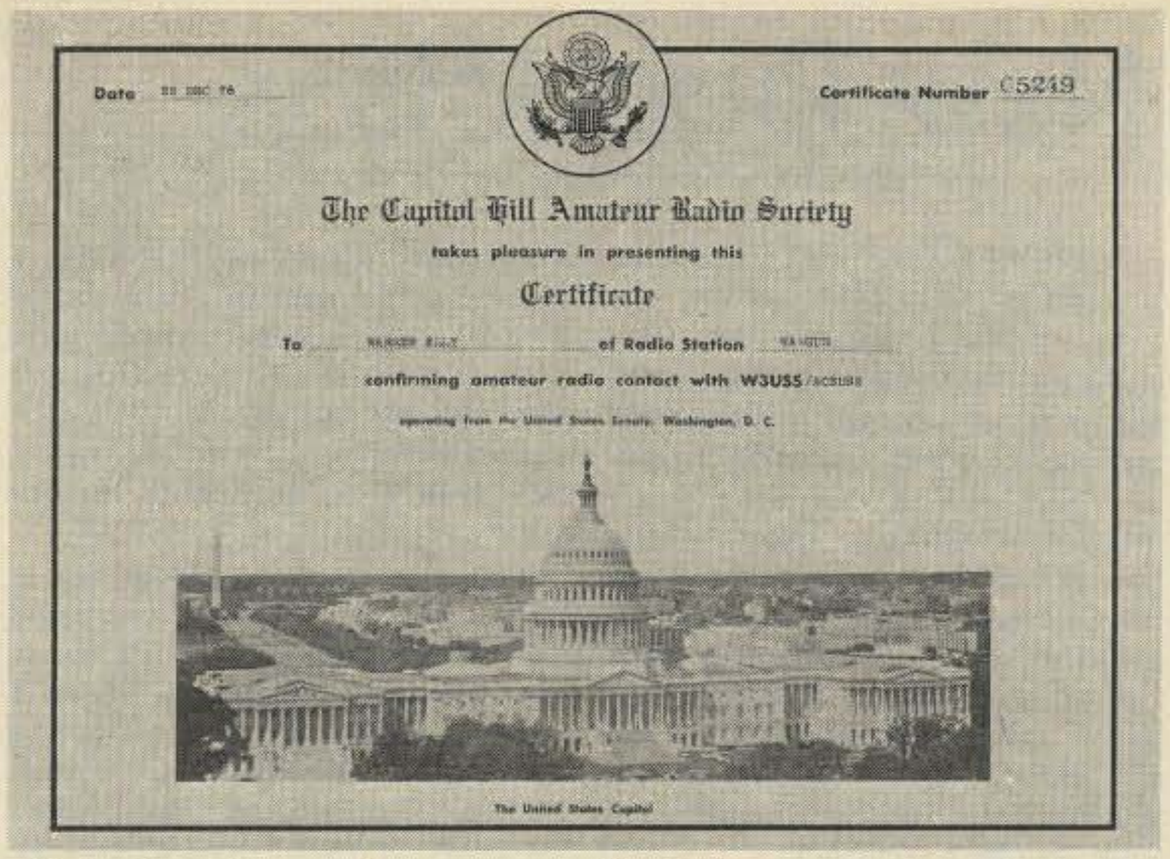
A featured highlight of the day will be the traditional military to amateur communications tests. The proceedings include operations in CW, SSB, RTTY, and SSTV.

Certificates will be awarded to amateurs who accurately copy the Armed Forces Day message from the Secretary of Defense, Harold Brown. The message will be transmitted in both CW and RTTY.

The military to amateur crossband operations will be conducted from 1300 UCT on May 21 to 0245 UCT on May 22. Military stations NPL, NMH, NAM, NPG, WAR, and AIR will transmit on military frequencies and listen for amateur stations transmitting in portions of the amateur band. The operators at the military stations will specify which portions they are listening to.

73 will publish a complete list of the frequencies in next month's issue.

Want a two letter callsign? April 1 will be the date on which you can apply if you received your Extra ticket between July 1, 1974, and July 1, 1976. If you received the Extra after July 1, 1976, you can apply on July 1, 1977 or later. If you had an Extra before July 1, 1974, you are eligible to apply immediately.


Date [illegible] Certificate Number C5249

The Capitol Hill Amateur Radio Society

takes pleasure in presenting this

Certificate

To [illegible] of Radio Station [illegible]

confirming amateur radio contact with W3USS/[illegible]

operating from the United States Senate, Washington, D. C.

The United States Capitol

The Dallas TX Amateur Radio Club reports that thefts of two-way radio equipment in the Dallas area declined at the end of 1976. During the month of December, 565 radios were reported stolen to the Dallas Police Department, a low for the year. The total for the year was a staggering 10,635. Several Dallas Police spokesmen expressed the opinion that the trend has gone full circle and thieves might go back to hubcaps and mag wheels. With 40 channel CB rigs and the increasing use of mobile 2 meter equipment, what will happen remains to be seen.

In an effort to improve their signal to the western United States, W1AW in Newington CT has been conducting tests with a variety of antennas. Comparisons were made between a 4 element 20 meter yagi and a rhombic. Reports from Los Angeles favored the rhombic, although stations 20 degrees off heading reported the yagi as superior. Comparisons between the W1AW signal and other amateurs in the Hartford CT area were also made. In some cases, signals were 10 to 12 dB in favor of the other stations.

It was decided to build a new array with stacked 4 element 20 meter beams at 60 and 120 feet, and a 3 element 40 meter beam at 90 feet. The project is funded by a bequest from silent key W8FX, a longtime Michigan S.C.M. The array will bear a plaque in his memory.

As part of a federally funded project, a study team at Cornell University recently spent time monitoring conversations on the CB channels. According to their conclusions, almost 50% of the conversations were discussions about the locations of the parties involved, 20% were discussions of equipment and technical aspects, and less than 5% were requests for information, "smokey reports," and traffic directions.

The study showed that 75% of the communications were directed specifically at another party, although in over 50% of the cases, the operator was unable to find the party that he was seeking.

They found that 50% of the traffic occurred on Fridays and Saturdays, with the peak time between 5 and 6.

In conclusion, the study team called CB a "wireless party line used primarily as a way of making friends and maintaining a community network."

EDITORIAL BY WAYNE GREEN

from page 4

stopping at either 13 or 20 words per, but heading for them thar hills. Some preliminary experiments with high speed code indicate that it may not be much more difficult to master than slow speed code ... indeed, it may not take much longer than learning slow speed code ... once instructors are able to get over using the graduated teaching method.

Despite the example of more and more code classes starting students out at 13 words per minute right from the beginning and making the goal in less than half the time required by the old (ARRL) system, all of the code learning systems on the market today (except the *73* tapes) go the same old route ... and that includes the just released ARRL tapes which teach 5, 7½, 10 and 13 per ... for those who want to take the time to learn four different code speeds.

The next step is to try starting people out at copying code at 50 words per minute, right from the start. The whole idea of copying code is to train the brain to translate the sound patterns on a subconscious level, thus getting around the slowness of the computer system on the conscious level. The code translation on the conscious level bogs down at around ten words per minute ... the famed "plateau." It is only after this plateau has been reached in the normal code learning system that the whole business is turned over to the subconscious mind for deciphering.

When you hear di-dah and then say, "hmmm, that's A," you're looking it up in memory and the circuits involved are many and relatively slow. When you hear di-dah and your fingers write or type "A" before you can say it, then you're working on a subconscious level and headed for speed.

Let's get some hams who would like to try for 50 per and start them out with the dots and dashes at that speed ... crank up the keyboard or bug and send individual letters well spaced at first ... then close up the spacing as you go. You'll quickly be able to tell the difference between even the most similar of letters such as 1 and J. Let me know how you do.

New Products

YAESU FT-221R TWO METER ALL MODE TRANSCEIVER

The 2 meter operators who have confined their VHF activities to FM are in for a surprise: The spectrum between 144 and 146 MHz is alive with SSB activity, but without the problems of QRM, jamming, and the general disorders associated with low band sideband operation. In order to join the fun of 2m SSB, a suitable transceiver is required, and the Yaesu people provide a perfect rig — the FT-221R. This all mode transceiver provides every feature required to fully exercise the 2m band.

The transceiver is VFO controlled, and main dial accuracy is maintained by dividing the 4 MHz 2m band into eight 500 kHz segments, with each segment being selected by a rotary switch. Main dial resolution is 1 kHz. If crystal control is desired, the operator has a choice of eleven crystal positions controlled by a front panel switch resulting in 88 crystal channels. The rig also has a standard built-in calibrator that can be used to perfectly set the main dial. This is accomplished by turning on the calibrator and adjusting the main tuning knob while locking the VFO with a button located by the dial. A signal strength meter doubles as a center scale discriminator meter when receiving FM. The meter also reflects relative output power when transmitting. The operator also has control over rf gain, squelch, audio and microphone gain, VOX gain, and repeater control via front panel controls. Standard and reverse repeater offsets are provided, as well as an operator selected offset. The additional offset is generated by an internal crystal, provided by the user. A mode control selects upper or lower sideband operation, as well as FM, AM, and CW. And finally, a clarifier control is provided for the SSB operator. CW sidetone, noise blanker, and repeater tone burst functions are standard features, making the FT-221R a totally versatile package. The radio can operate on either 12 volt dc or ac line. The power transformer is tapped for those who have non-standard line voltage.

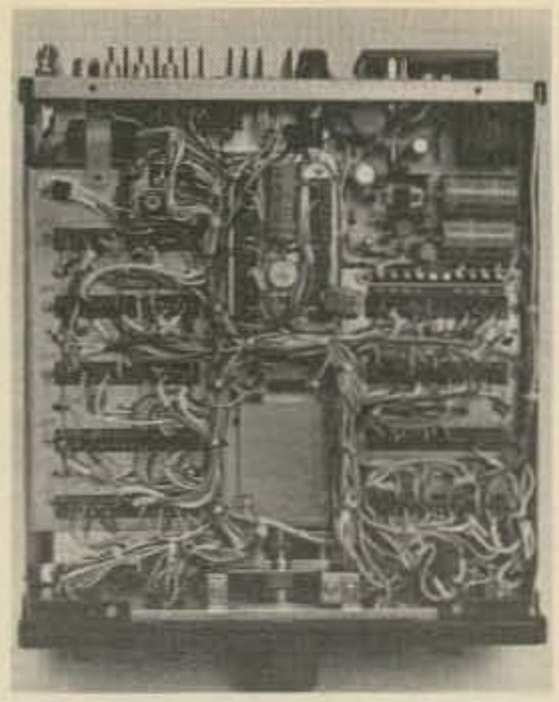
Operating the FT-221R is a joy. I spent an entire weekend operating the transceiver in the rf-burdened New York City area, and never experienced any problems relating to overload or intermodulation. I started my day by making a few basic tests on the transceiver.

I checked the FM power output with a Bird 43 wattmeter, and found the transceiver was delivering 22 Watts into the line. Sideband PEP output was about the same, as was CW. The AM output was four Watts. (Yaesu rates the FT-221R at a conservative 14 Watts on FM.) I have often wondered about the accuracy of VFO tuned rigs on VHF. A frequency counter check of the main dial resolved the question, as accuracy was within 100 cycles at all settings. Drift was undetectable. My first operating test consisted of a rag chew on FM simplex with friends. Perfect tuning is accomplished by using the center scale discriminator meter, and no off-frequency problems were encountered. The receiver is superb, and the rf gain control can be used with the squelch function to select the group of stations desired. I live on a hill, and undesired distant FM stations have always been a problem. Not so with the Yaesu; the rf control took care of that situation. I tried the local repeaters next and encountered no tuning or operating problems or peculiarities. The microphone gain control allows considerable latitude in deviation, a necessary feature when using city repeaters with narrow audio bandpass characteristics.

The time was finally right for SSB. Not knowing the two meter calling frequency, I tuned around "below" 146 MHz until the familiar SSB sound was heard. A touch of the clarifier, and perfect audio resulted. SSB tuning is sure and solid, and there is no drift once the signal is tuned. Breaking into the QSO resulted in an hour long round table with four others on SSB, and two of the stations were well outside my normal FM range. Encouraging signal and quality reports were received, so I decided to call CQ (it is acceptable on 2m SSB!) on the national SSB calling frequency of 145.025 MHz. I talked to several other SSB stations on both sidebands, and noted that there is no shift when switching between the upper and lower sideband. The 221R was rock solid throughout the session, and nothing but favorable reports were received. The VOX functioned well, and I found operating 2m SSB was much like a late evening crosstown QSO on 20m when the band is out. No QRM, no problems. It was also obvious that 2m SSB activity is growing, as virtually every CQ resulted in a contact.

The FT-221R is bound to excite the OSCAR satellite operators. Being VFO controlled, the transceiver can easily be operated in the OSCAR 7 Mode A transmit region, or the Mode B receive segment. One of the editors at *73* is an OSCAR enthusiast, and his first test of the Yaesu was to fire up during the first available OSCAR 6 pass. He was immediately rewarded with a contact from Argentina, with good signal and quality reports. The FT-221R has sufficient power to work the satellites with simple antenna systems. The operator at *73* used a Ringo antenna tuned to the high end of 2 meters with good results on both OSCAR 6 and OSCAR 7.

Everything considered, the Yaesu FT-221R is a pleasure to operate. There are enough controls and options to please the most demanding operator, yet one does not get lost when operating. There are no tuning or loading controls. The amplifier delivers full power from band edge to band edge, and there is no obvious evidence of spurious output (immediately detectable in the New York area, as there is a repeater or public service outlet on almost every VHF channel). The receiver does not appear to "peak" anywhere on the band, and is immune to the intermodulation headaches known by all city operators. Single sideband operation, which is the 221R's forte, is superb, and is guaranteed to open a new frontier for those 2m operators who are tired of FM and repeaters. The Yaesu FT-221R is priced at $629.



Underside of the FT-221R. Most of the circuitry is contained on easily removable cards that slide into the visible edge connectors.

Yaesu Electronics Corp., 15954 Downey Ave., Box 498, Paramount CA 90723.

John W. Molnar WB2ZCF
Executive Editor

MONITOR TUNER 160-10 MAT AND SUPER SUPER TUNER

Having moved into a new house just before the first snows of winter set in on New Hampshire, I did not have time to erect all the antennas that I wanted. In fact, the only antenna I could get into the air was one of the more common 75 and 40 meter multiband dipoles which are available commercially. This 66 foot antenna works fine in the 75 meter band (and has a pretty flat swr curve throughout the 40 meter band), but it was completely unsuitable for any of the other bands. This is quite a devastating problem for the avowed DXer, especially during the international DX contests when operation on other bands is definitely desired.

Of course, what I needed was an antenna tuner — and a good one at that. Knowing that eventually I was going to increase my station power from the current 180 Watts PEP to 2,000 Watts PEP, I started looking for a tuner that could handle the legal limit. Having had some prior experience with equipment by the Dentron Radio Co., I chose their Model 160-10 MAT Monitor tuner. Besides being able to handle upwards of 3 kilowatts,

The Dentron Radio Monitor Tuner — basically the same unit as the Super Super Tuner, but with an swr/power meter built in.

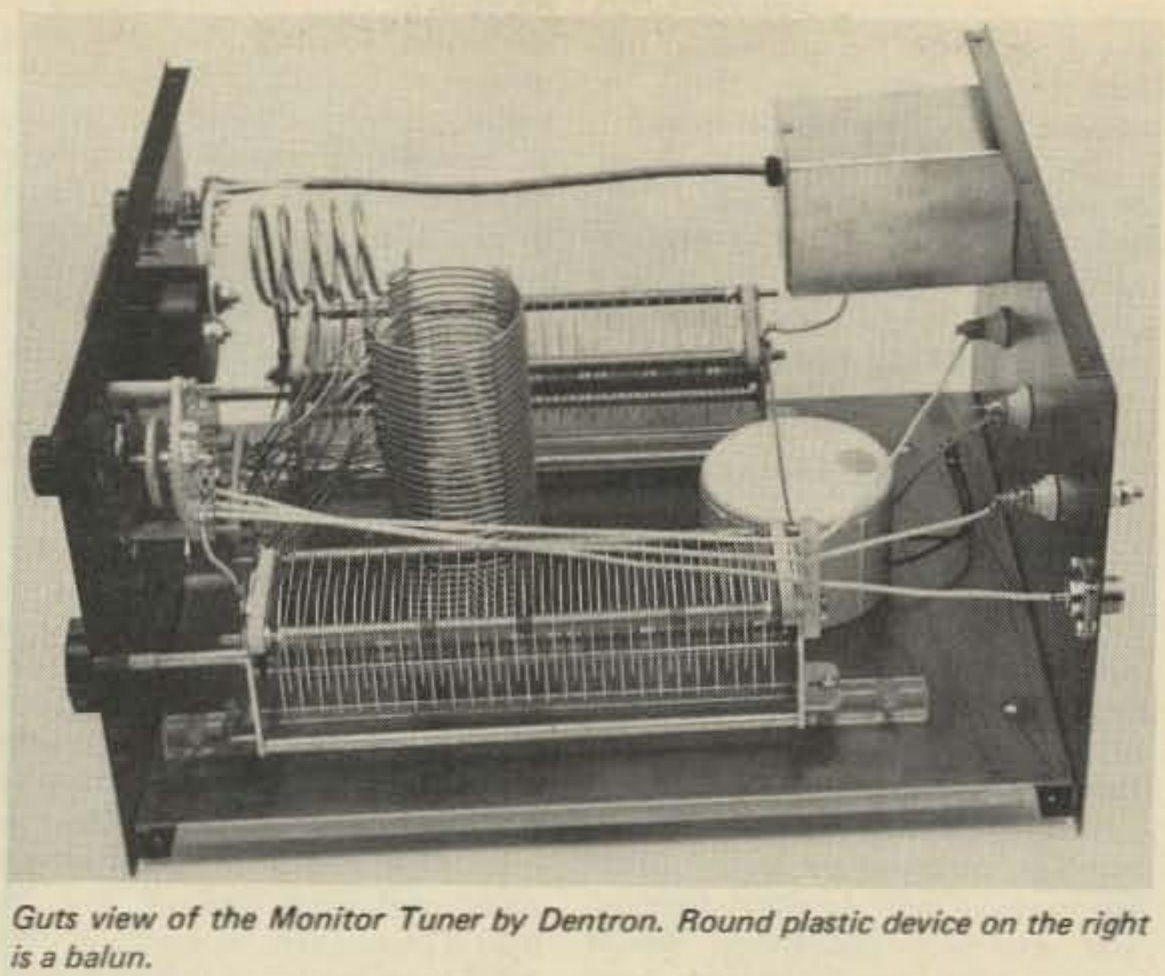
The Yaesu FT-221R. Note double-sided tuning scale and 8 position bandswitch that allow accurate VFO tuning.

this tuner has a built-in rf power meter which shows both forward and reflected power at the flick of a switch, making tune-up a snap. It also features an easily accessible front panel switch which permits you to select either the coax, balanced or random wire terminals on the back of the tuner. You therefore can have three antennas or a dummy load connected to the tuner at one time and be able to select any one without the need to disconnect the others. I tried this with a 50 foot wire which ran from my bedroom window to a nearby tree – it loaded perfectly on 15 meters while hooked to the random wire terminal. There was no need to disconnect my multiband from the coax connector while this test was being made. By the way, the multiband worked out fine on all bands through 10 meters, and I even managed to pick up a few new countries on both 15 and 10 during the February DX contest.

The Monitor tuner also comes without the rf power meter (in which case it is called the Super Super Tuner). For those of you who are lucky enough to have an accurate separate meter, this is a good deal. The tuner is well named. The bridge and meter unit is also available as a separate unit for $99.50.

The construction of the unit is very sturdy, and the coil and rugged capacitors were chosen to be well within the power range of the unit. The case measures 9" x 13" x 16" and fits nicely on any operating table. The price is also right, with the metered unit costing $299.50 and the unmetered version $229.50. *Dentron Radio Company, Incorporated, 2100 Enterprise Parkway, Twinsburg OH 44087.*

Rich Force WB1ASL
Associate Editor



Guts view of the Monitor Tuner by Dentron. Round plastic device on the right is a balun.

73 TESTS THE COMMUNICATIONS RECEIVERS

The 1979 WARC conference has many of us thinking about the future of the ham bands. As we reported back in February, and have updated elsewhere in this issue of 73, amateur radio is only one of more than a dozen services vying for spectrum space. And compared to amateur allocations, frequencies set aside for international broadcasting (about 2 MHz not counting the "tropical" SW bands) are much more important to the majority of WARC delegates.

Foreign broadcasting is closely tied to foreign governments, in most cases controlled *by foreign governments. It is a highly political business, employing great numbers of personnel (over 3 thousand in the Voice of America alone). Radio Liberty and Radio Free Europe, until recently, were secretly funded by the CIA. That should be a clue to the political stakes involved.*

US government figures compiled five years ago showed nearly 7 thousand hours of programming per week *from the communist bloc alone! That's enough programming to keep about 45 transmitters going continuously. The western bloc broadcasts about twice as much on the SW bands, over 12,500 hours per week, according to a BBC survey. Russian broadcasters, considered separately, are beaming programming in 84 different languages (by US figures), an expensive proposition at the least. Even the smaller countries are making substantial investments in foreign language transmissions, such as Cuba with 8 languages, and Mongolia with 4.*

Amateurs active on 40 and 80 meters are well aware of the power and bandwidth the SW broadcasters use, and the intensity of their activity. Stations from every corner of the world can be received with simple whip antennas, and many of us found our way into ham radio by listening to them.

Many hams are still SWLing and, by recent reports, it appears the hobby is headed for a revival on the heels of what's been called "the personal communications boom." One report has it that there are so many SWLs active in Japan that some broadcasters are limiting or ending QSL services. One country's SW service was saved from shutdown (an austerity move) by hundreds of complaints from overseas listeners!

Nearly all SW broadcasting is AM, but there are mounting arguments to switch to SSB while retaining the carrier, thus preserving space in the already overcrowded bands. The broadcasters themselves don't like the idea for a variety of reasons (mostly economic), but SSB on SW broadcasts seems to only be a matter of time.

Recognizing the growing interest in SWLing (and scores of letters from 73 readers wondering what's available nowadays in general coverage communications receivers), we begin this month a series of reviews intended to cover the major gear available. Our premise is that many amateurs are now considering a reasonably priced general coverage receiver, not only for SWLing, but as a standby for their station receivers. There are several ways you can use a standby – for spotting on other bands during a contest, for example, or with VHF-UHF converters to keep your HF station separate, and so on. On top of the amateur uses, there is, of course, the benefit of SWLing itself.

SWLing can be much more than listening to foreign broadcast outlets – there are thousands of point-to-point communications to intercept, ranging from aircraft control circuits to foreign embassies communicating with home. A book is even available on "secret" frequencies, called the Confidential Frequency List, *by Robert Grove and published by Gilfer Associates, Park Ridge NJ. Everything from foreign embassies to CIA frequencies (those registered with the ITU) is listed in 34 different sections.*

Microprocessor hobbyists are into SWLing as well, using their uPs for deciphering high speed RTTY broadcasts. (Several articles on the subject are coming up in future issues of 73.)

There is much more, of course, to be said about SWLing, but hopefully we've whet your appetites with this brief introduction. So here's part one of 73's survey of general coverage SW receivers.

THE DRAKE SSR-1 COMMUNICATIONS RECEIVER

My first receiver (save the crystal set I built out of a science lab kit) was a GE nine transistor portable. It covered only 4 to 12 MHz (plus the AM broadcast band) without the benefit of much more than a volume and tuning control. My antenna was a bizarre concoction of wire scraps that eventually wound around the house, up into the attic, and out to a tomato plant stake in my mother's vegetable garden. With each new find of scrap wire, the random antenna grew in length.

Fifteen years have passed, and a lot has happened with communications receivers. First of all, Dr. T. L. Wadley designed the so-called Wadley loop, first popularized in the British Racal line of receivers. The Wadley loop reached a worldwide audience through the South African manufacture of Barlow-Wadley receivers, and they were dominant among SW enthusiasts for decades.

More recent developments in PLL circuitry and the apparently booming interest in SWLing have brought a series of medium priced general coverage receivers, primarily from Japan. The Drake SSR-1 is imported by Drake from Japan and well represents the new generation in SW sets.

The Drake uses a synthesized first mixer injection circuit designed to yield thirty tunable ranges from the bottom of the broadcast band (.5 MHz) to 30 MHz. What that means is that separate control of the megahertz ranges and kilohertz bandspread is provided, which is a substantial departure from the superheterodyne that has dominated general coverage sets for years.

The Drake is calibrated to one kHz, and tuning known frequencies (such as a SW station listed in the *World Radio TV Handbook* published by Gilfer Associates) is a simple process of setting up the MHz range, peaking the preselector, and tuning the kHz control onto the desired frequency. Using only the built-in whip antenna (a feature unique to the SSR-1), I was able to hit nine of ten frequencies listed in the handbook with a minimum of tuning. The use of a dipole antenna increased signal strength, of course, but I found the SSR-1's sensitivity over its entire range to be very good, using only the whip antenna.

The Drake circuit employs a single

The Drake SSR-1 receiver, with a simple layout and 500 kHz through 30 MHz coverage.

10 MHz crystal oscillator, so unmodulated signals will appear at multiples of 1 MHz. Although this could be eliminated in circuit design, Drake says it would push the cost of the SSR-1 right out of its price class. Another side effect is small birdies, which are easily tuned out with the MHz control. Peaking a signal for maximum strength with the preselector, kilohertz, and megahertz controls will eliminate the birdies completely. They can, in fact, be used as a tuning aid, since eliminating the birdie peaks the receiver on frequency. In a month and a half of operation, I never found the birdies objectionable, and as for the 1 MHz unmodulated signals, they were very helpful as calibration markers. (Tuning WWV at 10 MHz, I found the SSR-1 within 100 Hertz.) One final point on this: Using other synthesized receivers in this price class shows that all of them have their share of birdies and 1 MHz markers. I never found them objectionable and they did not interfere with reception to a degree justifying the 2 or 3 hundred dollars more investment necessary to eliminate them.

The SSR-1 is completely solid state, with a built-in battery pack which requires 8 type D flashlight batteries. The dial lights are disabled when using the dc supply, which automatically switches on if ac is disconnected or interrupted. A push-button switch on the SSR-1's front panel is used to momentarily operate the panel lights when using dc power. Another feature is a 12 V dc power plug on the back apron which, when used with an accessory cable, allows use of the radio in an automobile or boat. Power consumption was measured at just under 100 mA at 12 V dc. The ac supply can be switched between 117 V and 240 V through a tapped transformer.

The Drake receives AM, CW, and SSB signals quite well, with good stability and audio response. The SSR-1 has separate detectors for AM and SSB, another feature unique to the Drake set. On AM it's a diode detector and 5.5 kHz filter, while on SSB-CW Drake uses a product detector and 3 kHz filter. Cross modulation noted on extremely loud signals was easily eliminated by switching in the 20 dB pad. Another feature exclusive in its class with the Drake is a ±3 kHz clarifier. The clarify control makes SSB and CW reception precise, since it acts as a fine tune control. In addition, heterodynes can be reduced in the AM mode with the clarifier.

I would not hesitate to recommend the SSR-1 as a standby receiver for CW and SSB reception in the ham shack. Muting provisions are included through an RCA type connector on the rear apron, and through a signal splitter, the SSR-1 served well as a spotting receiver during a recent DX contest. I've also used it with my standby transmitter for CW work with good results. I did find an audio filter (MFJ type CWF-2BX) very helpful in getting the passband down below the Drake's 3 kHz CW-SSB filter. The front panel 8 Ohm headphone jack came in handy there, plus I found the receiver had more than enough audio output to drive the outboard filter and headphones. (The SSR-1 is equipped with a front panel speaker.)

The Drake is the smallest general coverage receiver in its class — 13" wide by 11" deep by 5½" high. It weighs 14 pounds less the battery pack, and comes with accessory mounting feet to allow installation with the front panel sloped slightly upwards.

Among the accessories Drake offers for the SSR-1 are matching headphones model HS-1, dc power cord, and an antenna kit for the SWL bands. List price on the SSR-1 is $350, but company officials say dealers are discounting them down to the $279-299 price class. (Check with your local Drake dealer for details.)

In conclusion, the Drake SSR-1 is a compact, go-anywhere general coverage receiver with excellent stability, and sensitivity enough to receive signals from the broadcast band through 10 meters using only the supplied telescoping whip antenna. The SSR-1 allows precise tuning, directly from frequency tables, on the SW bands to within a few kHz. It is in an attractive, self-contained package that fits into ham shack, living room, or listening post and at the same time is capable of camping trips and vacations where ac mains are not available. *R. L. Drake Company, 540 Richard St., Miamisburg OH 45342.*

Warren Elly WA1GUD
Associate Editor

HY-GAIN 3806 2 METER HAND-HELD FM TRANSCEIVER

The evolution of "portable" 2 meter equipment over the years has been amazing. Just a few short years ago, commercial surplus "boat anchors" were the rule. If nothing else, they did make for excellent traction by adding fifty pounds to the trunk. Times have changed. Even the diehards who insisted that they would never become involved are seen sporting the ultimate in amateur radio portability, the HT.

There are quite a few HTs on the market with a wide range of features over a wide range of prices. Initially, the arrival of a box here at *73* containing Hy-Gain's contribution to the HT field created little excitement. That changed, however, after a few minutes of using the new 3806 transceiver. The standard-looking blue external case hides an HT that is outstanding.

The 3806 measures 8½" by 3½" by 1¾" and could be a handful for a person with small hands. Its weight is surprising: only 2¼ pounds, complete with battery pack. The weight is kept down by the use of an ABS case that is highly resistant to damage and shock. At first glance, the case looks plain enough, but in the process of disassembling the unit, a few surprising features come to light. Hy-Gain Electronics makes a well-respected line of commercial radio equipment, and it's evident that they've included a few of the heavy-duty features in this part of their amateur line. The two parts of the external case are gasketed to preclude moisture getting inside and fouling up the works. The grill that covers the speaker and microphone is specially baffled to prevent water from getting in. Even the power pack is completely separated from the circuitry. Lifting it off reveals a sealed compartment, with two battery contacts the only evidence of its use. Admittedly, just about no one is going to use an HT under water. But most are exposed to a wide variety of climate, from rain to high humidity to salt spray.

The receiver section of the 3806 is much more than adequate. Hy-Gain claims less than 0.4 uV for 12 dB SINAD. I had no trouble backing up the claims and was able to have a QSO with another HT seven miles away while operating the 3806 inside my Volkswagen, with its horrendous ignition noise. Add to that the fact that hilly New Hampshire terrain and a noisy road were involved, and you have a perfect test for sensitivity. The 3806 came through with flying colors. The double conversion superheterodyne receiver with MOSFETs in the mixer and amplifier stages is superior to anything I've heard in a hand-held unit. The audio output power to the 2 inch speaker is ½ Watt and is more than adequate for just about any situation.

The transmitter section of the 3806 puts out a measured one Watt. Although that might seem low compared to a few other HTs on the market, it's more than enough for HT range. It also keeps the battery drain down. The unit only takes 380 mA on transmit. On squelched receive, drain is 20 mA; with signal, it's 100 mA. The battery pack takes 8 AA penlights or an optional nicad pack. The six channels (52 supplied) use standard 12 MHz crystals.

A few other features of the 3806 will appeal to the avid HT fan. All the controls are right out front. While transmitting, a large red LED stares at you, as an indication that a signal is really getting to the antenna. A meter indicates battery condition on transmit and relative signal strength on receive. A telescoping ¼ wave whip is supplied as standard equipment, although a rubber duckie is available as an optional accessory. More and more amateurs seem to be returning to the ¼ wave. The difference between it and the effective negative gain of a rubber duck is truly amazing.

Jacks for an earphone, external power, and external antenna are also supplied, each covered with a moistureproof plastic cover. The list of available accessories is long and includes a case, earphone, external antenna cable, cigarette lighter adapter, nicad pack, and a plug mount charger. At the time this went to press, Hy-Gain announced a tone pad that will fit flush into the back panel of the unit.

Suggested retail on the 3806 is $189.95, making it a moderately priced transceiver with features and performance that rival much more expensive units. It's built tough for outdoor use and should take the occasional abuse inherent in hand-held use in stride. *Hy-Gain Electronics Corporation, 8601 Northeast Highway Six, Lincoln NE 68505.*

Stan Miastkowski WA1UMV
Associate Editor

The Hy-Gain 3806 hand-held 2 meter transceiver. Note the heavy duty moisture-sealed case and the convenient position of the controls.

HEATH HW-2036 2 METER TRANSCEIVER

In just about every endeavor there seems to be a "people's machine" — be it a Model T, a Volkswagen, a "Benton Harbor lunchbox," or a small portable TV. Utility these days demands a television and for most folks, a car. For hams these days, utility means 2m VHF gear, and the prices are getting lower and lower.

Heathkit got started with, among other things, amateur radio kits. Heath earned its reputation with DX-40s, AT-1s, DX-100s, and the company's famous SB line of tube transmitters and receivers. On the VHF side, Heath started out with the "lunchboxes" for 6 and 2 meters, the "Sixer" and "Twoer" as they were known. With the advent of FM came the HW-202, a crystal-controlled radio known for its high audio quality. Heath's first synthesized 2m rig was introduced in 1975.

The HW-2026, as it was known, sold quickly, but problems developed, and Heath became the only manufacturer on record to stage a full refund recall. Every 2026 customer was offered a full refund, and first crack at the rig's successor. A year later the new radio was ready, and somehow Heath had managed to get the price even lower! Suggested retail for the HW-2036 is $269.95.

The 2036 has gained quick national acceptance, just like its predecessor, and there have been no reports of problems. The 2036 works fine.

When we first got a look at the new radio, it had already been assembled at the Heath factory. Operating impressions were reported in January '77 73, so it only seemed proper to follow up with a construction review.

Upon arrival of the kit, I tore into the box, anxious to begin construction. There is no wasted space in the shipping carton; sub-packs and chassis parts are interlocked with the rest to form a cushion, an effective one since all parts came through FB. Chassis parts were in the bottom of the carton; the microphone was in a separate pack, as were the five circuit boards. The Heath method of sub-packaging makes parts sorting an uncomplicated procedure; you can bet it would have been pure joy counting and sorting some 1,241 parts contained in the HW-2036 kit. Heath only packs the hardware you need to build and install each individual circuit board or assembly. Especially fragile parts (like the 2036's signal strength/relative power meter) are packed in styrofoam-lined boxes to insure safe delivery. If you're like me and like to peek ahead a little and see what all the parts look like, you'll also find the 2 final transistors in the power amplifier pack, which supply a minimum output of 10 Watts to the antenna.

The assembly manual is typically Heath — very clear and concise. Each part is clearly identified, and another great help is the scales Heath has printed on the bottom of each page whose steps require a measurement.

Heath does not stop its design work with the production of new gear. Instead, a constant updating process takes place, with owners kept abreast of what's happening. In the case of the 2036, four pages of corrections are sent along, with substitute parts included. The builder merely changes a few values in the assembly instructions, and tapes new pages over the existing ones — then you're all set to begin work.

During assembly, I did not use any special method for parts sorting. Since each board package was opened one at a time, the parts could all be laid out on the work surface. I grouped all the common value capacitors together, the same resistors, and so on (no reason for the traditional cookie tins or pie pans!).

The first step in assembly of the 2036 is the installation of scores of printed circuit board pins (PCB pins) on each lead extending from the wiring harness. This is quite tedious work, especially when the majority of the pins must then be wrapped in heat-shrinkable tubing. Once installed, however, the pins make for simple interconnection of the PC boards during final assembly and testing. Heath supplies a small alligator clip to hold the PCB pins upright, so you can place the wire right into the end of the pin, then apply heat and solder. I found it much easier and faster to make sure the wire to be inserted was tinned first, followed by heating the pin and melting a small amount of solder into it. Using that procedure, it takes a very small time interval to place each wire in a pin, apply a small amount of heat, and make a perfect connection.

By the time the first six hours of assembly time had passed, the chassis was complete and mounted in place, and the front panel meter, switches, and pots were installed. At about this point, with the rig taking shape, the hours of concentration began to pay off. The front face and control knobs complete the first lion's share of construction, and from there on out the work is less mechanical. It's time for the PC boards.

The first circuit board to deal with is the smallest, the voltage controlled oscillator (VCO) board. The VCO's job is to produce signal to the synthesizer for frequency selection. Construction of the VCO assembly is crucial because this stage must be stable enough to keep the synthesizer on frequency. For this reason, the board is installed in a shielded case on the chassis, and is the only board without IC sockets.

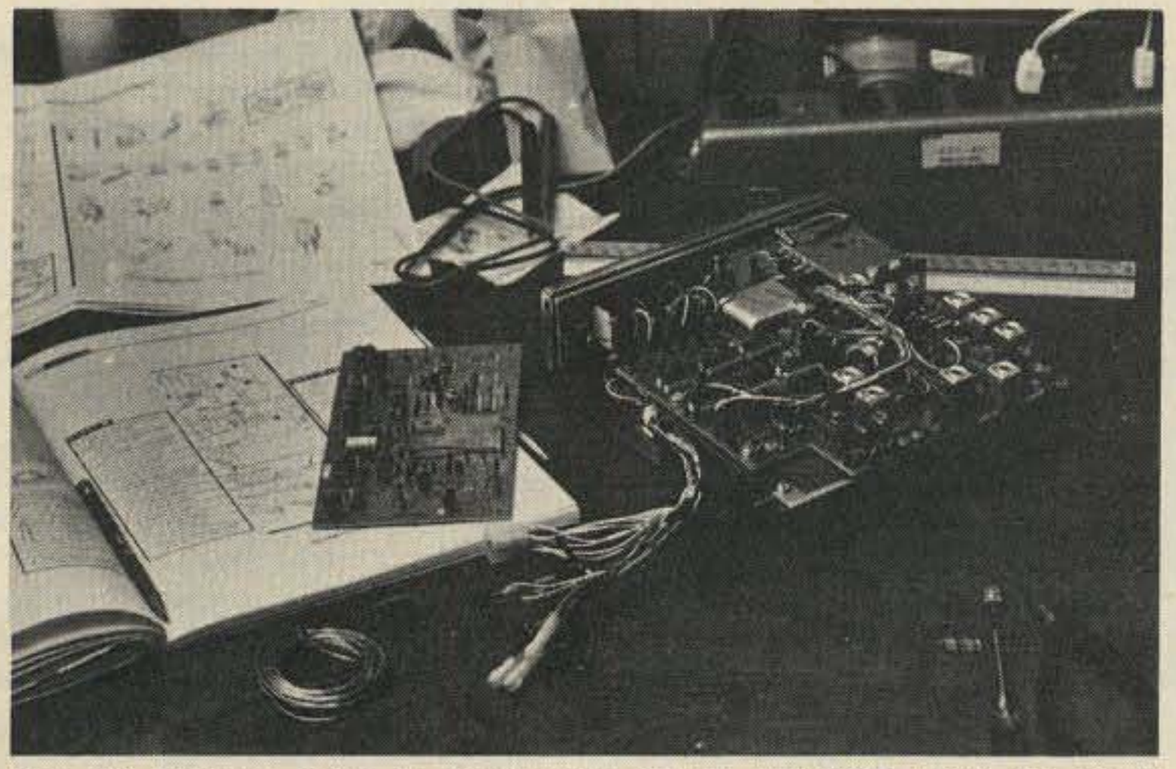
Soldering work on the circuit boards must be done carefully. Take your time, and save hours of trouble-shooting problems later. After each board is complete, examine your work carefully for solder bridges, cold joints, etc. After a careful visual check of each board (preferably using Heath's X-ray views from the assembly manual), installation is accomplished with lock washers and nuts.

The next step is to plug all those beautiful PCB pins into the posts on each board. You'd never think you'd be glad to see another one of those pins after you finish soldering them all, but they really are fantastic. You should, however, be careful to route all wires from the harness in their correct positions, or you may find yourself taking apart half the radio to fix a minor mistake. Pay special attention to wires going around the speaker assembly and see to it they are routed straight back and *under* the VCO shield. This will make for easier hookup later between the synthesizer and receiver boards. Also be careful when installing the VCO board on its mounting posts. The six 1¼" wires that go to the coupling capacitors on the shield could very easily get pinched. Try to route them on a smooth path out from between the board and shield. One more point on the VCO board: Be sure the insulation of each lead is snug up to the board. Stray wires hanging around could short on the two-sided board.

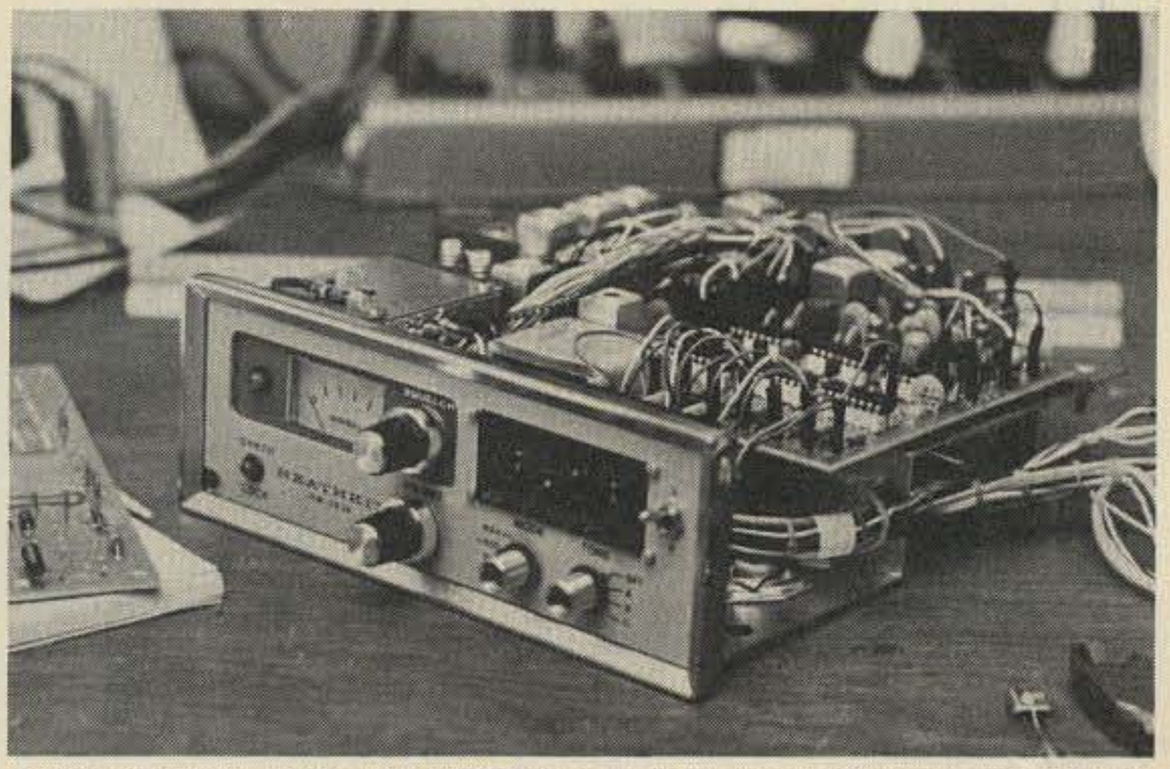
Space is limited in the rear portion of the 2036, where the power amplifier goes. The board is fastened to the back panel with screws, spacers, and the final transistors. Make sure you bend all the capacitors over towards the board when you install them, so when the time comes to put the whole unit together, you won't risk damaging them. Two heat sinks are mounted on the back panel after alignment, allowing for easy access to the PA during alignment.

Alignment requires only a VTVM and a receiver capable of copying WWV. I used a 1 Hz to 120 MHz frequency counter for maximum accuracy in setting the transmit and receiver offsets. All alignment cables, tools, and even a dummy load are included by Heath. The builder is instructed to build the dummy load out of two 100 Ohm 2 Watt resistors in parallel and a phone plug. (This assembly can be put aside after completing the kit to serve as a dummy load for future projects.)

The signal strength/relative power meter is used in alignment of the receiver, and also in peaking the transmitter and power amplifier boards. Later on, the transmitter board is used to provide a low level signal for peaking the receiver. Of course, if you owned a bench full of test equipment, alignment could be done with a signal generator, but Heath keeps the process pure and simple. The 13 pages of alignment took a total of 3 hours, making the total construction time 29 hours and 45 minutes from cracking



Past the halfway point in construction of the HW-2036. Note the Heath assembly manual and fold-outs.



Partial assembly of the HW-2036 from another view, with scores of PCB pins running off the wiring harness.

the box to making the first QSO.

If there's one failing of the Heath 2036, it's the lack of dial lighting on the thumbwheel switches used for frequency selection. One solution would be to drill a mounting hole into the front panel, just over the switches. That may be less attractive than an outboard mount, to minimize damage to the radio, especially if the illumination solution is attempted after construction is complete. With the help of W1ZAW, we came up with an outboard solution requiring no drilling and no circuit modifications.

All you need is a one inch piece of polystyrene (color doesn't matter), a Sylvania type 12ES 12 V bulb, and some Eastman Kodak type 910 cement. If you want to use a 6 V bulb (Sylvania 6ES), we suggest a 47 Ohm ½ Watt resistor.

To install the dial light, remove the top and bottom covers per Heath's instructions. Then remove the upper right-hand mounting screw, washer, and bolt from the thumbwheel switch assembly. Using number 20 insulated wire, color keyed for B+ and ground, solder the leads onto the bulb as close to the base as possible. (Be careful to avoid shorts at this point.) Run the leads through the front panel (using the now empty switch assembly screw hole) and dress the wires across the top of the switch assembly case. Solder ground to the lugs on top of the VCO board case, and the B+ lead to the 12 V line running between the synthesizer lock and signal indicator LEDs. This completes the wiring.

To mount the dial light, first glue the polystyrene strip (centered) above the thumb switch assembly on the front panel. Be especially careful not to get any of the type 910 glue onto your fingers or hands — Eastman says surgery has been necessary in cases where people ended up gluing their fingers together! Next, glue the bulb (as shown in the photograph) onto the polystyrene, making sure that the bulb protrudes at least ½ inch beyond the front panel. Finally, tape (with electrical or mystic tape) over the top and front of the bulb to direct the light downwards towards the switches.

Heath did choose very bright markings for the calibrations on the thumbwheels, so it isn't necessary to get a great deal of light on them for illumination. Shoot for the least possible light necessary to prolong the life of the bulb. Another point to watch is that the bulb and its wiring leads are

Lighting mod, as described in the text, for the Heath HW-2036.

mounted far enough above the switches so as not to interfere with their operation.

Normally, Keene NH, being the valley it is, is not what you'd call an outstanding VHF location. But with the 2036 and a CushCraft Ringo Ranger antenna up 30 feet, I could work 04-64 in Waltham MA (just outside Boston) regularly. In my judgment, the receiver is quite hot, and certainly consistent with Heath's claim of .5 uV for 12 dB SINAD. A great addition to the rig is a sub-audible tone encoder which can be set up for three different tones for repeater access.

If you run across a problem with the synthesizer not locking when you bring the rig out into the cold car, try tweaking the synthesizer in a colder atmosphere. A fellow on the Malden MA 19-79 machine suggested the above after his problems with the cold.

Three other stations running HW-2036s were contacted almost immediately after construction was finished. They all raved about the radio and had experienced no major problems in assembly. Performance of the HW-2036 over the last month and a half has been very consistent with what you'd expect on the basis of company specifications. And the fact that any problems down the road won't force me to send the rig back to the factory is a good feeling — since I built my rig, I'm not afraid to tear into it. How many of you can say that?

Paul Hebert WA1VJI
Keene NH

VENUS SCIENTIFIC INC. C1 CAMERA SLOW SCAN/ FAST SCAN AND SS2 SLOW SCAN TV MONITOR

Not being really involved with SSTV, I was hesitant to accept the assignment to test and review Venus Scientific's C1 Slow Scan/Fast Scan Camera and SS2 Slow Scan TV Monitor. In fact, up until that time, I was not very impressed with any of the slow scan systems I had seen.

I reluctantly carried the equipment home into the shack. I opened the boxes with all intentions of spending the remainder of the evening soldering wires and adjusting sync controls. As I opened the first carton, what appeared was a 4-3/4" x 10" x 5½" box with a lens on one end. It was the C1 Camera. Along the top were the slow scan controls (three knobs and three rocker switches). The knobs control the contrast, brightness, and framing. The rocker switches are for the bar generator, mode (fast or slow scan) selection, and positive/negative image. On the rear panel there was a six pin male Jones plug, a focus control, an output socket, a power switch, and an ac power cord. An accessory cable, video cable, and instruction manuals were included in the carton.

The other box contained the SS2 Slow Scan Monitor. The monitor measures 10-3/4" x 12" x 5". The front of the monitor, besides containing the screen, has five controls. These are for brightness, contrast, power off/receiver/tape/camera, accu sync/re-scan, and voice/video. The back panel contains sockets for inputs from a slow scan camera, a receiver, a tape deck, a microphone, and a telephone line. There are outputs for a tape deck, the transmitter microphone input, and 115 V ac. An accessory socket is also provided.

This brought me to the realization that I would not be in for a night of soldering. The accessory cable connects the 6 pin Jones plug on the camera to the accessory socket on the back of the monitor. I did this and plugged the units into my household current. I turned the monitor on first (as was specified in the instructions), and then the camera. I connected a cable from the rf output of the camera to the antenna terminals of my TV set, turned the set to channel 3 (this channel is preset at the factory, but any channel between 2 and 6 can be set), and pressed the button on the camera back which switches from video to rf output. Just like that, there was a blurry picture on the screen of the TV. I adjusted the focus and whammo! There was a fantastic picture. No soldering, no fooling with controls! It was a 15 minute process.

The next step was slow scan, and this I "knew" would take some time. I rotated the camera 90 degrees, as is necessary when changing from fast to slow scan. This puts the slow scan controls on the top of the camera. I made sure the image was focused on fast scan, then I switched the rocker switch to slow scan. I rotated the frame control to full frame. Then came a very impressive procedure which is outlined in the instruction book. I set the mode switch on the monitor to "accu sync" and turned on the bar generator on the camera. I then rotated the contrast control on the camera fully clockwise and adjusted the brightness control so that the display on the monitor clipped equally on the top and bottom. I then adjusted the contrast control until there was little or no clipping. Then I turned the monitor back to operate, touched up the brightness and contrast on the monitor, and there it was! A perfectly adjusted clear slow scan picture forming right before my eyes. A five minute process from fast scan to slow scan!

I just couldn't believe it was that simple. Over the course of the evening, instead of soldering and syncing, I was having fun. I made tapes of various pictures and played them back. I let the kids put on their own TV show with the fast scan. I just couldn't wait for the weekend to try it out on 20 meters.

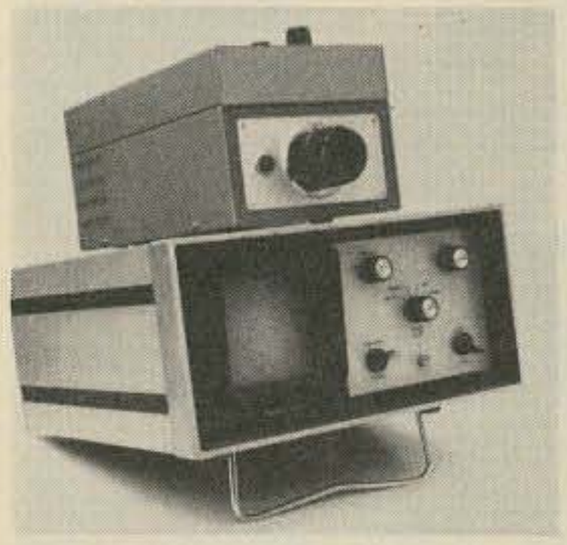
The weekend finally came and I was set. I had the TV equipment interfaced to my rig and was ready to go. First I just listened and copied signals. Perfect copy on clear signals I recorded and later reviewed. At last it was time for me to try my hand at sending pictures. I listened around 14.230 MHz until I picked up a station in Florida. After a brief explanation that this was my first SSTV QSO, I sent my first picture. The report was excellent and I was on my way. I spent the rest of the afternoon having fun again.

My one regret is that there is not very much ATV activity here in New Hampshire, but I am trying to stimulate some interest so I can use this camera on VHF.

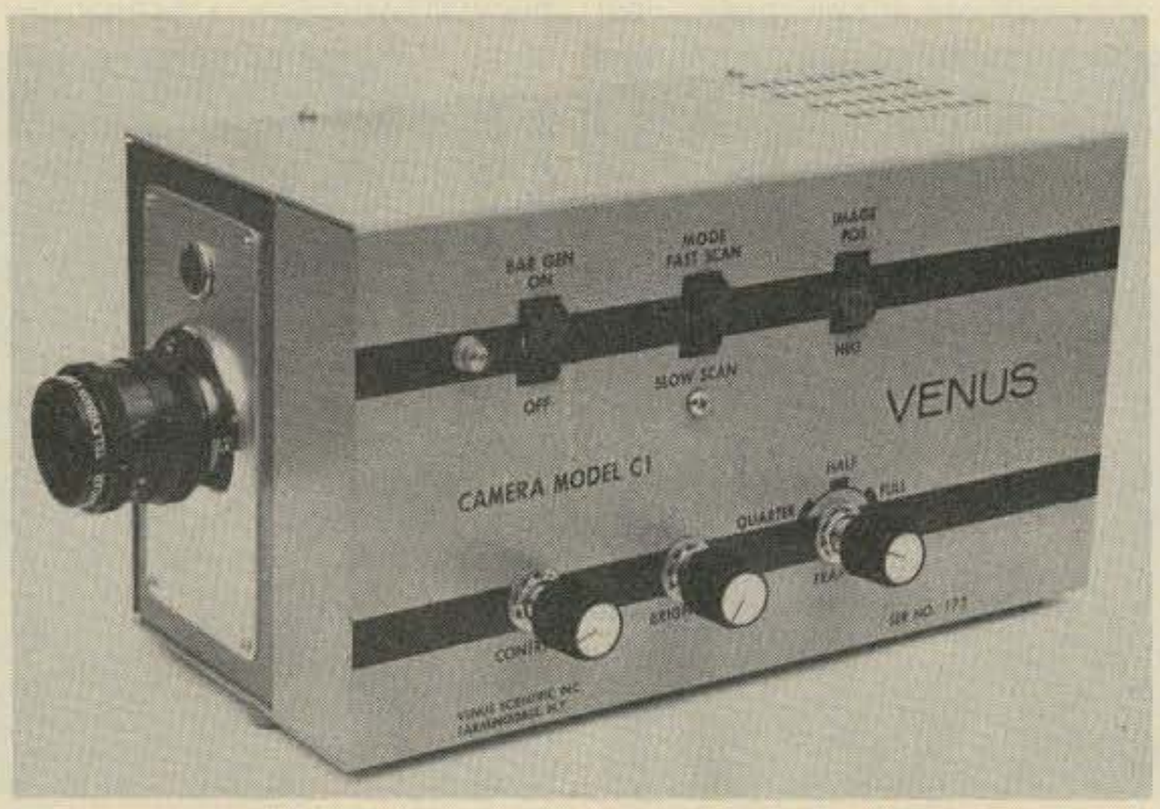
In that one evening, my whole idea of amateur TV, be it slow or fast scan, changed. I learned you do not have to be a video technician to enjoy its rewards and, if you use the right equipment, the results are very impressive. It has made a believer out of me and I hope to enjoy many years at this facet of our hobby.

The Venus camera and monitor would be an excellent choice for anyone interested in amateur TV, be he a newcomer or old-timer. Maybe someday we'll have a QSO and you can copy my pix.

Venus C1 Slow Scan/Fast Scan



The complete Venus SSTV outfit. The camera has a built-in slow scan bar generator; the monitor is available either as a kit or factory assembled.



Close-up of the Venus C1 camera. It will handle both fast and slow scan, and can be operated in horizontal or vertical format.

Camera $385; Venus SS2 Monitor Kit, $235; wired, $285. *Venus Scientific Inc., 399 Smith Street, Farmingdale NY 11735.*

Rich Force WB1ASL
Associate Editor

HUFCO DIGI-DIAL ADAPTOR

Hufco of Provo, Utah, has come up with a neat little device for hams who have a counter and would like to use it for transceiver direct frequency readout.

Known as the Digi-Dial Adaptor, this unit heterodynes the output from the transceiver variable frequency oscillator (VFO) with a variable crystal oscillator (VXO) frequency generated in the Digi-Dial Adaptor, to produce a 2.0 to 2.5 MHz frequency for the input of a digital frequency counter. The VFO must generate a frequency of 5.0 to 5.5 MHz. The actual readout of the frequency counter will depend upon the number of digital readouts available, but there must be enough to permit 2.000 to 2.500 MHz to appear, in order to be useful. The first digit (2) is ignored, and the reading 000 to 500 represents, directly in kHz, the frequency being received or transmitted for any amateur band, with some over-coverage. For instance, assuming the bandswitch was set for 14.0 MHz, the frequency will be understood as reading from 14.000 to 14.500, but will appear as 2.000 to 2.500.

The circuit of the Digi-Dial Adaptor accommodates either VFOs that compensate for upper and lower sideband shift (such as Heathkit), or those that do not.

Prior to purchasing the Digi-Dial Adaptor, I inquired of Hufco regarding whether or not the unit would operate with my particular transceiver — a Heathkit SB-101. A very prompt personal reply from Jim Huffman WA7SCB assured me that it would, and I placed an order. Within days I received a card telling me that shipment would be made in about a week, and sure enough, it arrived on schedule.

From the very start, I was pleased with the production of this kit. All parts, including the circuit board, were enclosed in one plastic pack, with the individual items of a similar nature grouped so that it was very easy to check.

The board is excellent — with a good commercial etch and outstanding plating characteristics, soldering is a breeze. Drilling is perfect, and the component side is screened for all component identities.

Important connection points are additionally identified on the etched side of the board. On the board I received, two transistors had the same board designation, but this created no problem because both transistors were of the same type.

Parts in the kit are of premium quality. Four similar encapsulated inductances are marked in microhenries in the standard color code, which makes any errors in the installation of these practically impossible.

The instructions accompanying the kit are very extensive and complete, considering the size of the kit. However, this is certainly not a detraction, because every one of the 16 pages is helpful, providing as it does, theory of operation, parts list, assembly instructions, tune-up, many diagrams, etc. One photograph, which has application only to anyone who is using the adaptor with one of Hufco's counters, has not reproduced well. The circuit diagram of the unit includes all information ever needed for servicing, such as exact normal voltages at every component operating point, all values, all designators, and all external connections.

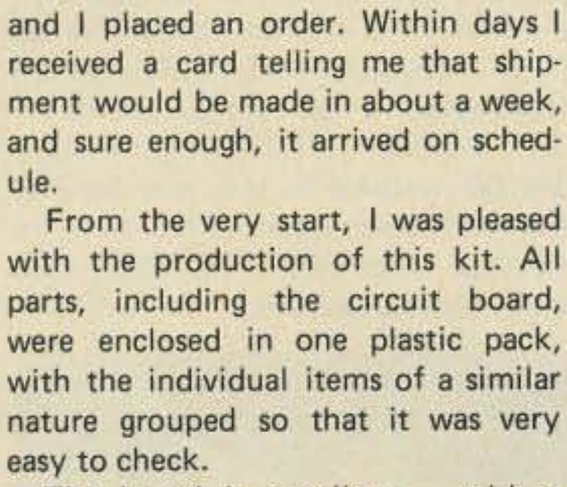
A problem became apparent with my adaptor at turn-on time. Troubleshooting the unit using the excellent schematic voltage references quickly identified an FET as the culprit. It is entirely possible that this was zapped during handling (even though this device is diode-protected), as the humidity at the time was around 10% and static charges easily accumulated, which only emphasizes the need for care in handling these devices.

A note to Hufco brought an immediate replacement in the next mail. Following installation of the new FET, no further problems were encountered, and, after putting the VXO on frequency, installation to the VFO was simple. Installation for each transceiver make is a little different, but the manual clearly describes hook-up for all currently popular transceivers. Power supply circuitry is part of the Digi-Dial board assembly, so that the only external requirements are 6.3 volts ac. Five volts dc may be used directly if desired.

About a month after receiving the kit, I was pleasantly surprised to receive a postcard from Hufco hoping that I had the kit working and offering help if I had any problems. A nice gesture.

For those looking for a unit that will perform as stated, the Hufco Digi-Dial seems to be the answer from all points of view. Priced at $39.95 for the kit, and $49.95 assembled, shipping charges paid, it is available from *Hufco, P. O. Box 357, Provo, Utah 84601.*

A. A. Wicks W6SWZ
Agoura CA



Hufco's Digi-Dial Adaptor.

COMMUNICATIONS ELECTRONICS INTRODUCES THE BEARCAT 210

Communications Electronics has introduced its new 5 band, push-button, programmable, crystal-less super synthesized scanner. Named the Bearcat 210, this unique scanning instrument gives the user push-button access to more than 16,000 different frequencies including 2 meters and the entire 3/4 meter amateur band.

The Communications Electronics Bearcat 210 is literally packed with exclusive space age electronic advancements and features. Completely synthesized circuitry, including Bearcat custom designed integrated circuits, makes possible lower cost and higher reliability.

The user never needs to worry about buying crystals. The synthesizer circuitry permits one to enter or change any ten frequencies in a matter of seconds. The unit will then scan those frequencies at a rate of 20 channels per second. A large digital input and readout display allows the operator to *see* the frequencies he has selected, as well as the frequencies currently being broadcast. Rolling zeros on the large LED display, a Bearcat exclusive, also indicate channels being scanned.

The *search* feature on the Bearcat 210 is fantastic! With this feature, you can locate and identify the frequencies that are currently in use by reading the frequency directly from the seven segment LED readout. This makes this scanner ideal for discovering those "hidden" or nonpublished frequencies.

In addition to an automatic frequency search feature which allows the operator to listen to *selected* segments of the different frequency

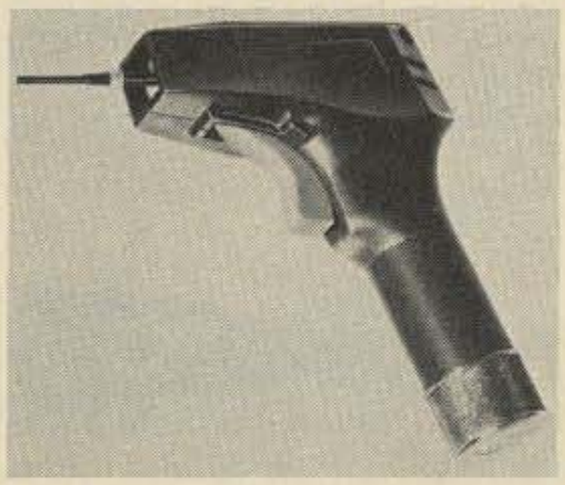
The Bearcat 210 programmable scanner.

bands, there is a selectable two second scan delay that permits the listener to hear all the excitement and prevent missing transmissions when "calls" and "answers" are on the same frequency. A push-button lockout feature allows selective skipping of those channels not of current interest. Other features include 117 V ac or 13.8 V dc, a large front speaker with 2 Watts rms output, slope front for easy programming and vehicular use, patented track tuning, tone bypass, and many of the traditional features that have made Bearcat scanners the most sophisticated ones at Communications Electronics. The Bearcat 210 covers 32-50 MHz, 146-174 MHz, and 416-512 MHz, with a sensitivity of 0.6 uV for 12 dB SINAD on low and high bands.

The Communications Electronics Bearcat 210 is mail order priced at $319.95, and CE still offers their unique "guaranteed lowest price" sales policy. You can place a telephone order on their toll free USA 24 hour order line 800-521-4414 and charge it to a BankAmericard or Mastercharge. In Michigan and outside the USA dial 313-994-4441. To order by mail, or for a free catalog including a four page full color brochure describing the Bearcat 210 as well as CE's other electronic products, write: *Communications Electronics, P.O. Box 1002, Dept. RS-3, Ann Arbor, Michigan 48106 USA.*

OK MACHINE AND TOOL CORPORATION'S HOBBY-WRAP TOOL

If you have ever built a microprocessor kit, or any other complex digital device, you know soldering is not the ideal way to make hundreds of interconnections. The technique of "wire-wrapping" allows easy circuit construction, and when the inevitable mistake occurs, it is a simple process



The OK Machine and Tool Corporation Hobby-Wrap Tool.

to disconnect and rewire the offending connection. A special wire-wrap tool is required to correctly and securely "attach" the wire to IC sockets. These tools range from simple hand-operated devices that are useful for very small jobs all the way to bulky ac-operated devices with the associated power cord.

The best approach to wire-wrapping is the Hobby-Wrap Tool, manufactured by the OK Machine and Tool Corporation. This wrapping tool is motor driven for ease of use, yet is battery operated, eliminating the trailing power cord. The device is powered by two size "C" cells, and weighs only 11 ounces. The wire bit accepts standard 30 AWG wire for .025 inch square DIP stakes. The bit produces the "modified" wrap, which wraps a two turn layer of insulation around the stake for complete mechanical security. I used the tool to wrap a CPU board and found it a pleasure to use. Each wrap was uniform, and the battery-powered motor allowed complete flexibility when maneuvering into tight corners on the board. The battery lasted for the entire session. The best feature of the rugged Hobby-Wrap Tool, however, is the price. The device is available for $34.95, which puts professional wire-wrapping within the means of every serious hobbyist. *OK Machine and Tool Corporation, 3455 Conner St., Bronx NY 10475.*

John W. Molnar WB2ZCF
Executive Editor

NEW HAMTRONICS CATALOG

A PA/preamp unit for 2 meter walkie-talkies, 6 new test probe kits, and a VHF FM receiver kit model are featured in the new Hamtronics catalog. The 24 page edition contains a wealth of gear, including UHF FM receiver and transmitter kits, scanner adapters, multichannel adapters, and a vast array of ac power supplies. To receive your copy, write Hamtronics, Inc., 182 Belmont Road, Rochester NY 14612. It's yours for an SASE.

SOLDERLESS, CABLE-MOUNTED FEMALE UHF SERIES CONNECTOR

A new "In-Line" SO-239 type connector for both OEM and field application use has been introduced by Gold Line, the nation's largest manufacturer of CB accessories.

A Gold Line spokesman said that the units are available for RG-58/U type cable in both bulk for OEM use and single packaged for the distributors' shelves. The No. 72 series connector eliminates the need for double female splice connectors (PL-258) when additional cable lengths are required. A unique crimping of the center conductor is featured with manual or production ferrules available along with production tools. The model 72-F designates a completely solderless, field-assemblable unit intended for sale through the Gold Line national distributor system. Gold Line designs and produces a complete line of accessories for the CB, ham and marine radio markets. *Gold Line Connector, Inc., P.O. Box 893, East Norwalk CT 06855, (203) 853-1211.*

BRAMMALL BARRELS

Various locking devices are available to prevent the ripping-off of your transceiver, stereo, etc. But as someone has said, "A lock only keeps out an honest man" — and this applies to any of these devices when confronted by a determined thief who has plenty of time.

Now there is a lock available which probably makes the rip-off about as tough as possible for any thief. Designed originally for CB transceivers, it may be used equally as well for any bracket-mounted amateur transceiver, stereo radio, or cartridge/cassette player.

Incidentally, most insurance companies will insure a mobile radio which is *locked* in, without applying the additional premium for "CB/8 track."

Several unique design features have been included in this rather simple locking device, known as the Brammall Barrels. As shown in the photograph, a tapered cylinder fits over the hole for each of two of the mounting screws, which are replaced. After tightening the screws, the barrel lock including key is inserted in each of the cylinders, and, once the key is removed, the lock barrels prevent access to the screws on each side of the mounting bracket.

The purpose of the tapered barrel is to prevent a thief from breaking off the barrels with a pipe — a frequent method of stealing a unit with non-tapered similar locks. The manufacturer claims a unique preventative to another act of thievery whereby the chief inserts a screwdriver in the key slot and works the barrel off. Because Brammall Barrels cylinders spin freely once installed, the barrels cannot be twisted off. Each key is individually keyed to the lock with which it is supplied, thus making the possibility of duplicate keys from the manufacturer almost non-existent.

At $9.95 a set, the Brammall Barrels provide about the least costly form of theft insurance available today. They are available in most CB, amateur, and hi-fi outlets. Manufactured by *Brammall, Inc., Box 208, Angola, Indiana 46703.*

A. A. Wicks W6SWZ
Agoura CA

1977 AMATEUR RADIO EQUIPMENT DIRECTORY

The most complete buyer's guide ever on amateur radio equipment has been published by Kengore Corporation. Over 130 pages and 70 different manufacturer/distributor listings are included, along with one element traditionally missing from product ads — list prices. Recent letters to the editor would indicate some frustration with the lack of prices in manufacturers' ads, and the '77 equipment directory is bound to go a long way towards plugging the information gap. Not only are prices included, but each product is well illustrated with a photograph and the most complete listing of specifications possible. Many of the pages will be familiar to readers of *73*, since the publisher used a large number of ads and manufacturers' brochures that have appeared in the various magazines. In all cases, Kengore has added the prices and, where necessary, additional information that may have been missing from the original. The *1977 Amateur Radio Equipment Directory* sells for $2.95 and will undoubtedly be in demand among hams and would-be hams, whether their interest is horse trading, buying, or just drooling over what gear they'd like to have. (The directory may not be too popular among wives, parents, or others concerned about amateurs spending money.) The directory is available from *Kengore Corp., W2TGH Editor/Publisher, 9 James Avenue, Kendall Park NJ 08824.*

O.K. TOOL'S SPEED-WRAP TOOL

The new G200/R3278 Speed-Wrap Tool is designed to produce solderless wire-wrapped connections by merely squeezing the trigger. The hardened steel working parts ensure long life and troublefree service. It is enclosed in Lexan (Trademark of General Electric Company) housing, enabling the tool to be light in weight, and is designed for production line and field service use in the electronic, telecommunications, and appliance industries. For 22-30 AWG.

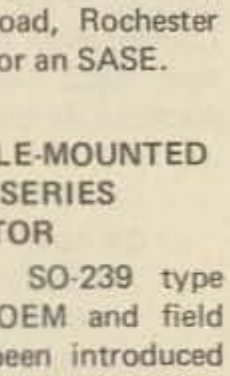
Wire-wrapping provides a positive, uniform, "gas-tight" connection. *OK Machine and Tool Corporation, 3455 Conner Street, Bronx NY 10475.*

RF TRANSFORMER MATCHES VERTICAL ANTENNAS

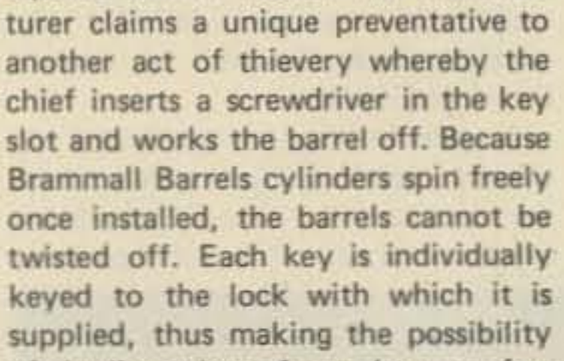
Palomar Engineers has introduced a wideband rf transformer rated at 5 kW PEP (2 kW CW CCS) from 1-30 MHz. Taps are provided to match 50 Ohm coaxial cable to 32, 28, 22, 18, 12, 8, or 5 Ohm antennas. The transformer is unbalanced-to-unbalanced for use with short vertical and whip antennas.

Quarter wave antennas or short verticals that have been resonated with loading coils can be matched to 50 Ohm coaxial cable by selecting the proper tap on the rf transformer. In many cases, the transformer can be used instead of an antenna tuner. It is much smaller than a tuner of equivalent power handling capability, is less expensive, and is more efficient. It has particular application to phased vertical directional array.

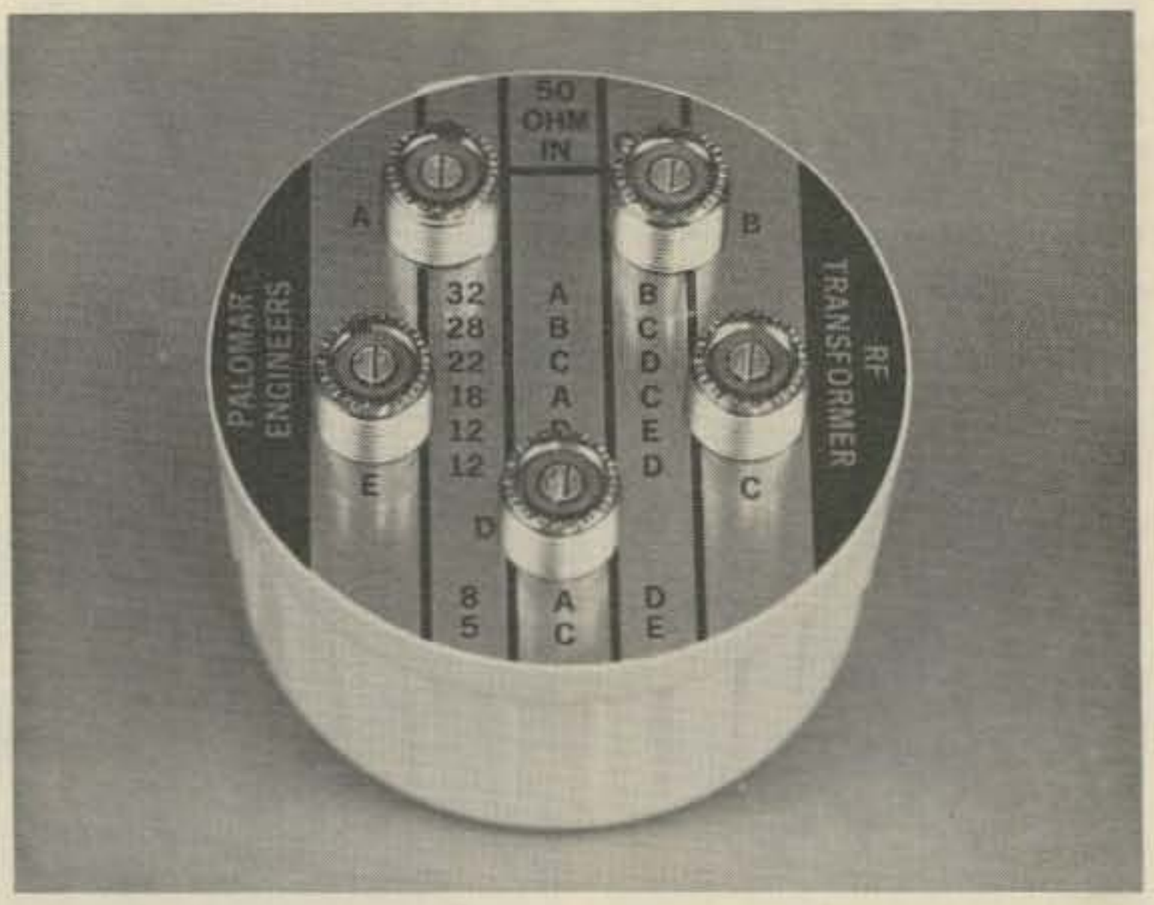
The transformer is wound with teflon insulated wire on an rf ferrite toroid core, has UHF (SO-239) connectors, and is epoxy encapsulated in a white PVC case so that it can be used in any climate. Loss through the transformer is less than 0.1 dB. Size is 3½" diameter and 2½" high. Price is $42.50 postpaid in U.S. and Canada. For additional information, write to *Palomar Engineers, P.O. Box 455, Escondido CA 92025.*



Gold Line Model No. 72-F.

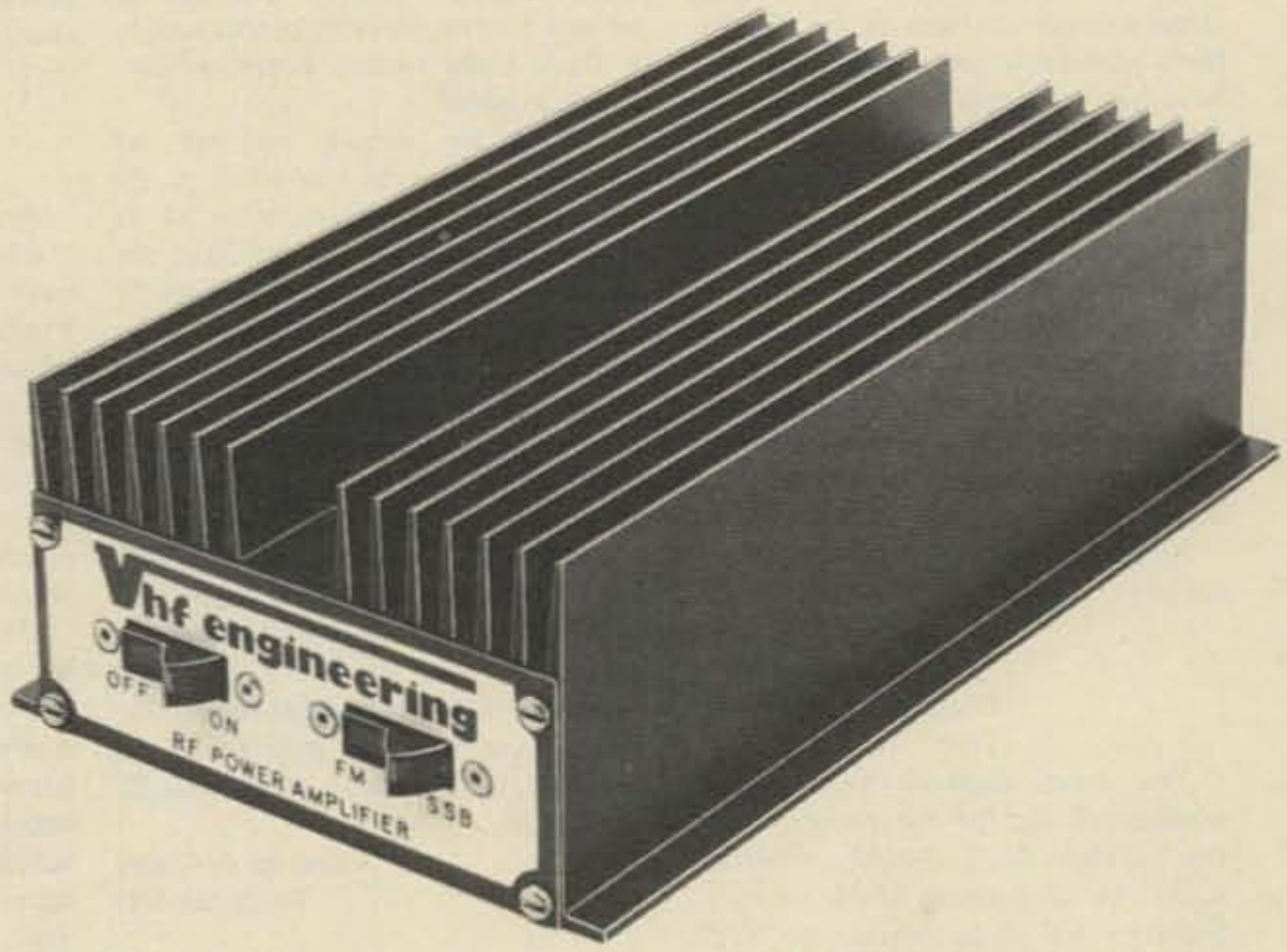


Gold Line Model No. 72.



Palomar Engineers rf matching transformer for use with vertical antennas.

THE BLUE LINE IS HERE!



Don't sacrifice maximum power output and high efficiency for linearazation. The BLUE LINE offers you the best of both designs. The BLUE LINE amplifiers are engineered using the latest state of the art stripline technology. This design technology means efficient broad band output with a very high degree of mechanical stability.

Vhf engineering is the only name you have to remember when it comes to VHF or UHF amplifiers, just look at the variety available.

MODEL	FREQUENCY	EMISSION	POWER INPUT	POWER OUTPUT	WIRED AND TESTED PRICE
BLB 3/150	45- 55MHz	CW-FM-SSB/AM	3W	150W	TBA
BLC 10/70	140-160MHz	CW-FM-SSB/AM	10W	70W	139.95
BLC 2/70	140-160MHz	CW-FM-SSB/AM	2W	70W	159.95
BLC 10/150	140-160MHz	CW-FM-SSB/AM	10W	150W	259.95
BLC 30/150	140-160MHz	CW-FM-SSB/AM	30W	150W	239.95
BLD 2/60	220-230MHz	CW-FM-SSB/AM	2W	60W	159.95
BLD 10/60	220-230MHz	CW-FM-SSB/AM	10W	60W	139.95
BLD 10/120	220-230MHz	CW-FM-SSB/AM	10W	120W	259.95
BLE 10/40	420-470MHz	CW-FM-SSB/AM	10W	40W	139.95
BLE 2/40	420-470MHz	CW-FM-SSB/AM	2W	40W	159.95
BLE 30/80	420-470	CW-FM-SSB/AM	30W	80W	259.95
BLE 10/80	420-470	CW-FM-SSB/AM	10W	80W	289.95

Don't forget our popular PA-2501 and PA-4010 at $74.95 (wired and tested) $59.95 (Kit)

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- High efficiency means low current drain.
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Export prices slightly higher. Prices subject to change.

AVAILABLE AT THESE DEALERS:

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C & A Electronic Enterprises, Carson, CA
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Electronic Enterprises, Rio Linda, CA
SON Electric, Fresno, CA
Sequoia Stereo, Inc., Eureka, CA
Tele-Com Electronics, San Jose, CA
Westcom, San Marcos, CA
ZacKit Corporation, Vallejo, CA

COLORADO
Listening Post & Electromagnetics, Durango, CO
Communication Specialties, Aurora, CO

FLORIDA
Amateur Wholesale Elec's., Miami, FL
West Indies Sales Co., Ltd., Miami FL

ILLINOIS
Klaus Radio, Inc., Peoria, IL
Spectronics, Inc., Oak Park, IL

INDIANA
Aptron Lab, Bloomington, IN
Lectracom, Inc., Bourbon, IN

IOWA
Bob Smith Electronics, Fort Dodge, IA
Quad City Ham & C.B. Sales, Davenport, IA

KENTUCKY
Cohoon Amateur Supply, Trenton, KT

LOUISIANA
Frank L. Beier Radio, Inc., New Orleans, LA

MASSACHUSETTS
Tufts Radio Electronics, Medford, MA

MICHIGAN
Harry G. Crofts, Northville, MI
Adams Distributing Co., Detroit, MI
Radio Supply & Engineering, Detroit, MI

MISSISSIPPI
Communications Services, Philadelphia, MS

MISSOURI
Alpha Electronic Labs, Columbia, MO

NEVADA
Vegas Radio, Las Vegas, NV

NEW YORK
Airex Communications Corp., Freeport, NY
Barry Electronics, New York, NY
CFP Enterprises, Horseheads, NY
Delmar Electronics, W. Babylon, L.I., NY
Loffler Electronics, Ogdensburg, NY
VHF Communications, Jamestown, NY

NORTH CAROLINA
Vickers Electronics, Durham, NC

OKLAHOMA
Derrick Electronics, Inc., Broken Arrow, OK
Radio Store, Inc., Oklahoma City, OK

SOUTH DAKOTA
Burghardt Amateur Center, Watertown, SD

TEXAS
AGL Electronics, Dallas TX
Teco Electronics, Garland, TX
Signal Engineering, Houston, TX

VIRGINIA
Radio Communications Co., Roanoke, VA

WASHINGTON
A·B·C Communications, Seattle, WA

WEST VIRGINIA
Communication Systems Co., Ripley, WV

WISCONSIN
Amateur Electronic Supply, Milwaukee, WI
Communications Elec's., Fond du Lac, WI

CANADA
Bytown Marine Limited, Ottawa, Canada K2H 7V1
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V5

Ham Help

This is a plea on behalf of blind hams, at least in this area. I teach ham radio at the local Braille Institute, and the blind hams I know need an audio meter for tuning transmitters. Despite about a dozen contacts on the air with hams who know just what is needed, I have yet to receive further information.

Even though I feel I have little time for building projects, the one article I have been able to find in ham magazines contained junk box parts that no electronic supplier could identify or provide a replacement for. A commercial source is the most desirable; however, a simple schematic composed of obtainable parts certainly would be acceptable.

Any help will be greatly appreciated.

Searle L. Bennett
2656 Riverside Drive
Costa Mesa CA 92627

You have recently published a number of circuits for programming the number 8223 PROM, manufactured by Signetics. Unfortunately, Signetics has discontinued the 8223 and replaced it with the 82S23. If an effort is made to program the 82S23, using the circuits designed for the 8223, nothing will happen. The links just won't blow out.

The *Signetics Bi-Polar Memory Book* gives a schematic for programming the 82S23, but it is an extremely complicated pulse generator, using all kinds of hard-to-get ICs.

I have experimented, and I have found the simple circuit enclosed to be effective in programming the 82S23. The same circuit — which is based on a design put out by Southwest Technical with some of their kits — can also be used to program the DM8577 and 74188 PROMs. When programming DM8577 PROMs, the circuit will change logic ones to zeroes. When programming 82S23s, the circuit will change zeroes to ones.

There is nothing special about the power supplies. The 18 volts can be derived from a variable bench supply or from three lantern batteries connected in series.

To use the circuit, you set the address switches to the word to be programmed. You then throw S1 to the program position and set S3 to the bit to be programmed. Momentarily (less then ½ second) push S2. Then return S1 to the "read" position and observe the LED to verify that the bit has been programmed to a one or a zero, as the case may be.

Because this is not a factory-recommended circuit for the 82S23, I can't guarantee that it won't harm the PROM. I can only say that I've tried it on 82S23s and DM8577s and have experienced no difficulties. Nevertheless, users should work slowly to avoid excessive heat buildup, and push S2 only briefly.

Lauren A. Colby
Frederick MD

Do you know where I can obtain conversion information for the R-15 receiver?

Robert Eckard K3PFU
RFD 3 Box 162
Cogan Station PA 17728

I have run into a problem. I now have the Heath SB-301, SB-303, and the Heath SB-401 transmitter. What I would like to do is to use either the SB-303 receiver and the SB-401 transmitter together (transceive) on a Navy MARS frequency, or the Heath SB-301 receiver with the Heath SB-401 transmitter (transceive). As it stands now, the Heath equipment will only go as high as 4.00 MHz. The Navy MARS frequency on which I wish to operate is 4.045 MHz, so I need about 50 kHz outside of the 80 meter ham radio band. What I would like to know is if there have been any articles on using the SB-303 and SB-401 or the SB-301 and SB-401 on Navy MARS frequencies (outside of the amateur bands). If not, can you please give me some idea of how to go about changing the equipment to operate outside of the 80 meter amateur radio bands?

Everett C. Bollin WA3DVO
2543 Perring Manor Road
Baltimore MD 21234

First of all, I want to let you know I think your magazine is great. Just can't wait until the first issue of *Kilobaud* arrives. I already take *Byte*, so with the two magazines, plus the I/O articles in *73*, I should be able to digest enough info on computers. I'm still in the studying phase of computers; my Navy salary won't allow me to purchase one. I'll solve that problem about a year from now.

Also, I want to thank WA9VFG for his article in the Holiday issue. I do a lot of designing using ICs, and his method has really saved me some headaches on my latest project. Wish I had known of it earlier. (While on the subject of ICs, if anyone in the Jacksonville area needs help with digital logic, especially TTL, get in touch with me.)

I'm not a ham yet. I'm working on code now. Will attempt to get my General license in April when the next exams are given in Jacksonville. I already have my first class phone ticket, so I'm not anticipating any problems with the theory section.

Now for my appeal for help. I would like to correspond with anyone who is interested in the 1750 meter band (160-190 kHz). I'm really needing some antenna ideas. The FCC rules and regs on this band are few. Anyone wanting to know them, send me a SASE and I'll be happy to reply. I don't expect to be able to establish a reliable net on this band, but the experimentation should be fun. Any pioneer spirits left out there?

Jim Arner
Box 268
Fleet Electronics
Calibration Lab
U.S. Naval Station
Mayport FL 32228

I would like to get in touch with other amateurs using MTTY (Morse teletype decoders and keyboards) for possible net activity. Thank you.

Mike Stone WBØQCD
1110 East 4th St.
Durant IA 52747

Please inform the writer just how he can learn the Morse code! I have purchased records, tapes, and that cassette that the ARRL puts out with no results. I understand that a 9 year old can learn the code in a couple of weeks, but I'm 60 years old and have been at this for the last four months. I know the code, but I just can't receive it. I've signed up for a radio operating course at one of the colleges here in Milwaukee.

I've never had trouble with the different languages I've learned, so I'm beginning to think there is a gimmick or something ... Any information you may give me would be appreciated. I'm a subscriber to your mag and enjoy it very much!

Robert C. Norton
3162 So. Hanson Ave.
Milwaukee WI 53207

Try the 73 code courses, Bob. Thousands of delirious hams will attest to their value. — Ed.

I need information on the SSR-4 receiver that covers the 50-200 MHz range.

F.G. Senker K4OKD
436 Wallace Drive
Charleston SC 29412

This is the former RAE5/LU2AX, about to make a comeback as a W6 or K6. Coming close to my 74th birthday, the one who was "bitten" by the radio bug back in 1922 must go back to "pound the brass" (even if now the "brass" is a Ten-Tec RK-20A).

I am about to start trying for my American license. So I am thinking definitely in terms of equipment. To begin with I have gotten a Hallicrafters SR-150: yes, one of those "orphans." In reception it is working beautifully on the three indoor half-wave dipoles that I have set in the camera-room of "PHOTOG," my "studio" here in San Jose. BUT ... I haven't been able to secure a copy of the instruction manual for that transceiver.

I wonder if *73* can guide me to obtain one, either original or a photostatic copy. I am a bit lazy to start tracing each and every circuit and prefer to buy a manual.

By the way, here is an idea for a possible addition to your "line" of tapes for radio amateurs: How about a two-tone short one for tuning SSB transmitters?

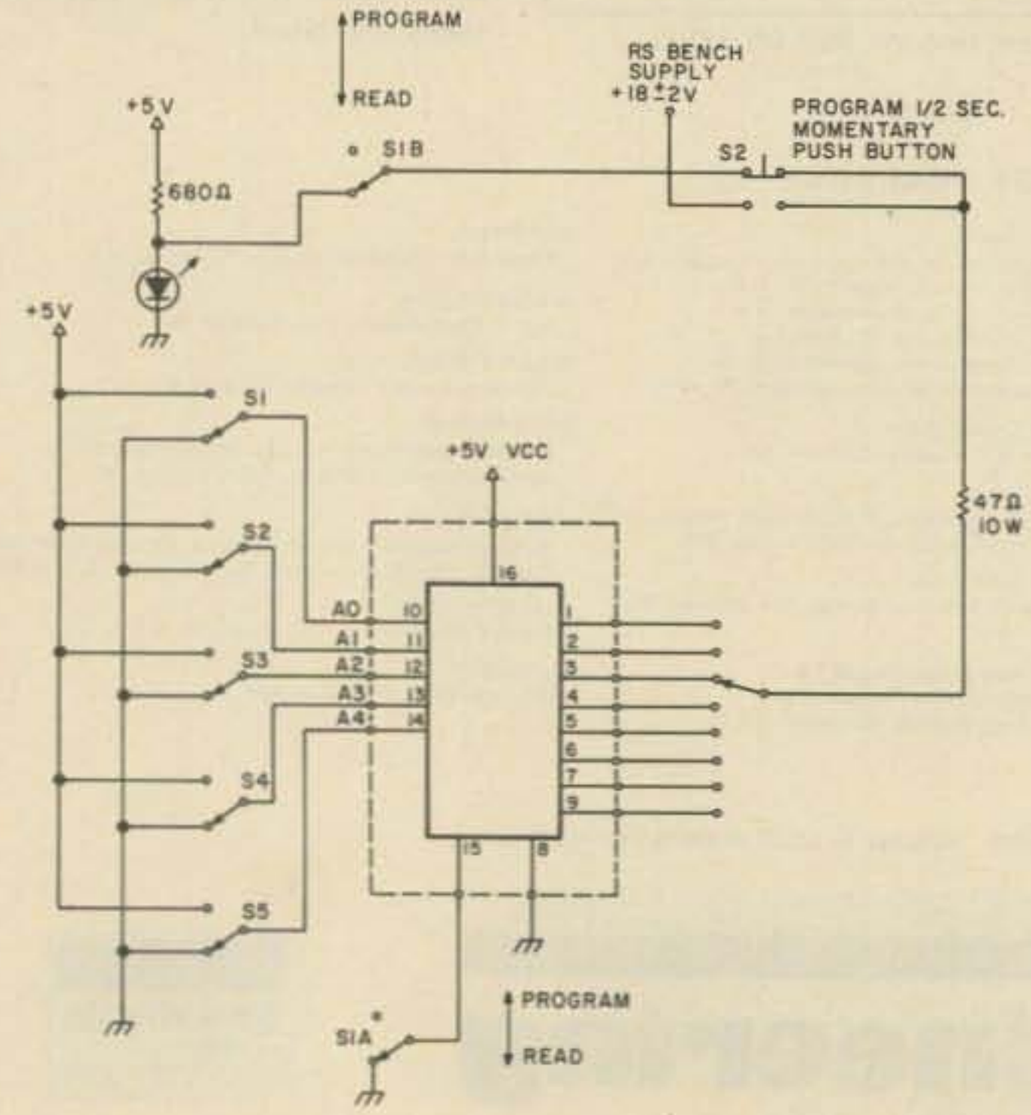
An "old dog" in this matter of radio publications (I was first Technical Editor for Argentina's "REVISTA TELEGRAFICA"), I most certainly do appreciate your efforts to make *73* one of the best of its kind in the world. It is a real pleasure to see the work of a real "pro" and this last "Holiday 1976" edition is *TOPS*.

May 1977 be good to you and to your magazine. You most truly deserve the reputation already attained in "hamdom"!

Segundo P.I. Acuna
142 Graham Ave. #5
San Jose CA 95110

PS. I hope that your 14 and 21 wpm tapes will "unrust" my code to take me up to an "Extra" sometime soon.

I want some Ham Help on code. I would like to get with some lady, man, or boy who wants practice on code. I have been off the air 26 years — had a Novice, then a Technician license for over 20 years. I had a heart attack a few years ago and the license lapsed. Then in 1976, on April 6, I got another Novice license. Up to date, I have had one contact on 15m —



nobody answers my calls, and I know that my code is no worse than others that I hear call. I am 84 years old. I call every day, but no luck so far. I have been using a vertical antenna, but I am going to a long single wire antenna to see if that will make a difference. I think most hams are on the snobbish side, the way they have acted toward me. If I could get a contact further away from here, it would suit me fine. I'm hoping that you could recommend some ham who is having the same trouble as I have been having. Thanks for the trouble that I am making you. I will say that you have a great magazine.

Glenn N. Crawford WBØSLV
207 5 Ave. N.
Humboldt IA 50548

Last year about this time I bought the *Slow Scan Television Handbook* from the British ATV club. I decided to build the W7ABW/Ø plumbicon camera. After a great deal of trouble getting components and making the focus and scan coils, I did manage to make up all the circuits, make the chassis, and put it all together. However, the camera doesn't work.

I wonder if there are any mistakes in the schematics in the values of the components. As I do not have a thorough grounding in electronics, I wouldn't be able to spot any mistakes. It would also help greatly if I could obtain photos of oscilloscope traces for the alignment procedure, especially 50 MHz.

I would also like to know if the transistors are critical. I made the following substitutions: 2N718 for 2N1711, 2N722 for 2N2907, 2N3117 for 2N930, and 2N697 for 2N1711.

Any help that you could give me in getting this camera to work correctly would be greatly appreciated.

Paul Kaminski GM3PIB
5 Tytler St.
Forres, Murrayshire
England IV 36 ØEL

I've got a problem. I just purchased a 10-80m vertical antenna and I just don't have the room for all the radials needed to make the antenna resonate properly. I have to fit the antenna and all 10 radials (2 for each band) on a 28' x 52' roof.

I can't use any part of my backyard because it is divided up by three sets of overhead power lines and three telephone lines. The yard is only 30' x 30' anyway. My question is this: Can the radials be shortened physically somehow and still be electrically correct? The 80 and 40m radials are the real problems.

I think there are quite a few other city dweller hams who face the same problem I do.

Any help or suggestions from you or your readers would be appreciated by all of us. Thank you.

Ken Gustafson WB9ZPN
5149 W. State Rd.
Burbank IL 60459

I have, for a long while, been trying to get hold of a copy of your article concerning coaxial dipoles, which you published in June, '73, in *73 Magazine*. I have been unsuccessful thus far. I am therefore hereby trying to get it "straight from the horse's mouth." I intended to build a 40m coaxial dipole and did try one, but I guess the calculations are incorrect, so I would be much obliged if you will help me out.

As far as W2DU's rude comment and article — forget it. I read it and since it is a whole lot of theorizing, I am yet to believe it until proved. Your idea that it works has been proved and therefore bears much merit.

Thanking you and looking forward to your reply.

Dennis P. Sladen VE3DPS
17 Glenshephard Dr.
Scarborough Ontario
Canada M1K4N2

As I am concerned with the increase of radio thefts, I am unsure of the proper, legal way to mark my equipment. The Privacy Act doesn't allow for the tracing of Social Security numbers as I understand. Instead, the idea of using driver's license numbers has been suggested. My driver's license (OKLA) number *is* my Social Security number. Legal advice I have received here overseas is undependable at best. HELP?

Dennis Miller WB5KEA/DA1DM
PSC Box 2858
APO NY 09057

I would appreciate a transistor circuit that would give sharp, strong, ringing pulses. I'm looking for a way to use my audio sine/square wave generator and oscilloscope to test inductances, measure resonant frequencies, and find values of capacitance in tank circuits.

John Peer
7183 Buckthorn Dr.
Orchard Lake MI 48033

I am looking for a design for a burglar alarm system. I would like to interface such a detection system to an automatic dialing unit connected to an ordinary cassette tape recorder.

Your help in advising me of any articles on how to build the above system will be greatly appreciated.

Robert E. Bunn WAØLKE
508 Porter Wagoner Blvd.
West Plains MO 65775

I am looking for information from your readers who have modified an IC-230 with Mu-rata CFS455E 15 pole filters, or equivalent filters.

John F. Meyer WB6OWP
4605 Esther St.
San Diego CA 92115

I have an HQ-110 receiver that is giving me a pain in the neck. Every time I switch the rig from "send" to "receive," it drifts all over the place. I checked all the tubes and replaced two bad ones. It stopped doing it on 160-20 meters, but still does it on 15-6 meters. Any ideas?

Tom Carnket WB9RXJ
605 7th Ave
Sterling IL 61081

Review

AN INTRODUCTION TO MICROCOMPUTERS
Volume II — Some Real Products
by Adam Osborne
and Associates $12.50

This is the second, and by far the largest (865 pages), of Mr. Osborne's four volumes on microcomputers. The first volume dealt with the basic concepts of computing in general and microcomputers in particular. The remaining two volumes are concerned with the application of two specific devices, the 8080 and the 6800, to system logic design.

Each chapter of this volume analyzes one of the currently available microprocessor/microcomputer devices. Virtually all the most popular microcomputers are covered and every type of architecture is discussed. There are 4-bit, 8-bit, and 16-bit machines, chip sets, single chip computers, and chip-slice devices. The 8080A, MC6800, Z80, and MCS6500 are dealt with in the greatest detail, but there is still a wealth of information presented for other systems. Many of the chapters are 60 to 80 pages long and the chapter on the 8080A, which is 176 pages long, would itself make a fair-sized book.

Like all of Mr. Osborne's books, this one is noteworthy for the thoroughness of the presentation and the immense amount of detail. The treatment of the 8080A is especially remarkable. The internal workings of the 8080A and of all the various accessory devices are explored down to the last trailing edge of the last waveform. Some of the information presented is simply a reprint of manufacturers' published literature, but much is original. The total result is a truly comprehensive analysis of 8080A microcomputer hardware and its workings.

Although the treatment of the 8080A is the most extensive, it differs from the other chapters only in degree. A typical discussion covers everything from the pin assignments on the chip to the intricacies of the timing for complex control tasks and data transfers. An instruction list is, of course, provided for each device with a symbolic description of the operation executed by each instruction. Insofar as is possible, this book tells everything about how a machine performs a given operation and the status of all lines, registers, and devices before, during, and after the operation.

However, this is essentially a hardware book and, as such, is not of equal value to every reader. For the professional digital engineer, whether his interest is his personal hobby or his on-the-job assignments, this should be an invaluable reference. For the computer hobbyist who is not a professional, the value of the book is less clear cut.

Mr. Osborne's preceding book, Volume I of the set, was a beginner's book, which assumed that the reader had little or no knowledge of digital technology. The presentation began with the basics of computers in general and worked up to the consideration of microcomputers in particular. Volume II is not really a continuation of Volume I except, perhaps, for the professional engineer looking to master microcomputers for his job. It is a reference book rather than a tutorial text, and it is a reference book for use on hardware design projects.

Many hobbyists are essentially programmers. Their basic machine was an assembled and operational computer when they obtained it. Their hardware involvement is the bare minimum necessary to expand their system with a new device or kit and they have no desire to expand that interest. They want to *use* the machine as it stands. In this case, there is little value to them in the detailed analysis of internal logic and timing.

The final decision naturally rests with the individual. Each reader knows the extent to which he is involved with, or wishes to be involved with, his microcomputer hardware. If there is any considerable involvement and if that hardware is one of the systems treated in this book, then Mr. Osborne's book should prove to be a valuable and frequently used reference. *Adam Osborne and Associates, P.O. Box 2036, Berkeley CA 94702.*

A. H. McDonough
El Segundo CA

MOS AND SPECIAL-PURPOSE BIPOLAR INTEGRATED CIRCUITS AND RF POWER TRANSISTOR CIRCUIT DESIGN
Texas Instruments
Electronics Series,
Published by
McGraw-Hill Book Company,
$16.50

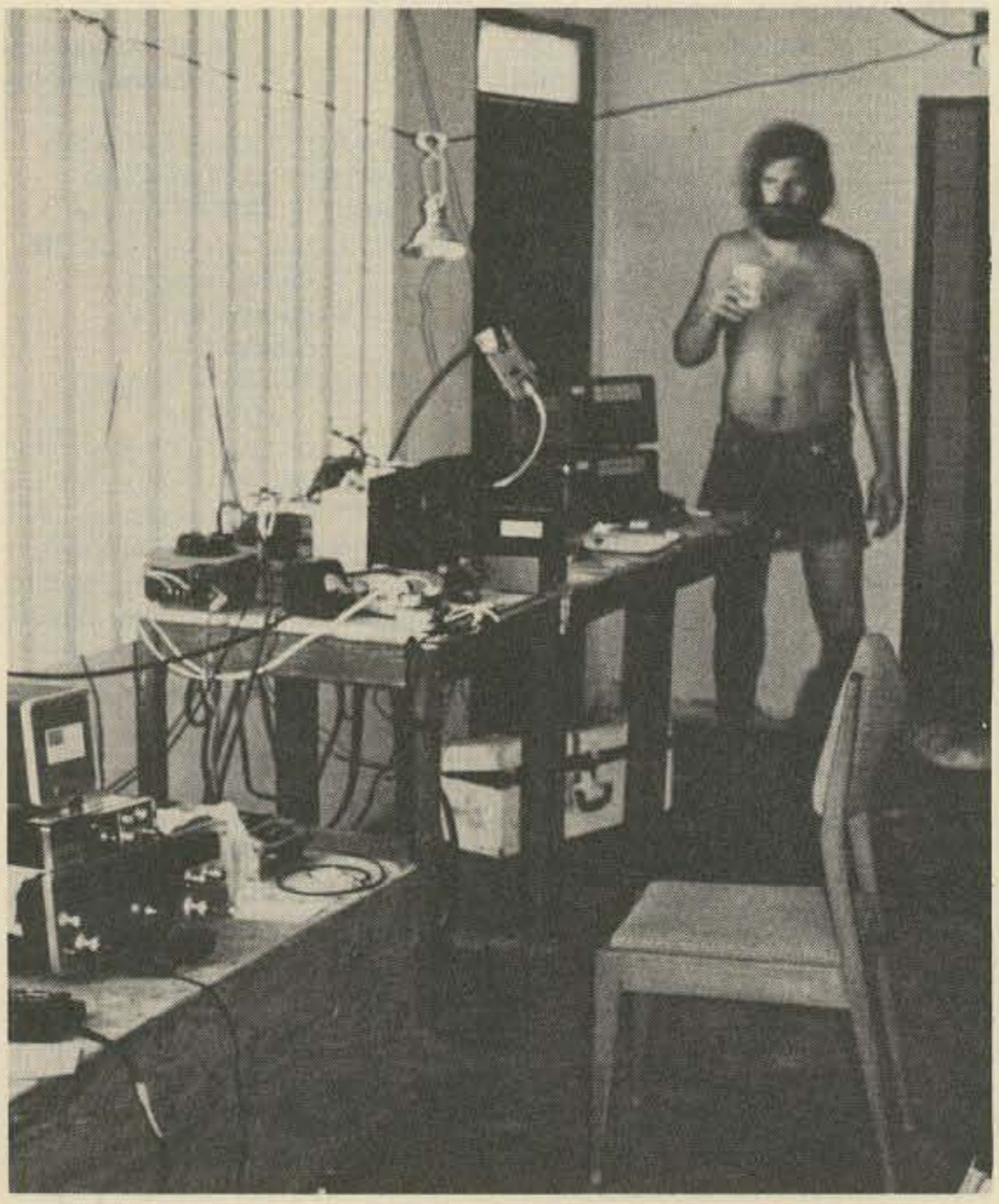
Designed a memory system for your micro lately? If so, you are aware of the timing problems, chip selection, and interfacing involved in such a project. Next time, refer to "MOS and Special-Purpose Bipolar Integrated Circuits and RF Power Transistor Circuit Design," by the Texas Instruments staff. This reference provides design information, examples, and applications using bipolar and MOS memory chips, as well as details relating to the interfacing of memory to the outside world, namely, your computer. Special purpose chips, such as keyboard character generators, are also discussed. The section on rf power may not interest the average home computer experimenter, but the book is nevertheless a useful acquisition.

John Molnar WB2ZCF
73 Magazine Staff

Shoot the Moon!

- - Pack Rat power

Walt Bohlman K3BPP
101 East Street
Doylestown PA 18901



The possibility of going to South America really seemed like a wild dream when toying with the idea in December, 1975. This is about the time this dream turned into a reality. With that reality came a long list of technical problems to solve. This article will describe how most of these problems were solved.

Having had W3CCX/3, the Pack Rat moonbounce station, in operation for about a year, the main technical group (W3HQT, W3HMU, and K3BPP) had a good feel of what a successful 432 moonbounce station required. These requirements are as follows:

Antenna: 26 dBi gain minimum, field repairable, easy to construct, sturdy, easy to rotate (azimuth, elevation, polarization).

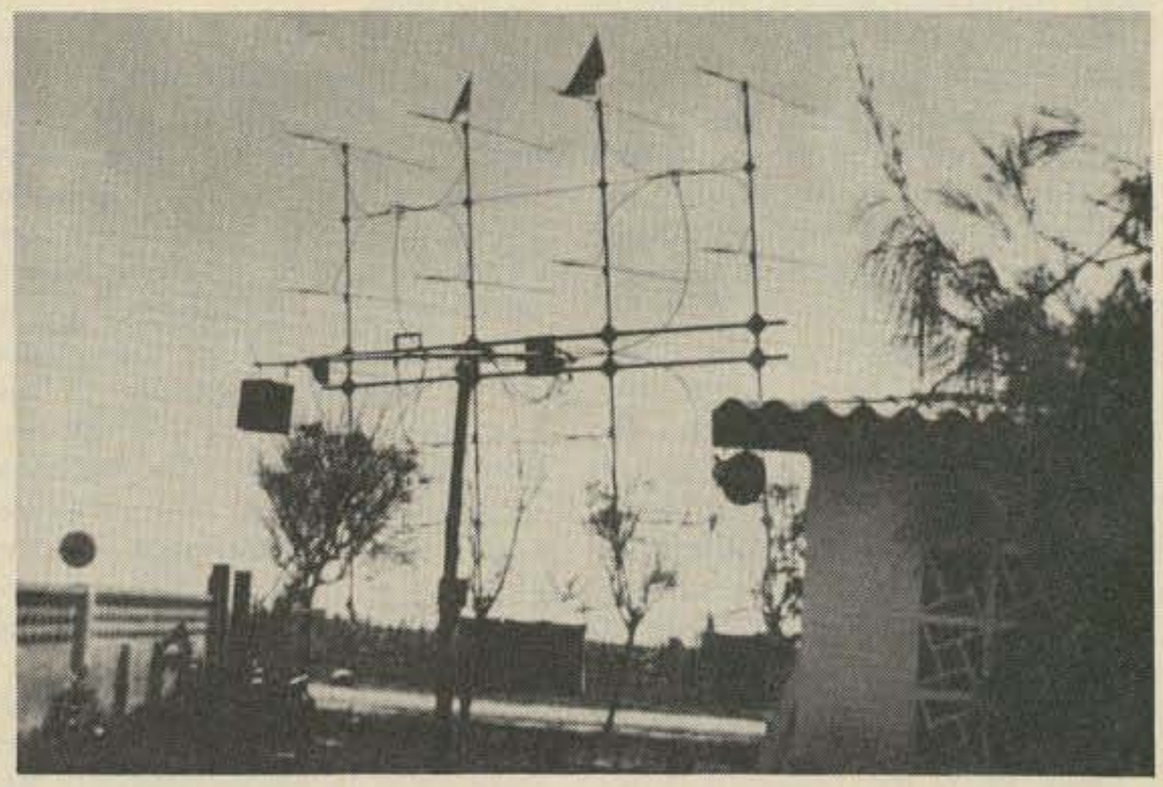
Transmitter: Straight-forward design, 1 kW output without straining, stable, rugged.

Receiver: Spares, .5 kHz B.W., 1.3 dB noise figure at antenna, rf filter.

Antenna

After considering many possible approaches, the simplest and most conservative design was used. The antenna consisted of 16 K2RIW yagis fed in phase through adapter power dividers. At the TR relay (Transco-Y), the power divided equally into 4 50Ω outputs. The 4 ports each fed 10' lengths of ½" foam hard line, each of which terminated in a 4 way adapter power divider, each of which fed 4 yagis. Each yagi had an 8' length of RG214 running from its ½λ UT141 balun transformer to the power divider.

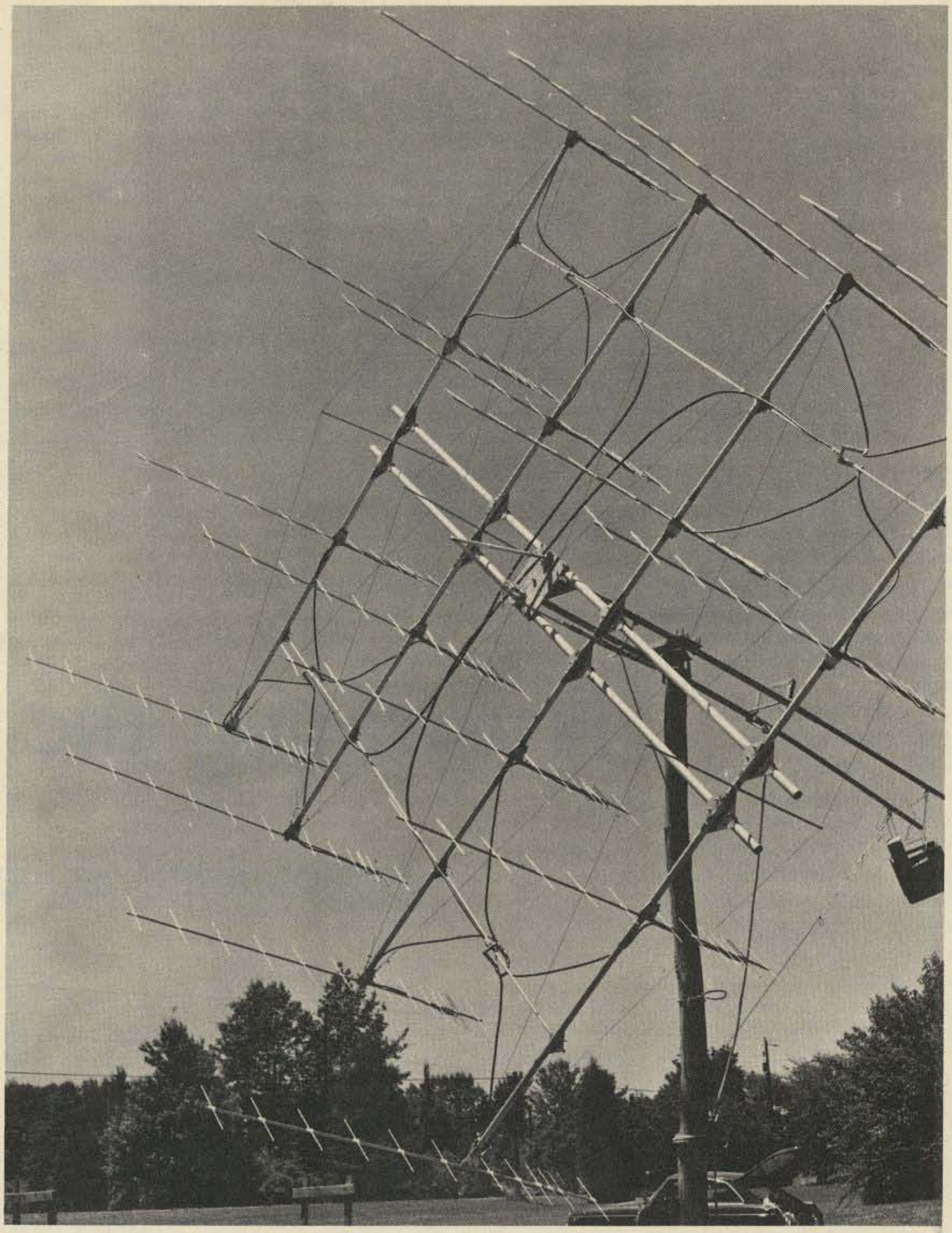
Each antenna boom split in the middle, allowing it to be packed in a small space. The 16 yagis were mounted on a double H frame made of



On location.

lengths no longer than 6'. The very careful design of this frame by W3HMU and W3HQT performed and packed quite well. The antenna spacing was optimized by K3BPP by the use of heuristic reasoning and a computer program to print out the resultant pattern. The ideal spacing worked out to 5' between antennas, thus giving a 15' x 15' array with a theoretical gain of about 29 dBi. Side by side comparison with the 20' dish gives ≈ 2 dB improvement over the dish, putting the realization gain in the proper area.

The mount was mainly the result of the cleverness of W3HQT. Very shortly into the program it was decided the polarization rotation was absolutely necessary. This was accomplished by a bearing plate extended 4' from the azimuth elevation mount. Also, since the moon would be quite high, the antenna had to point straight up (a favored position of dish owners), aligning the axis of the mounting pole with the antenna axis. This complete operation was accomplished with parallel water pipes that straddled the mounting pole in the straight up position. So, in total, the parallel pipes had the polarization bearing at one end, mount back 1/3, and a counterbalance (one of the shipping boxes) at the other end. Though a little difficult to pick the best yagi to use for boresight, the mount and antenna worked just great.



Testing in the U.S. Photo by Richard Boyle K3IGX.

Transmitter

The requirement was set for 1 kW output with no strain. This 1 kW starts to decrease rapidly when things are not just right (line voltage, exciter tuning, weak tubes, etc.). Upon evaluation of a portable transmitter generously loaned by K2UYH, it was decided to construct a new model around an 8938 grounded grid triode. This tube had performed very nicely at W3CCX/3. Having invested many hours trying to optimize the link coupled ¼ wave box cavity of the W3CCX amplifier, a new design was considered. The design was patterned after the successful K2RIW stripline kW. The amplifier was constructed and tested by W3HMU in approximately one month and worked superbly. The design consists of a ½λ triplate line with the tube at one end and a flapper tuning capacitor at the other end. Output coupling is also done with a flapper tuning capacitor at the tuning end of the line. The cathode line is quite similar in construction to the plate line. The amplifier puts out about 1200 Watts with 50 Watts of drive. The power supply is about the size and weight of a DX100. The exciter, also similar in size and weight to the power supply, consists of a conventional 220 MHz 10 Watt 6360 rig with a 4 x 150 doubler to 432. The doubler drives a conventional cylindrical coaxial cavity 4 x 250 amplifier which can put out up to 120 Watts. The exciter was designed so that the 4 x 250 amplifier could be used separately to amplify the Echo 70 for OSCAR 7 use. The exciter was self-contained with power supplies.

Receiver

Though only 40' of ½" foam hard line was used for the feedline, it was still necessary to mount the first preamp at the TR relay on the antenna. The main preamp consisted of an FMT4575 with about 1.3 dB noise fig-

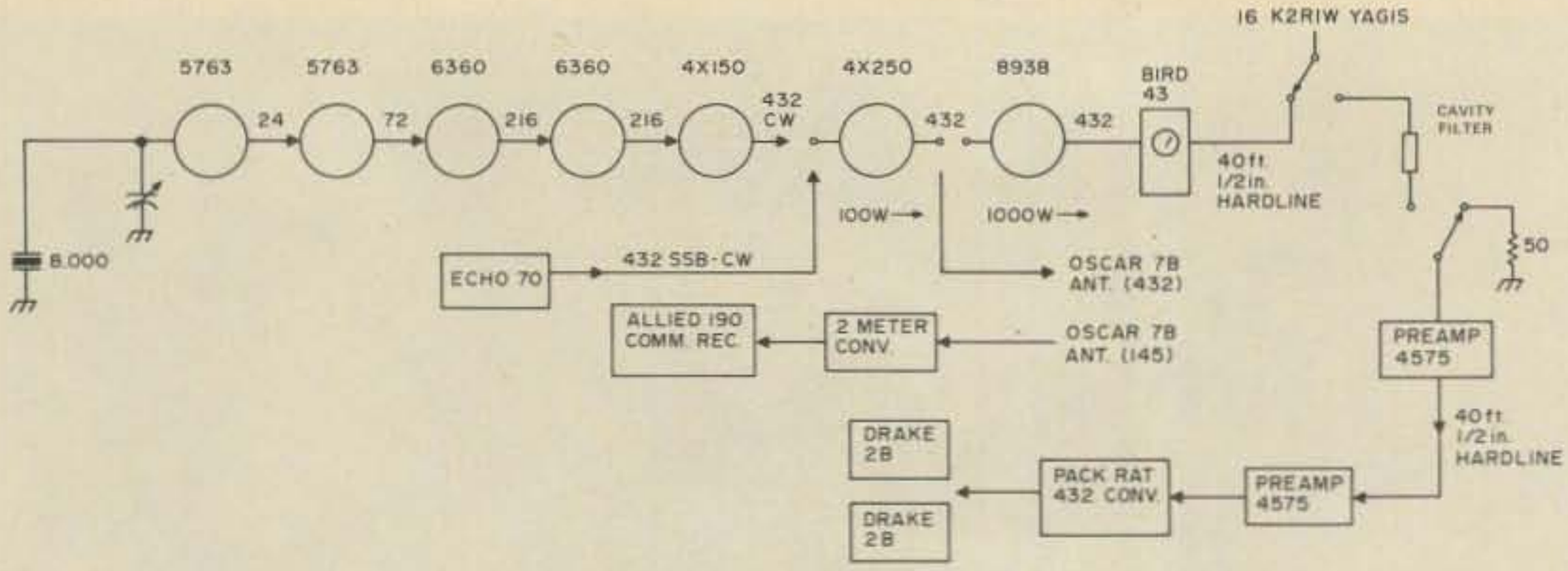


Fig. 1. Pack Rat EME OSCAR portable station, HK1TL.

ure. Between the antenna relay and the preamp, a 3" dia. λ/4 cavity filter was used. The required low loss of the filter necessitates making this a separate item and not a part of the converter.

At the end of the hard line, a 2 dB noise figure preamp was placed to override the loss of the connecting hard line. A Pack Rat converter was used into one of 2 Drake 2B receivers. One of the 2Bs was linearized and used in conjunction with a VOM for sun noise measurements. An audio line from the receiver ran directly to a cassette tape recorder for recording the history-making event. ■

Stephen Wimmer WBØGGT
RFD 1
Lincoln NE 68502

Frustrating the Thieves

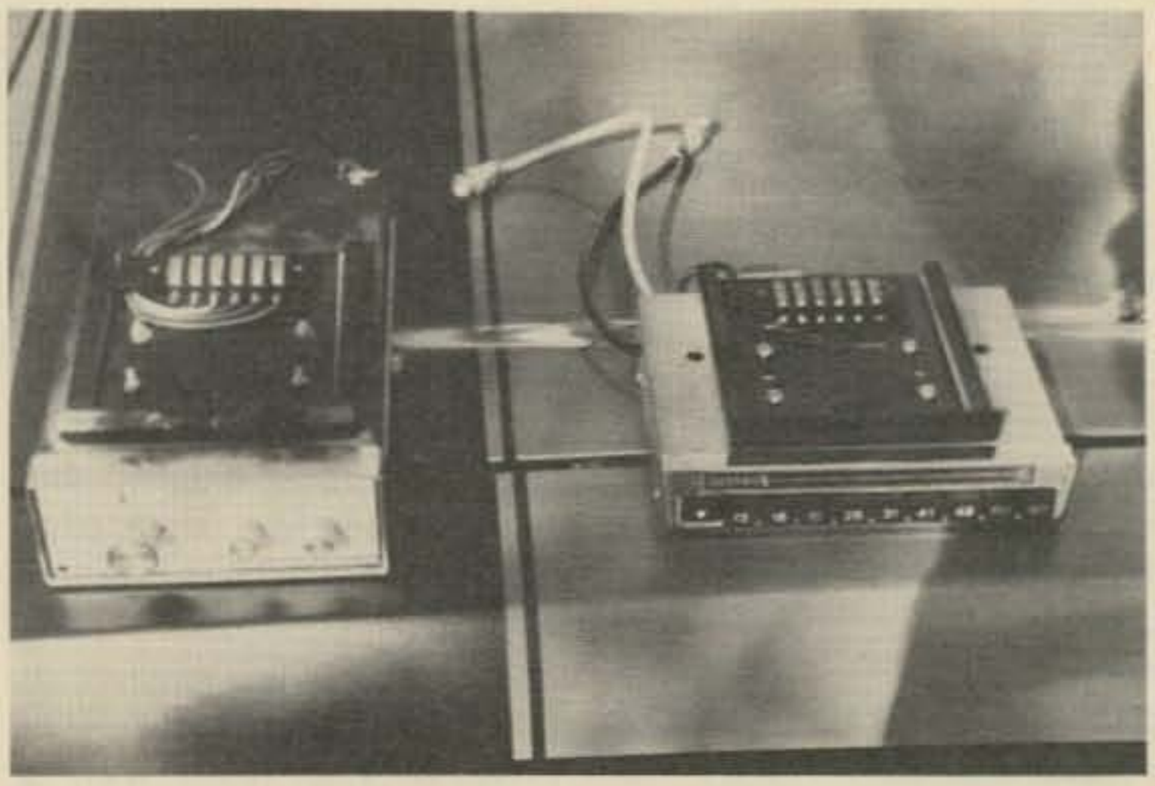
-- removable mobile mount

Looking for a really easy way to mount my HR-2A in the car, I hit upon using slide mounts that are normally used for stereo tape players. For me this turned out to be a very good idea, as I am in the Navy and not at home that often. During tours in the Philippines and Italy, this setup has really worked. While I was away, my parents used my car, and since neither is licensed there was no reason to leave the rig in the car. Having had a short-wave converter in the car before I acquired the rig, I decided to make them interchangeable. That way my parents could use the SW converter when I was away.

To put the mount on my HR-2A, I had to remove the speaker. At first I used a speaker box mounted on the hump behind the gear shift lever. I doubled the hot lead and the ground lead to ensure that the rig was getting enough power. The antenna connection was left as a PL-259 since I had to use two of the connectors for the speaker leads. Later I purchased a cassette/radio, placed it in the hole for the old radio, and used the radio speaker in the dash for the rig. Ensuring that the tape player still worked, I moved it to my father's pickup. Since I was going to be driving for him for a while, I put a mount on the tape player and bought a gutter clip mount for an antenna. The mount in the truck is covered by a blank slide when not in use.

Now when I get home, all I have to do is dig the mike out of the attic, slide the rig in the car, and I'm ready to go. ■

The HR-2A in the car.



View showing slide mounts on the rig and SW converter.

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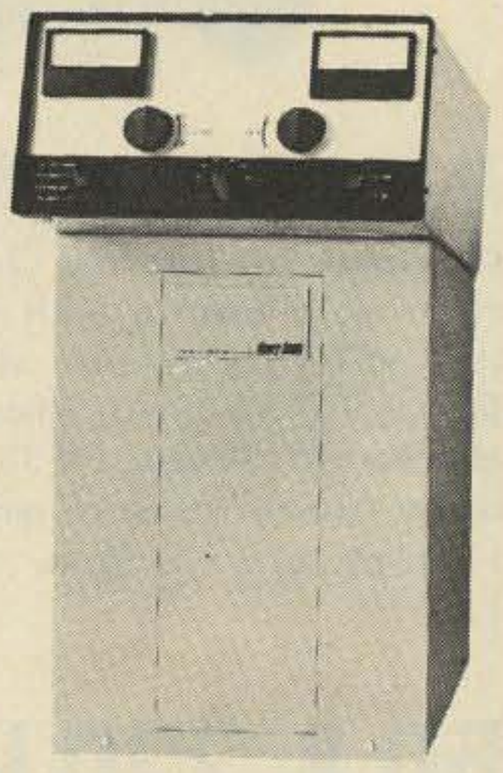
Henry Radio's 2K-4



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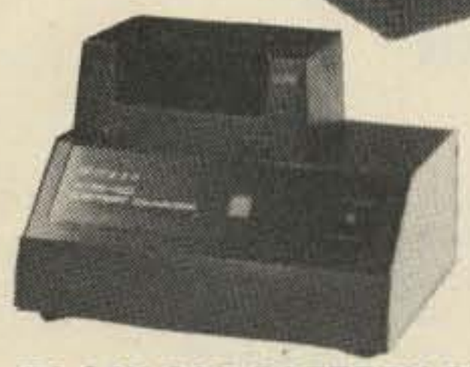

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WR5AHT	Slidell	224.66	223.06 IN
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WR4AZF	Short Mountain	146.91	

TEXAS

WR5AHA	El Paso	146.79	
WR5AJW	Beaumont	147.12	Autopatch
WR5AJW	Beaumont	52.525	53.12 IN
WR5AOK	Groves	29.60	29.64 IN
WR5AOK	Groves	52.64	53.64 IN
WR5AOK	Groves	146.82	
WR5AOK	Groves	444.0	449.0 IN

VIRGINIA

WR4ACW	Richmond	146.88	Private
WR4APC	Tysons Corner	147.21	Autopatch RTTY
WR4ATJ	Bristol	146.61	Autopatch
WR4APE	South Hill	147.24	

WASHINGTON

WR7AGS	Seattle	444.70	449.70 IN

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Thomas R. Yocom WA1RTD
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Automatic Autopatch Release

- - safer mobile operation for the troops

There's no denying the value of an autopatch on a reliable repeater. Whether it's for the "little" calls or the more important emergency calls, the autopatch is fun to operate.

All autopatches have a defined attach and release procedure. Some of them have a straightforward "easy" attach and release while others may have relatively complex access codes designed to limit use of the autopatch to "qualified" persons. The attach and release can be made as complex as desired. Generally, the release procedure is somewhat simple. If you want to streamline the use of your autopatch, you can make the release fully automatic.

To automate the release, a simple circuit is added that will generate a "disconnect" signal for the patch control logic when the called party hangs up (signaling the end of the telephone call). The circuit is based upon a fairly consistent characteristic of the phone line's polarity. The voltage across the phone line is typically 48 V when the handset is "on hook." When the handset is removed, the voltage drops to around 6 V. When the called party answers, the 6 V reverses polarity for the duration of the call. When the called party hangs up, the polarity returns to the pre-answered condition. This pattern of voltages and polarity transitions can be used to generate a patch release signal. The various levels and polarity conditions are summarized in Fig. 1.

CALLING PARTY -- ON HOOK +48
CALLING PARTY -- OFF HOOK +6
CALLED PARTY -- ANSWERED -6
CALLED PARTY -- ON HOOK +6
CALLING PARTY -- ON HOOK +48

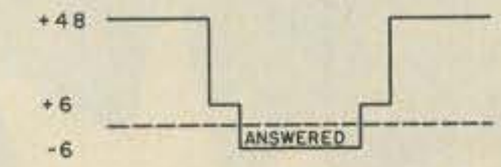

Fig. 1.

The circuit shown in Fig. 2 is used to provide a contact closure when the called party has answered. This contact closure is then used to provide a path for charging a capacitor that in turn generates a negative pulse when the called party hangs up. Notice that there are two power supplies – a dedicated "floating" power supply for the polarity detector and the +12 V power supply for the system. The separate supply for the detector is an absolute necessity to avoid grounding one side of the phone line! A capacitor is connected across the relay coil to delay the relay pulses that may occur during the answering process. You may need to experiment with the capacitor's value to accommodate local conditions or a different relay than the one used in Fig. 2.

The output stage is simply a transistor switch that is biased on (output = .5 V). The capacitor is charged via the 1000 Ohm resistor during the answered period and then generates a short negative pulse on the base of the transistor when the called party hangs up. The negative pulse momentarily turns off the transistor causing a momentary positive pulse at the output. This pulse can be used to turn off the autopatch by simulating the normal manual turnoff character, pulse, signal, etc.

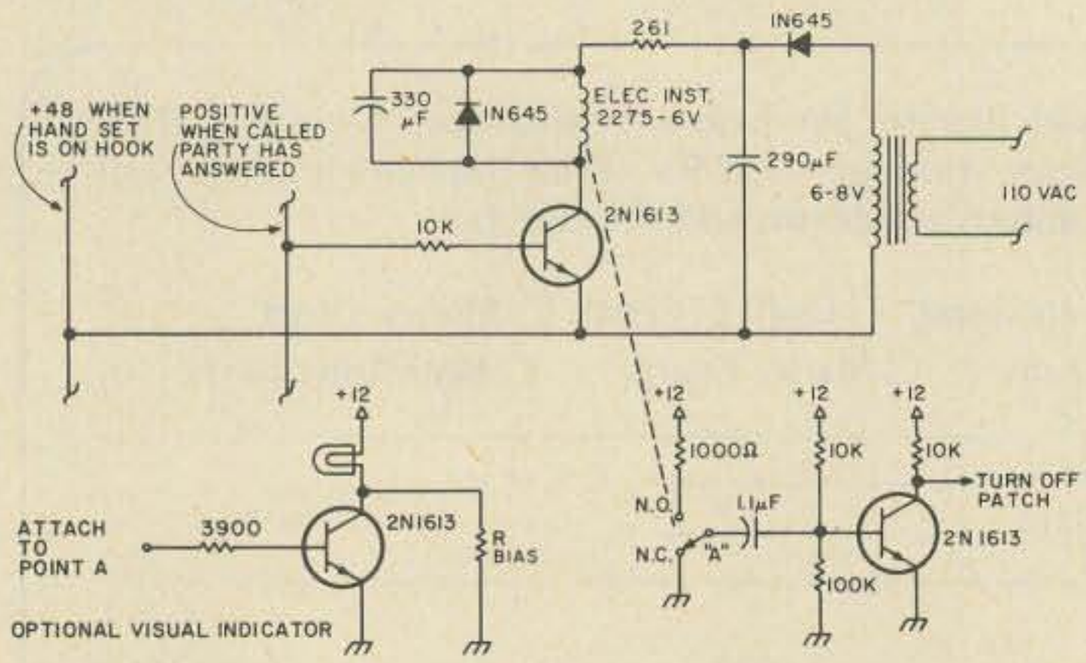

Fig. 2.

The optional visual indicator is simply a lamp driver that can be used to light a panel lamp when the called party has answered. If the repeater is already equipped with a group of status lamps, this additional lamp may be added to provide a little more operational and diagnostic information. Select the bias resistor so that the lamp filament is slightly lighted when the input to the base (Point "A") is grounded. Keeping the lamp warm will prolong the lamp's life and protect the transistor from current surges through the lamp's filament.

The polarity detector should be attached to the phone line on the "repeater side" of the relay that connects the phone line to the patch. This will eliminate any improper interaction with the phone line when the patch is not in use. Fig. 3 shows the appropriate interface. Check the phone line polarity with a voltmeter and attach the detector as illustrated in Fig. 2.

Why not add this little circuit to your autopatch? It makes using the patch a lot more convenient and saves having to reach for and dial a release command at the end of the call. The less you dial while driving, the safer you will be! ■

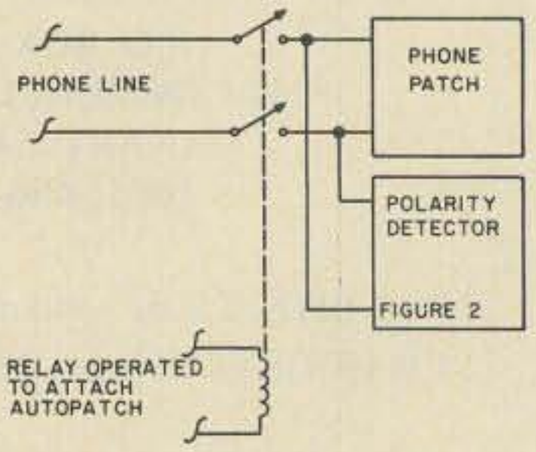

Fig. 3.

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Bill Higgins WA2RXQ
430 Ocean Terrace
Staten Island NY 10301

Emergency 911 System - - help for NYC

It was December 27, 1976, and Christmas gifts were still in sight in the Higgins' living room as Mike WB2EIL and Bill WA2RXQ were hurriedly rewinding a video recording of the evening news. NBC had just aired a three minute and 19 second special entitled "Helping Hams," when over the monitor of WR2ADP came WA2UTV, "Is there any control station on frequency?"

Almost before I could reply, WA2YYZ came on frequency followed by WA2JSJ, KTUAT, WA2VBJ, WA2ECI, WA2FUL, W2DME, WA2KHN, WA2HYT, and a continuous parade of well-wishers. Mike remarked that he had not heard the machine this active since 1975 when we loaned the station to the New York City Police Department for three days, following a five alarm fire in a main switching center of the New York Telephone Company. The station call then was WR2ABK, but it was the same group that was operating WR2ADP now. We reflected on how it all began and how grateful we were to the production crews at NBC, particularly to Stephanie Stern, who had worked so hard to produce the special news documentary about amateur radio.

News Center 4 began the show with Mary Merendini WA2CSM driving down a country road and talking to her harmonic, Lisa, about her day in school, when Lisa, dramatizing, remarked that she saw a burglar breaking into Mr. Jones's home. Mary, determining that the Joneses were away on vacation, proceeded to pull off the road and produce a Wilson HT with TT pad and, as the camera zoomed in over her shoulder, punched the digits 911. In response, a voice returned, "Police Department, where is the emergency?" Mary proceeded to report a burglary in progress. From there, the cameras took us to the repeater site and focused on the repeater cabinet and control circuit that Jim WA2ECP had designed and built. The cameras then took us to police headquarters where calls for emergencies are processed.

I got my chance before the camera and explained that the project implementation was delayed for more than 15 months due primarily to objections and conditions set down by the police department. I explained that it was the desire of the Radio Amateurs Repeater Association of Staten Island to assist the public and government in times of emergency, that while landslides and earthquakes get the most publicity, there are many such catastrophes in individual lives each day on a local level. Assisting with one of them is equally as important as giving aid to a foreign country.

The program ended by showing the awards the repeater group had received in the past: a letter from the FCC, an ARRL Public Service award, and a certificate of appreciation from the New York Police Department. A file film depicting the work we had done during the 1975 telephone company fire was also shown.

Due to the time limitations of television and, I suppose, the desire not to get technical with the viewing public, it was not possible to get into the why and how of our 911 system on television. However, for those of you who live in or visit New York City, here is how it works. The repeater is capable of autopatch and reverse autopatch but, as you already know, the prefix codes to activate dial tone are reserved for active members' use. It seemed to me that to have more than $2,500 worth of equipment idle, when someone had an emergency but could not raise an operator with the autopatch codes, was not good business. My first approach was to request permission from the police department to install amateur equipment at headquarters on 147.911 MHz. The equipment I suggested could be manned by police officers who hold ham tickets. The idea was turned down about four months after my first letter was sent. The police requested that all calls for emergency aid be directed through their 911 telephone system.

It seemed to me that the police did not care or want to cooperate. Some months later, while cleaning up some paperwork, I came upon that same letter. This time the words "directed through their 911 system" had a new meaning for me. I called Jim Passione WA2ECP who had built most of our control circuitry and asked him if he could modify the circuit so that unknown hams and transients could access the 911 police emergency number without knowing the dial tone access code.

The system we came up with is so simple that I am almost embarrassed to tell you how long it took to devise; anyway, here goes. A station comes on frequency (147.915) and signals 911 on a TT pad (no need to bring up dial tone). The decoder receives it and closes a relay which energizes an eight track tape recorder. Track A reports back to the caller, "Please stand by. Your call for emergency assistance is being automatically processed." Track B, simultaneously, is redialing the New York City Police emergency number 911 on an open telephone line and informing the police to stand by: "A call for emergency assistance is being automatically relayed via amateur radio station WR2ADP." Approximately 15 seconds down the line, the caller and the police are patched together. They are permitted 100 seconds of conversation and then are

automatically disconnected. There is a 30 second warning prior to disconnection which states that, "If more time is required, signal 911 again."

The repeater has been programmed to rebroadcast the US weather in order that interested parties may test their equipment: *41 activates weather and *47 disconnects. This function should discourage anonymous operators from embarrassing the amateur fraternity by falsely signaling 911 without reporting a bona fide emergency.

The police department requests that all callers, except those located in Staten Island, state the borough from which they are calling. Since the repeater is using a Staten Island trunk, all calls processed through the repeater appear on the Staten Island dispatcher's desk. They can be routed to other boroughs through the police computer switching system if they are properly identified.

Bill Higgins WA2RXQ, trustee of WR2ADP, demonstrates the "emergency autodial" to officer Andy Merendini WB2EIR. Andy now carries two HTs when on duty.

All hams are welcome and are invited to use the 911 feature in the event they encounter a situation that they believe requires police attention. I sincerely hope that calls for minor disturbances are avoided in order that the network not be overloaded both at the repeater and at an already overworked communications bureau. ■

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Warren OH 44484

The Downspout Vertical

- - a great 15m antenna for soda pop drinkers

Just imagine going from 21.000 to 21.450 and not having to touch the loading controls, after an initial tune-up on about 21.220! I built this one in the middle 50's, right after I received my General Class, so most of this is from memory. My reference was an article in a 1954 *QST*, "Beer Can Vertical," which was for 40 meters.

Description

I used 11 feet of rain gutter downspouting for the vertical element. Since downspouts don't come in such odd lengths, I had to use an extra piece of sheet metal wrapped around the top section to make up the difference. This was attached with sheet metal screws.

The vertical element was insulated from ground by a quart soda pop bottle. This bottle was first placed about halfway into the ground to stabilize it.

The vertical was guyed from the top with non-metallic clothesline. At the base I used a 6 foot ground rod, and the transmission line was a long length of RG-58. I realize now that two improvements would be: several 12 foot radials and feeding the whole thing with RG-8.

Operation

My rig was a Johnson Adventurer (50 Watts input to an 807) with a wi-i-i-de range pi-network output tank (no tuner needed). This rig loaded up just fine to this vertical. I don't know what the swr was, because I didn't have an swr bridge. In fact, I don't think *anyone* did in those days, except the ARRL's laboratory! With today's "modern" 50 Ohm output transmitters, you probably will have to resort to feedline trimming or use an unbalanced tuner to get a match.

I was able to work "all over" Europe and Africa and into Asia, and I have QSLs to prove it! ■

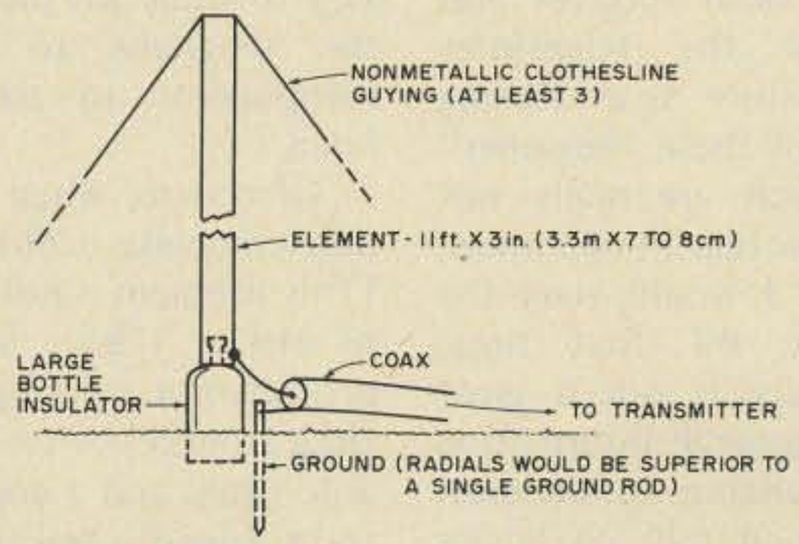

Fig. 1. Ultra-wide bandwidth 15 meter vertical.

Paul Schuett WA6CPP/WA7PEI
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Wallace CA 95254

RTTY? What's That?

- - how to get started with teletype

After doing some years of customary operating, I thought it would be fun to operate with a teleprinter — encouraged by another amateur donating a teleprinter and a lot of advice. Thinking that it would be fun to get involved with something new, I accepted; since then I have learned a lot of good information about how machines operate, how to fix them and the like.

There is a lot of information available about different printer models and basic information on how they work, along with basic operating techniques. Rather than repeat or summarize that information, this article will give a couple practical ideas to the person wanting to get started.

You really only need two things to get started — a printer and a converter (the converter both receives and generates the teleprinter tones). Rather than fussing with one of these "beginner" units, which are really not very satisfactory in operation, I thought I would start the right way the first time. There really is not a great deal of general information readily available, so one must pretty much rely on advice from others. Looking at prices and specifications, I elected to purchase the Hal ST-6 kit. There are several converters available in several price ranges; this one appeared to have the most features at the best price.

The Hal organization is excellent at getting materials out in a hurry. I received an immediate confirmation of my order with the sad information that there would be a slight delay on shipment (it developed that they were out of the power transformer). The merchandise arrived before the expected delivery day by UPS. They were nice enough to send the instruction book right away so I could get acquainted with what to do. It took about a week to put it together — the instruction book was most complete and quite necessary since the circuit boards are not marked, making it necessary to study the pictures and the diagrams to get the components in the proper holes.

Of course, when I got the unit complete it didn't work. (This problem is not confined to Hal — I have had many projects not working the first time around.) After considerable strain and a couple visits to a friend's test bench, it developed that the +12 and -12 voltages were not exactly the same + and -, and one critical place was not balancing. A paralleled resistor got the voltage to balance and everything worked fine.

One must have access to a frequency counter in assembling the Hal unit (or get it already built) since it is necessary to adjust the audio oscillator to the proper frequencies for RTTY operation and necessary to prune the tuned circuits in the receive section to get right on frequency. This takes the better part of an afternoon checking the resonance of the tuned circuits and pulling off turns from the toroids or changing capacitors to get the exact resonant frequency. It's quite necessary to have a little pile of small-value high-precision capacitors in order to get the resonance within 3 Hz of the specified frequencies. The Hal people could make some improvements in their unit by providing support for the circuit boards (they're held in by the edge connectors only) and by supplying several colors of wire instead of the generous supply of one color. It took one day to do the interior interconnecting wiring between the switches and edge connectors; I used different colors, which makes it much easier when tracing and troubleshooting.

Modifying the Heathkit SB-401 transmitter was simple. To transceive on RTTY, two contacts are jumpered to permit the unit to transmit on the RTTY position. The crystals and filter in the equipment, although ideal for 850 Hz shift, work out quite well on the almost universally used 170 Hz shift. With careful work on the carrier suppression, satisfactory operation is easily achieved by feeding the AFSK tones in the microphone jack with resultant FSK (F2) output. There is no problem using a VHF unit since AFSK is used; the signal goes in the mike jack and comes out the speaker connection.

The areas of RTTY concentration are easily found on the bands. Most operation uses 60 wpm operation and 170 Hz shift, although some 850 Hz shift is still occasionally found. A RTTY QSO is little different than an SSB QSO — the same general type of conversation takes place: name, location, equipment listing, weather report, etc. One must remember that it takes longer to say the same thing when typing, so watch that 10 minute timer. Also watch the plate ammeter since you are using a 100% duty cycle — don't exceed the plate dissipation rating of your finals. On VHF, the same information is exchanged that is heard on voice repeaters: "just testing out my new rig" along with a lot of highly technical talk of interest primarily to RTTY and computer specialists. There are RTTY repeaters that have the customary weekly net and check-in. One in this area is complete with swap shop and ARRL bulletins.

With a change of gears, one can use a communications receiver and eavesdrop on commercial transmissions (remember the FCC's secrecy rule), although much of this traffic is ASCII or encrypted.

There is a lot of press activity in Spanish at 67 wpm. Of course it helps to be able to read Spanish . . .

It also helps to be able to type for those intending to engage in 2 way teleprinter contacts. It's surprising that some teleprinter operators are rather poor typists.

At the moment my teleprinter operation is quite small-time in comparison with what many others have. Just a printer (with keyboard) and a converter. Later, when funds permit, I hope to include some tape equipment (puncher and reader) and get set up with a UART to improve the performance. Right now everything is still quite simple and satisfactory. It might be mentioned that the more sophisticated the operation, the more there is to go wrong and the more adjustments there will be.

It's a good idea to start simple and build up the more elaborate installation as your interest and funds permit. At the same time, put in good equipment that will work well, which will, in the long run, reduce your total cash outlay. Don't get a bunch of junk that will take two hours' maintenance to one hour's operating. Don't expend heavy amounts of cash on equipment that is 50 years old and getting obsolete. There is fairly good used equipment generally available; make sure it is working if you are not sure how to do the internal maintenance (or have a friend who knows how). Before starting, check the FCC rules on teleprinter operation which in general is restricted, on the low bands, to the CW portion; identification is done by CW but by your call only (you can use the letters key for dots and the blank for dashes).

You can make new friends and have a lot of fun on the teleprinter, as well as learn a lot of operating and technical savvy. ■

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Do-It-Yourself

Photosensitizing

- - practical PCs

Most of the contemporary articles on printed circuit fabrication begin with photosensitized board and take the reader through the various steps of exposure, development, plating, etc. One or two of the articles explain that a spray sensitizer is available, leaving the reader to assume one simply sprays clean board and is then ready to begin fabrication. This is not true. In fact, I found the most difficult part of the whole process was just coating the plain PC board, such that the resist was not floating in streamers in the developer like octopus or squid tentacles. If you've never seen this, you simply cannot sense how frustrating it is. And presensitized board usually costs several times as much as plain board.

After several frustrating times, it became obvious that I was getting the board too clean and too smooth with steel wool and scouring powder . . . so clean and smooth that the paint (lacquer base resist) could not stick. A new procedure was devised and success has been mine, unfailingly, since then. I share this with you:

1. Forget the scouring powder and steel wool. Switch to #400 wet-or-dry emery paper. Work in the sink with running water and rub the board in straight, parallel strokes until you have a satin finish on the copper. Keep everything wet to prevent deep scratches. This microscopically rough surface is just what is needed for good bonding of the resist.
2. Dry the boards thoroughly.
3. Immerse them next in clean lacquer thinner. A quart purchased for this cleaning purpose can be split, with half used to remove the resist after etching . . . separate containers are a must.
4. Remove the boards from the thinner, point down so they drain well.
5. Place the boards on newspaper, copper side up and dry with warm air from a hair dryer . . . ten or fifteen minutes will ensure complete removal of moisture and a slight warming of the boards.
6. Spray the boards. I do it horizontally, although the instructions on the resist say to do it vertically. I use my son's darkroom, but a yellow bug bulb over the workbench at night will do. After the spray, turn the hair dryer back on and blow warm air on the boards for another fifteen minutes, then let the whole mess dry overnight in the dark. Store in a box or wrap each board in black paper.

That's it . . . from here on, I proceed as usual. I use an ultraviolet bulb about a foot off the surface of the negative. Too much closer than this and the thickness of the negative and parallax will produce non-sharp images on the copper – the light rays will actually shine under each line on the negative and ruin your copy.

Oh yes, I use the General Cement photoresist and developer. Their numbers are 22-231 (resist spray) and 22-234 (developer). No more tentacles. ■

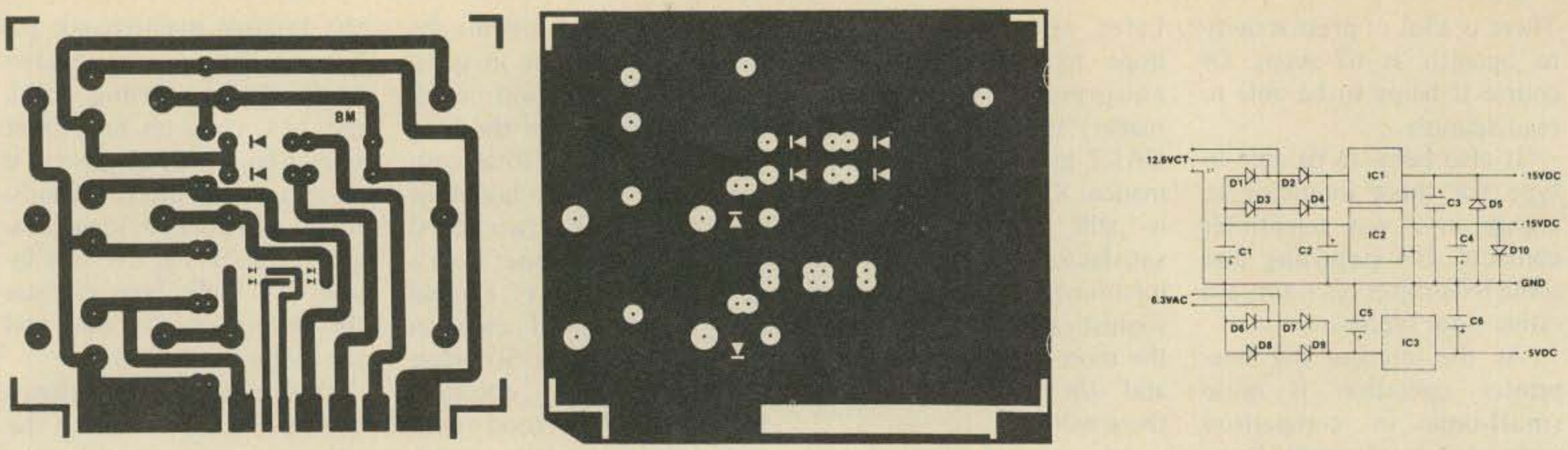

Fig. 1. Artwork and basic schematic diagram for the power supply used for illustration.

Making Your Own PC Boards

- - part II

Charles F. Smith
c/o 73 Magazine

This is the second and concluding part of this article. Last month, you may recall, we discussed all the "paperwork" involved in making a printed circuit board. We concluded with a finished 4 digit clock on a single-sided board. This month we will cover double-sided and multi-layer boards, as well as the manufacturing process.

To begin with, a definition of double-sided and multi-layer is appropriate. Last month a double-sided board was described as a circuit board with printed wiring on both sides. Components are placed on the side with the least amount of wiring. A multi-layer board is a board with many very thin boards laminated together. The multi-layer board described in these pages is not quite as complex as this, but works as well.

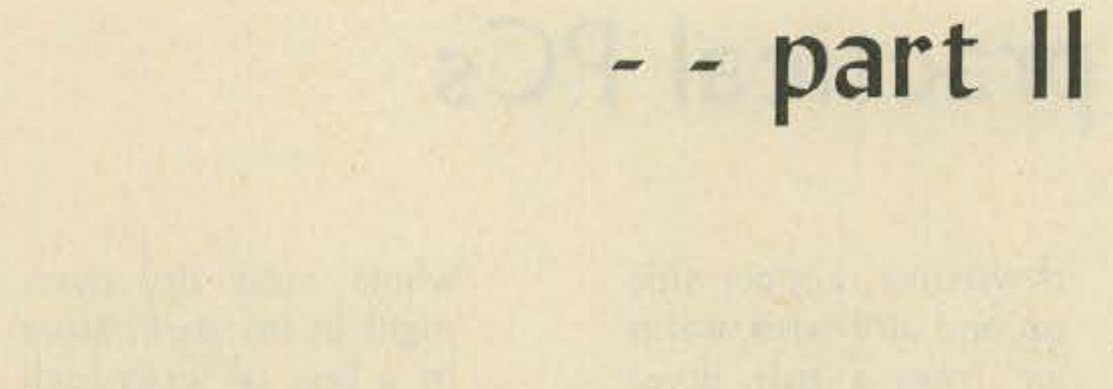

Fig. 2. Rounding the corners using cut pads.

Layout Design

Perhaps the easiest way to lay out a double-sided circuit board is to make it similar to the single-sided board. Use different colored pencils for each side (or layer, for multi-layer). Some people prefer doing each side on a separate piece of graph or tracing paper. Others use one piece of graph paper for everything. The use of two colors on one piece of graph paper will keep the two sides separate, and assure no errors caused by an overabundance of papers to keep track of.

When laying out a double-sided circuit board, it is best to keep a conductor on one side of the board. To elaborate, do not run a conductor to a component lead and then change sides. Shying away from doing this will prevent depending on side to side connections for circuit continuity.

Everything else about a double-sided board layout is basically the same as for a single-sided board.

Artwork Design (Methods)

For taping the artwork for a double-sided board, there are several different methods. The most obvious is to make separate artwork for each side. Another common method uses one sheet only containing pads and other

markings common to both sides. Use separate pieces of clear mylar for the top and bottom sides of the board. On these, place only the conductors for each side and registration marks. When a negative is made, each side or layer is placed separately above the dots. This "set" is shot together, coming out with a combination of the two. This is probably one of the best methods. Side to side registration is going to be excellent, with very little error.

A similar method is to have a print or film positive made of the pads only (one print for each side/layer), and tape directly over the photographic paper or film.

Fig. 1 shows a schematic diagram and board artwork of a power supply you may want to build. This circuit will be used here for explanation purposes.

You will notice that although the conductors are all straight and even like last month's clock, the corners have been rounded. This was done by "quartering" a donut pad twice the size of the tape used. In this case I used a ½" pad with ¼" conductors. Fig. 2 details this process.

A method worth noting was used for the top side of this board, being used as both a heat sink and a ground plane. When the artwork for the bottom side was finished, I placed another piece of mylar over it. At points where no connections between sides were to be made, I placed pads as large or larger than those on the bottom. You can see that this is exactly the opposite of what we want. Using this "overlay," I made a contact print. This gave me artwork on photographic paper for the second side. Fig. 3 should make this clear.

By the way, if you ever have to lay out a ground plane without recesses, and do not wish to use a lot of tape, use red paper. It should be a good grade of paper and be pure red. Rubylith is also a

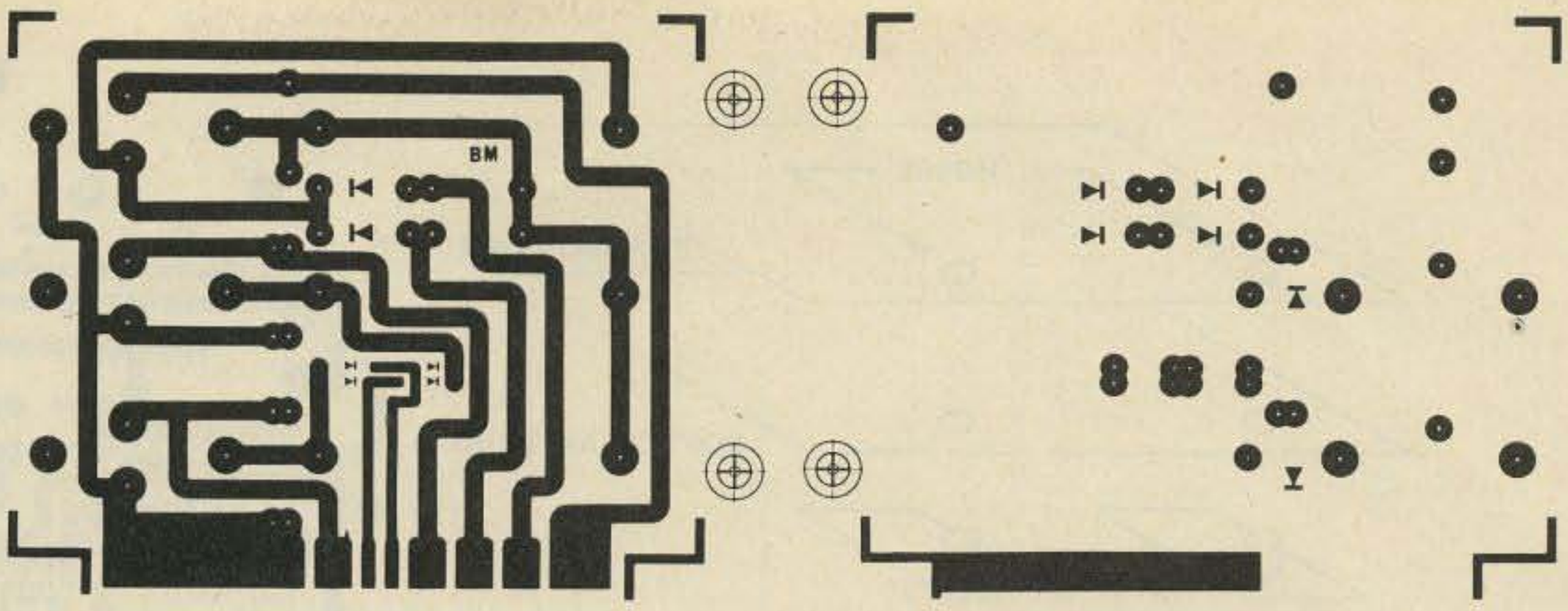

Fig. 3. Contact print method of making a ground plane.

material that can be used. It is manufactured for this purpose. A good drafting supply store should have some. Black paper can also be used with good results. Because of the properties of film, sometimes red appears as a better black than black does. Strange, but true.

Registration Techniques

There are many registration techniques available. Some are easier than others, but all work well. For the artwork, special preprinted "stick-ons" are available. Fig. 4 illustrates some of these, which are placed on each piece of artwork at three corners. When all layers are laid above each other, these marks should be superimposed to appear as one mark.

Pin registration is a method the graphic arts industry has been using for a long time with great success. This method involves punching a pair of holes in each piece of artwork and using small pins (usually ¼" in diameter) to hold the pieces in register. Fig. 5 shows these two methods of registration.

A relatively new method of registration for double-sided boards has been introduced by Bishop Graphics, Inc. They call it their "Red and Blue System." Instead of using black tape and pads, they suggest using red and blue. Pads and other marks that go on both sides of the board are laid down using black pads and "stick-ons." Conductors for the first side are laid down using red tape. On the same artwork, blue tape is used for conductors on the second side. This method uses only one piece of mylar, and one set of pads. This means that you have only one piece of artwork to keep track of.

When making a negative using the "Red and Blue System," special film (Panchromatic) and filters are used. A red filter is used to drop the red images and hold the blue. A blue filter is used to keep the red and drop the blue. Since there is no filter available to drop the black, mainly because you cannot, such images on the artwork are picked up on both negatives.

This method assures perfect registration every time, as well as the above mentioned benefits.

Manufacturing

Now that you have negatives for the circuit board you want to make, you are ready to do some home manufacturing. You are going to need some blank circuit boards and several types of chemicals. Each of these will be discussed separately.

The type of circuit board you use will depend upon the type of project involved, and

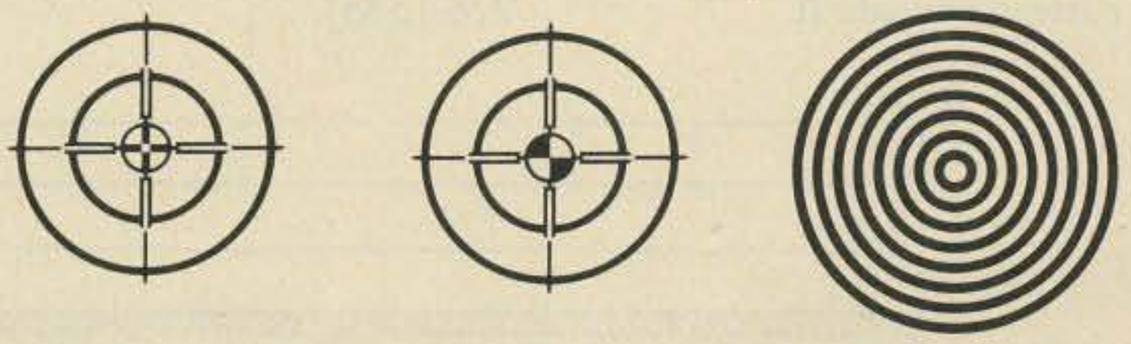

Fig. 4. Typical "stick-ons" used for registering artwork. The concentric circles are used on multi-layer board artwork.

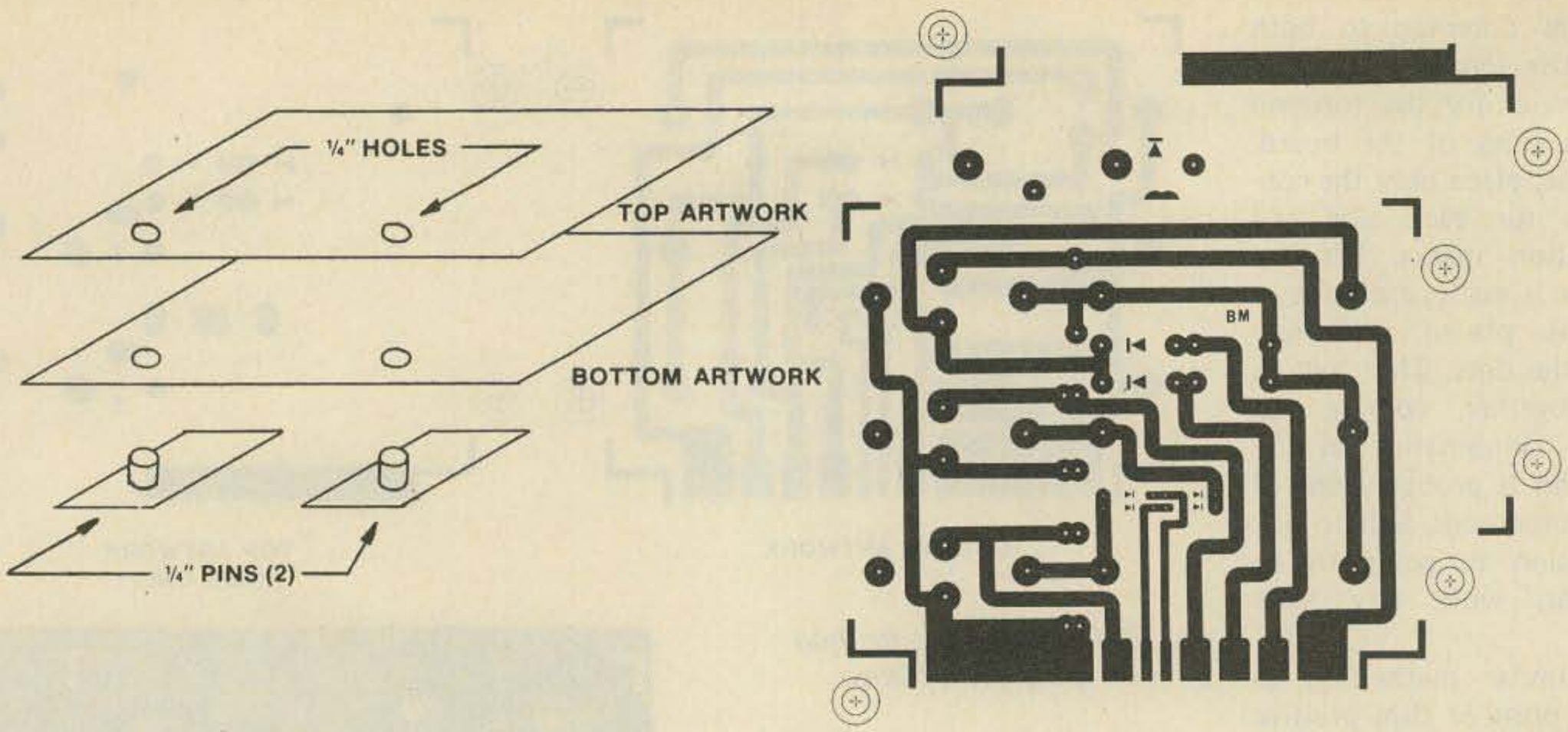

Fig. 5. Methods of artwork registration.

your choice of supply. Obviously, if one type of board is unavailable, you will have to use what is available.

The most popular types of circuit boards are glass epoxy and paper phenolic. Glass epoxy is a good board for everything, but especially for high frequency circuits and critical applications. Its leakage resistance is very high and its stability is good. It is also able to withstand harsh environmental conditions reasonably well. Paper phenolic is satisfactory for most applications, but G-10 glass epoxy is usually better.

Circuit boards come with many different "properties." Thicknesses range from 1/32" to 1/4" and beyond. Most common is 1/16". The copperclad comes in 1 oz., 2 oz., and 3 oz. thicknesses. Here, 2 oz. is most favored.

The Resist

The resist is a chemical placed on the board in places you want a copper pattern. During etching, it resists the acid and protects the foil pattern beneath it.

Resist is available in many forms. Almost any substance that can withstand heat and the etchant may be used. For the purposes of this article we will be using General Cement's "Etch Resist Sensitizer" (cat. nos. 22-230 and 22-233). This is similar to Kodak's KPR photo resist and comes in an aerosol can. KPR can be used with the same results.

The developer for this type of photo resist is either GC's "Developing Solution" (no. 22-234) or Kodak's "Photo Resist Developer."

The Etchant

After the board has been "printed," it must be etched. Etching removes all unwanted copper, leaving only the foil pattern. Different types of etchant include ferric chloride, ammonium persulfate, and cupric chloride. Ferric chloride ($FeCl_3$), available in both powdered and liquid form, will be used here. Radio Shack stocks one pint bottles of pre-mixed ferric chloride (stock no. 276-1535).

Cleaning the Board

Cut a piece of circuit board slightly larger than your finished board will be. Before you make the board, you are going to have to clean it. Unless you have commercial chemical degreasing facilities handy, you are going to have to clean it by hand. I have found two out of many methods to be very good when it is necessary to do this.

Washing a circuit board with dishwashing soap is done like this: Using warm water and a pad of Scotchbrite, lightly scrub the board to remove oils, oxides, and other unwanted residues. Rinse with water. If the board is clean, the water will not stick to the copper. Be careful, though, as water will not stick to an oily board either. Unfortunately, neither will the resist. Do not dry the wet board with a towel or cloth. Let it dry naturally to prevent any oils or foreign matters from sticking to it.

The other method is a little easier. Use fine steel wool and clean the board with this. Be careful not to touch the clean areas of the board with your fingers. As clean and dry as they may seem, your fingers will deposit oil onto the board. This will cause oxidization and prevent the resist from adhering properly.

Resist Application

When the board is completely dry, it is ready to be sprayed with photo resist. Lean the board against a wall with the foil side facing toward you.

Shake up the can of resist to mix the chemicals well. Apply a thin layer to the board by holding the can about ten inches away and spraying horizontally from the bottom to the top of the board. Best results will be obtained by spraying a continuous spray without removing pressure from the nozzle until you are finished.

To sensitize a double-sided board, spray the first side as before. Handling only by the edges, turn the board around and lean it with the coated side facing the wall. Spray the second side and let the board dry in a vertical position.

After the board has been completely coated with an even layer of resist, set it down so it is lying flat. It normally takes at least an hour for resist to dry, but the process may be sped up by

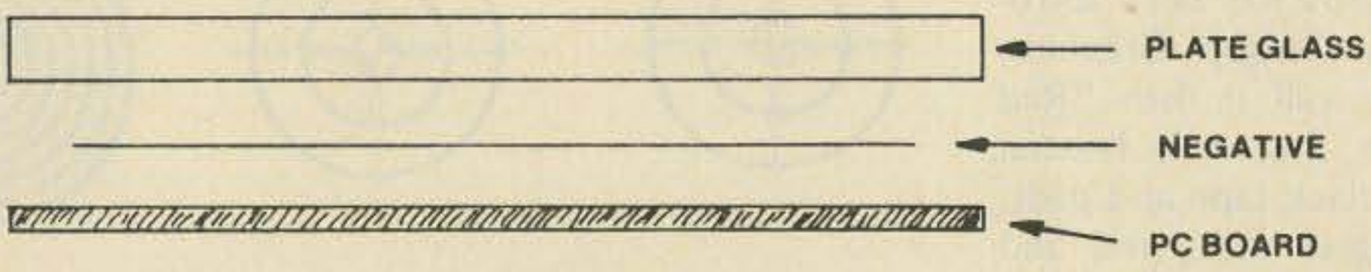

Fig. 6. Simple method of exposing the sensitized board.

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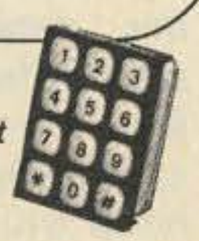

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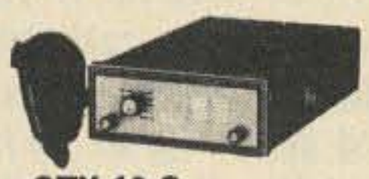

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Curing Mobile Noise Miseries

- - particularly on 80 and 160

My car had been away for some time for repair after an accident. When I got it back, I was not surprised to find the suppression was much poorer than it had been before.

I began checking everything: the ignition leads, the distributor suppression, the bonding of the exhaust pipe, etc., and could find no fault.

Then a curious thing happened. I had an 80 meter QSO and complained about a whine which was causing considerable QRM all over the 80 meter band on reception. I could not understand this, drove home and checked the 80 meter band for the whine on the fixed station. No unusual QRM was heard on the fixed station receiver. I had parked the car under the fixed station antenna and went back to the car and switched on the mobile rig. There was the whine all over the 80 meter band again. I ran back to the fixed station. Now I could hear the whine on the fixed station receiver also. After listening for a time, I went to the car and switched off to save the battery and decided to monitor from the fixed station. But, on returning to the fixed station, the whine was gone!

Could it be that the mobile was generating this whine itself even on receive? I switched it on again, and the whine appeared on both fixed and mobile stations.

After repeating this a few times, I was satisfied that the mobile station was definitely generating the whine, which was picked up not only by its own receiver, but radiating enough to be picked up on the fixed station if the two were close enough.

I was really confused, as the whine was not a constant note but seemed to fluctuate rhythmically — somewhat like a jammer.

I rang up a good friend of mine, G8KW (of K W Electronics), who is very knowledgeable and has much experience. He had experienced this phenomenon, but only on 80 and 160 meters.

He suggested that the whine came from the transistor oscillators in the power supply. But why did it fluctuate rhythmically? He suggested it was beating with some other oscillator in the transceiver which caused the fluctuation.

He suggested that either the antenna was not resonant at the operating frequency or else I had a bad connection on the outer braid of the coaxial cable.

I doubted whether it could be the non-resonant antenna, as I had most carefully resonated it and had had good reports when I was transmitting from the mobile on 80 meters. It was only on receive that the trouble arose.

So I took my ohmmeter, which is calibrated down to 1/10 Ohm and on which I can easily interpolate to 1/20 Ohm, and began testing: chassis of the rig to rear bumper, 0.15 Ohm; chassis of rig to engine, 0.15 Ohm; chassis of rig to headlamps, 0.2 Ohm; and so on. Nowhere was the resistance over 0.25 Ohms. Then I broke the connection of the coax from the rig to the antenna base. The center conductor showed a resistance 0.1 Ohm. I reconnected the coax at the rig, but left the coax disconnected at the antenna base, and tested from the outer of the coax cable at the antenna base end to the chassis of the rig — 3 Ohms!

Note that the beautifully low resistance of 0.15 or 0.2 Ohms from the chassis of the rig to the car was through the car, due to good bonding, and that explained the strong signal on transmission. It was not until I had disconnected the coaxial feed line that I found the high resistance.

I discussed this with my friend and we were at first inclined to believe that since it was a big car and a fairly long coaxial feed line, this might be possible. It was hard to believe that the outer braid of the coaxial cable could have a higher resistance than the inner conductor.

So the tests went on . . .

The coaxial cable was broken at various points to insert an swr bridge near the rig and also to insert a loading inductance near the antenna for fine adjustment on 80 meters. These are joined by standard coax connectors.

We found slightly corroded connectors here and there and reduced the resistance from 3 to 2½ Ohms. But the 2½ Ohms resolutely remained.

Then we found one more connector we had overlooked. That really was corroded badly, and the outer conductor was badly corroded too.

We cut out the bad parts, made up brand new connectors, and the resistance — end to end — was 0.15 Ohms including all the connectors.

Now we tested again. The suppression now was superb — as good as it had ever been. The whine on 80 meters was gone.

One cannot overemphasize the vital importance of really low resistances everywhere on a mobile installation. For suppression purposes the feed line, both outer and inner, *must* be really good and very low resistance. For a good radiated signal the car must be really well bonded, and this helps suppression also.

A really low resistance on all leads in the car is vital, and a means of measuring low resistance — by that I mean down to 1/10 Ohm — is essential. ■

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More on HKITL

- - Colombian views

It has been about a year since the Mount Airy VHF Radio Club (the Pack Rats) started planning for the Colombian moonbounce expedition, HK1TL. I was recently reviewing all of the articles written about this successful 432 MHz moonbounce project in South America, when it occurred to me that something was lacking. With all the publicity afforded this project by the radio press, and with the technical and descriptive articles which have been published, still missing was a description of what this project meant to our Colombian hosts. We Pack Rats knew how they felt, but it would not be proper for us to tell their story. So, I asked Dr. Atenogenes Blanco HK1BYM, the project's Colombian coordinator, to write of his impressions. The following article is the result. I think that Ate has conveyed in his article all the emotion that exists. – Elliott T. Weisman K3JJZ.

My first encounter with the South American moonbounce project occurred when I received a letter from Sam Martinez WB3AFY/HK1CWB, a fellow Colombian who now lives in the States at Baltimore, Maryland. Sam informed me about the Mount Airy VHF Radio Club's DXpedition plans and asked if I could coordinate the Colombian end of the project. I didn't know the first thing about moonbounce, but here was a request from a fellow Colombian which had the potential of providing international recognition for my city and country. I had no doubt that my answer would be in the affirmative, since I was told that the planned operation would be the first of its kind on the continent of South America and the request came from a fellow ham and Colombian. However, I did have doubts about the capabilities of the Mount Airy VHF Radio Club (the Pack Rats) and the probability of success of such an ambitious project. It was sure to be a very difficult – if not a crazy – undertaking.

I soon saw that my contribution would be in translating what the North Americans wanted to do into the Colombian way of doing things. Every country's customs and governmental procedures are different, and such an unusual project would no doubt create special problems in licensing, customs, immigration, and so forth. So I responded to Sam that I would do whatever they asked of me to the best of my ability. Here I was discussing a difficult project with a group more than 1000 miles away who were either very capable or very crazy. I really didn't know, but it made no difference – we were going to be a part of the project.

A special meeting of our AREA 2 radio club was held by the president, Juan Navarro HK1JJ. The word "AREA" stands for Association Radio Experimentadores Afficianados, and the 2 for 2 meters (the band in which we are primarily interested). We are a group of a dozen or so hams from the Barranquilla, Colombia, area who like to build and operate 2 meter repeaters and mobile and base stations. Our ambition was to one day combine forces with the Defensa Civil Columbiana (you should say Civil Defense), in order to provide a communications system which could be used in times of emergency. The AREA 2 radio club was responsive to the moonbounce project and volunteered to serve as the sponsoring organization. You see, a DXpedition to Colombia requires both local sponsorship and participation in order to be licensed and approved by the Ministerio de Communicaciones (Colombia FCC).

The problem areas identified for action at that first meeting included licensing, customs, transportation of both people and equipment, and the location for the moonbounce station and lodgings for our expected guests. The most difficult problem would be the customs arrangements.

We began our preparations in February, 1976, for the August operation. I informed Elliott Weisman K3JJZ, the Pack Rat moonbounce project leader, of what documents were necessary for the license and customs. They wrote a beautiful letter to the Ministerio, but when I checked with the head office in Bogota, I found that it had not been received in the correct department. So I flew to Bogota to meet directly with the Ministerio of Communications. Here I was lucky. The counselor to the minister is a young lady lawyer who graduated from the same university at which I studied dentistry. I showed her our official request and some background information reprinted from *73 Magazine* and the Philadelphia *Bulletin.* She issued our special call letters, HK1TL, for Tierra-

Luna (earth-moon in English), and gave me an official letter to present to the customs officials. Many letters and documents were necessary for customs in order to bring in such a large amount of complicated radio equipment without having to pay duty. After a mountain of correspondence with the Colombian customs, I was at last beginning to believe that this problem was solved.

The site for the expedition station was selected to be a family beach house on the Caribbean coast about 18 miles from Barranquilla, with a horizon-to-horizon view of the August moon. This is in an isolated area serviced by an experimental power station. I visited the superintendent of the station, a relative, who assured me that there would be adequate electrical power and no problems. I also located some emergency generators for backup. Various ladders, poles and other equipment were located and readied.

Transportation in our country is mostly by bus. Few people own private automobiles, because the cost of even a Renault 6 is about 10,000 American dollars. The AREA 2 members volunteered to drive their cars for our guests' transportation. In addition, I made contact with the chief of the Defensa Civil in our area – which proved to be to our future mutual benefit. He would provide civil defense trucks and civil defense guards for the expedition.

The AREA 2 group was hard at work on our new 2 meter repeater, which we hoped to have ready in time for the expedition. We needed some special parts to complete this project. Our new friends, the Pack Rats, were able to obtain them from VHF Engineering and send them to us. This new repeater is located at 11,000 feet above sea level on a shoulder of Cristobal De Colon Mountain in the Sierra Nevada, about 80 miles from Barranquilla. It operates under an AREA 2 club callsign, HK1EE, on the frequencies 16-76. It covers several thousand square miles from this high location. We used this repeater extensively for liaison during the moonbounce project.

A few days before our guests were to arrive, a problem with their airline tickets came up. Sam's XYL, Rosalba, had arrived in advance with a check to purchase their tickets from Aerocondor Airlines; however, the prices had gone up and the check was thus too small. The group was coming from Philadelphia to Miami on Eastern Airlines, connecting with an Aerocondor flight to Barranquilla. Both airfares had increased. Aerocondor agreed to keep their price as originally quoted. Sheila HK1CWD underwrote the extra cost until the group could arrive and reimburse her. Another problem solved.

Our Pack Rat guests arrived early on the morning of July 26, 1976. There were 9 of them: Elliott K3JJZ and his wife, Lorraine Bolmar WB3AOP/HK1AMW, Sam WB3AFY, Tony W3HMU and his wife Jan, Walt K3BPP, Bill W3HQT, and Danny WA3NFV – along with 1370 pounds of equipment. Even with all the preparations and documents, it still took us two hours to clear the equipment through customs. That doesn't seem too bad, however, when you consider that it usually takes 15 days. We loaded our guests and their equipment into several cars and small trucks. The first stop was for several press conferences. Our guests were prevented from wilting under the hot Colombian sun by several bottles each of our good local beer. Finally, late in the afternoon, we arrived at the beach house QTH.

I must tell you of my impressions of these Pack Rats. These people should be millionaires back in the States, if they work as hard at their occupations as they do at moonbounce. It was very rare when they got more than three hours of sleep a night. If they weren't working radio contacts, they were either repairing something or making preparations for the next day's operation. They were always smiling (except when the power went out) and, even more important, they were always willing to take time to explain, to teach, or to make friends.

The site was not a Shangri-La, but Rosalba did a great job of making it home for our visitors. The AREA 2 gang contributed daily goodies of beer, soda, rum, and homemade cakes. In addition, there is this enormous ocean out front to help moderate the August heat and also provide diversion during power outages. These power problems developed because of the strong afternoon breezes which kept knocking out the electricity. The moonbounce crew located the troublespot. I had three generators which were either too small or too poorly regulated to be of value. The Defensa Civil finally came up with one which would do the job, but by then the problem was cured. However, now we knew where to get one for emergency radio operations. I kept our friends calm by telling them a "proverb" I made up, "The disappointment of a power failure is best soothed by a swim in the ocean." It worked.

We found a combination of English and Spanish and "ham" to work very well. The universal language of amateur radio was equal to all occasions. The success of the expedition has been reported elsewhere. In all, fifteen moonbounce contacts were made with eight countries and 70 QSOs on Oscar 7B were made with five countries. We celebrated at a banquet hosted by the AREA 2 radio club, where we presented our Pack Rat friends with a plaque commemorating the first South American moonbounce contacts. We also elected the Mount Airy VHF Radio Club a brother organization. Afterwards, we found out during an all-night soiree that our North American friends were fully equal to the challenge of a Colombian fiesta.

The benefits of our joint efforts have gone well beyond the moonbounce project. The amateurs and the Defensa Civil have become closer, and are now working on a system of cooperation for times of emergency, when we will provide radio communications through a system of repeaters covering the whole north coast of Colombia. With the AREA 2 club, the radio club of Atlantico, and the Cartegena radio club, HK1BAR and HK1AAH are also working on Oscar systems. Maybe someday soon we will QSO with our friends via the satellite.

A dividend of our project came recently and unexpectedly. A very sick Colombian lady needed a medicine manufactured by the drug company where K3JJZ works. I spoke to Elliott via 20 meters, and he made arrangements for the drug to be flown to Colombia in time to save this lady and her unborn child. This was made possible by the friendship resulting from the project.

Finally, as I wrote this, I flipped through my file of correspondence, looked through the photographs we took, and re-read the newspaper articles that were written. I felt again the excitement of those golden moments we shared together and the warm glow of the friendships we made. The only thing I can say is, "Come back, Pack Rats, we have a Mars bounce waiting for us!" ■

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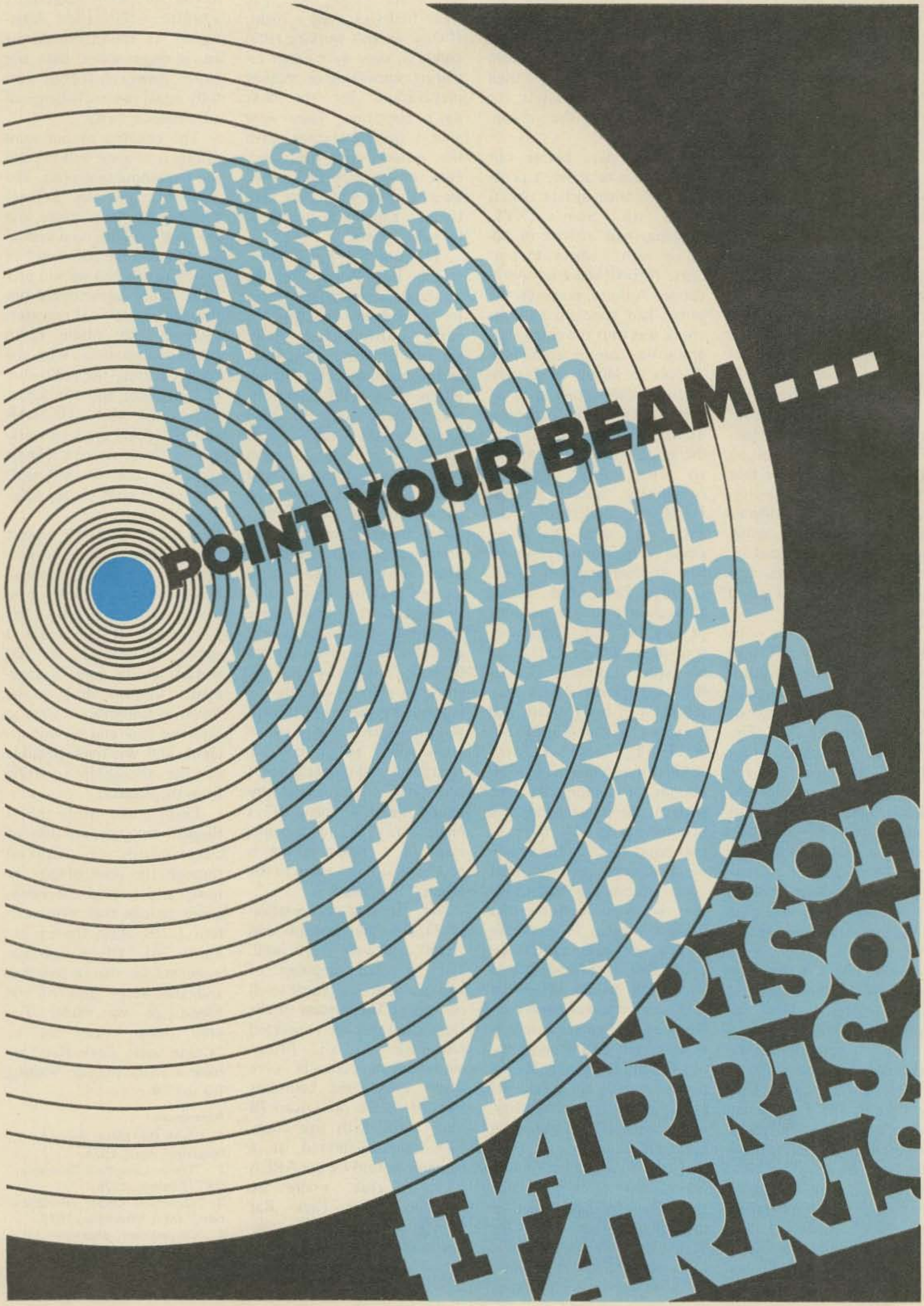
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73's BIL HARRISON, W2AVA

by Wayne Green W2NSD/1

I/O EDITORIAL

KILOBAUD VS 73

One of the tougher decisions to live with was the one whereby we would not print the same articles in both *73* and *Kilobaud*. Every now and then an article comes in that is a natural for *both* magazines and I have to decide where it will go . . . knowing that I am really shortchanging the readers of the other magazine when I make the decision.

For instance, take a beautifully detailed article on keyboards which thoroughly covers every kind of keyboard that you might run into . . . the debouncing circuits . . . gating circuits . . . coding vagaries. Obviously the computer nuts have to have that data . . . and so do you. It's going in *Kilobaud*, so it comes down to this . . . either you subscribe to both magazines (a move I endorse), you write to me and convince me that some articles should be in both magazines . . . or you just make do without some of the cream.

What do you think?

HOW'S KILOBAUD DOING?

The response has been most gratifying. Apparently there was a gigantic need for a magazine for beginning computer people . . . people who know as little as I do about them. I've made sure that the articles are simple enough so that I'm able to understand them — and this has hit the jackpot.

Kilobaud, like *73*, is *packed* with interesting articles. I'm getting a lot of the same comments on it that I do on *73* . . . particularly that while the readers do get other magazines, it only takes them a short while to read the others and it takes days to read *Kilobaud* because there is so much of interest in it.

The first print run of 25,000 copies of the first issue of *Kilobaud* sold out and we're printing up some more to try to keep up with the demand. If we can keep up the momentum, *Kilobaud* will be the largest circulation magazine in the hobby computer field by its fifth issue . . . all the result of our publishing a massive amount of fantastic and easy-to-understand articles.

News? We need input, and one of the best sources is the club newsletter. Got one? We reiterate our longstanding offer of a free subscription to 73 *or* Kilobaud *in exchange for a spot on your ham or computer club newsletter mailing list. Deal?*

HAMS VS COMPUTERS

Computer exhibits at hamfests and conventions continue to be the most mobbed, as more and more hams discover that a microprocessor is just a newfangled IC with which they are going to have to get familiar. The longer you put off getting into this fascinating part of modern electronics, the more alienated you may find yourself. Try to remember, if you're old enough, how a sizable group of hams tried to ignore solid state, complete with *QST* as their flagship.

The fact that there are about 50,000 people into hobby computing should be an inkling that it is fun. You don't gather up that many fish in a two year period without awfully attractive bait.

One interesting part of this is that while it doesn't hurt to understand how computers work to play with them, it is by no means mandatory. You'll find that only a small percentage of the hobbyists know as much about their systems as you think they do. This is one of the reasons that *Kilobaud* has been such a hit . . . it doesn't assume a lot of knowledge on the part of the reader.

It's quite possible to either buy an assembled computerette or put together a kit and have a ball with it without ever knowing how the blamed thing works. The "appliance operator" rides again. I tend to think in terms of "black box" users . . . and I think that this is going to be the direction of the major growth in microcomputers.

More and more we will be seeing interfaces between these computers and ham gear . . . with television sets . . . with the new video games . . . and all we'll have to be able to do is load programs and have fun. I think most of us will get accustomed to writing our own programs for special jobs we want to do . . . and get so we can read a program in BASIC just as we do a schematic diagram. Kids under ten years old can do it.

Be sure to get to Atlanta in June (18-19) and check out the computer exhibits . . . there will be a lot of them. Those of you who can get to Seattle will have a choice bunch of computer exhibits to see also . . . last weekend in July. I'll be at both . . . be talking on the programs . . . and answer as many questions as I can.

ATLANTA JUNE 18-19

This is the biggest convention in the country outside of Dayton . . . and will be dragging 'em in from all over the South. Chaz Cone (of Navassa Island fame) is the fearless leader on this one and he's rounded up some nice prizes for those who still think there is a free lunch. The biggy is a KDK-144 synthesized rig, a Larsen antenna and a new car to go with the combo . . . talk about thinking *big!*

That's the good part . . . but then nothing is ever perfect, so the fact that I'll be speaking every now and then needn't be held against the effort. If there is any interest, I'll give some details and answer questions on how to get your own business started in your spare time making ham gear (how to become rich). If everyone is so used to being poor . . . or is rich already . . . then I'll give some inspiring words on the WARC debacle . . . a message of cheer to ARRL fanatics . . . how to write articles for *73* and get famous . . . or stuff like that.

It is high time to pencil in that weekend for some fun . . . and Atlanta is a ball! Between Underground Atlanta (I wouldn't miss it!), Stone Mountain (ditto), Aunt Fanny's (wow, what food!), there is so much to do and see around Atlanta that it is worth the trip without any convention.

The convention will have some of the top speaking talent . . . great prizes . . . possibly more exhibits than Dayton . . . including the latest in ham-oriented computer stuff . . . and the friendliest bunch of hams you'll run into anywhere.

HELP!

A glance at any issue of *Kilobaud* will indicate an amazing number of companies providing microcomputer kits, peripherals, and software. The *KB* laboratory is obtaining as much of this hardware as possible, for evaluation purposes as well as for production of software cassettes that you will be seeing at your favorite computer emporium. We have reached the point where our computer specialists could spend their entire day building, testing, and debugging micro systems. Of course, this is not the best situation when there is so much else to do, like getting a chance to do some skiing or snowmobiling every once in awhile. We are looking for a digital technician to help with our microprocessor overload. This individual must be up on digital construction techniques, and familiar with TTL and CMOS. Practical experience with microprocessors is a must considering the nature of the job! Also, feel free to include in your resume any experience you may have had in interfacing peripherals, such as floppy disks, terminals, or cassettes, to a microprocessor system. The *KB* laboratory has the scopes and test equipment you will need to get our microprocessors going. (Software knowledge sure would help, since hardware expertise gets you exactly half-way in the computer business!) Give it some thought. If you are interested in coming to New Hampshire (no gas shortage here), let us know, addressing the above points as completely as possible. Sell yourself. We plan on reading more than one resume, so please — no hand-written jobs. After reading every sort of scrawl that gets sent to *KB* for six hours, imagine what sort of reception your hand-written resume will receive at 4 pm. Please mark your envelope with a bold "RESUME," as our mail sorters also put in a full day's work . . .

If You're Still Playing Games It's Because You Haven't Seen Our Software Library

This Library is the most comprehensive work of its kind to date. There are other software books on the market but they are dedicated to computer games. The intention of this work is to allow the average individual the capability to easily perform useful and productive tasks with a computer. All of the programs contained within this Library have been thoroughly tested and executed on several systems. Included with each program is a description of the program, a list of potential users, instructions for execution and possible limitations that may arise when running it on various systems. Listed in the limitation section is the amount of memory that is required to store and execute the program.

Each program's source code is listed in full detail. These source code listings are not reduced in size but are shown full size for increased readability. Almost every program is self instructing and prompts the user with all required running data. Immediately following the source code listing for most of the programs is a sample executed run of the program.

This Library is destined to become one of the reference bibles for the small computer field, due to its versatility and uniqueness and the ease of operation of the programs it contains. These volumes are deductible as a business expense when purchased by a company. Send your remittance for prompt delivery, while supplies last. Volume discounts are available to qualified dealers.

The entire Library is 1000 pages long, chock full of program source code, instructions, conversions, memory requirements, examples and much more. ALL are written in compatible BASIC executable in 4K MITS, SPHERE, IMS, SWTPC, PDP, etc. BASIC compilers available for 8080 & 6800 under $10 elsewhere.

This LIBRARY is a complete do it yourself kit. Knowledge of programming not required. EASY to read and USE. Written in compatible BASIC immediately executable in ANY computer with at least 4K, NO other peripherals needed.

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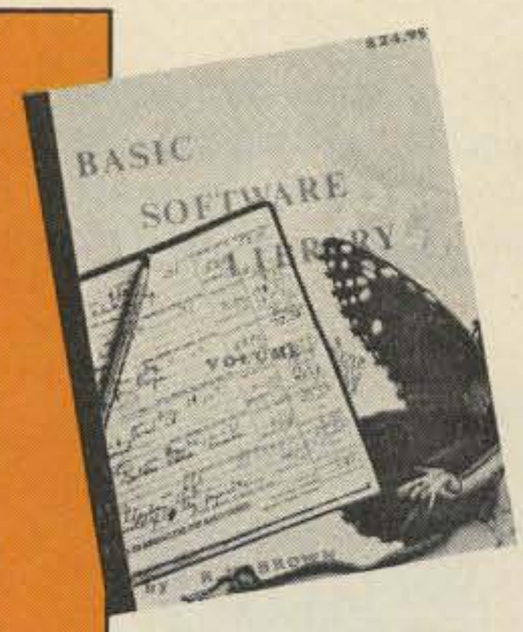

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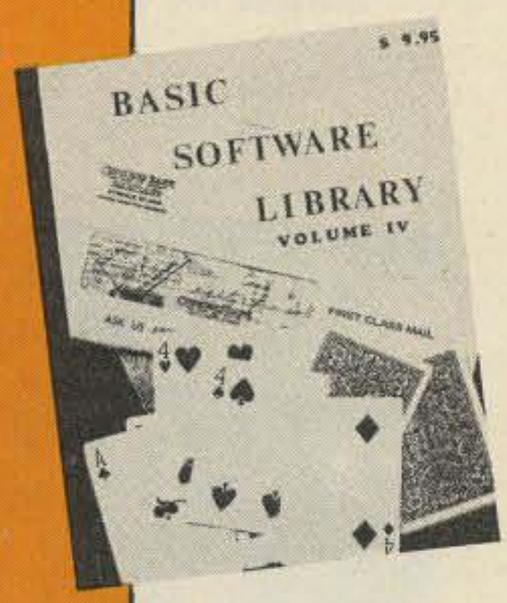

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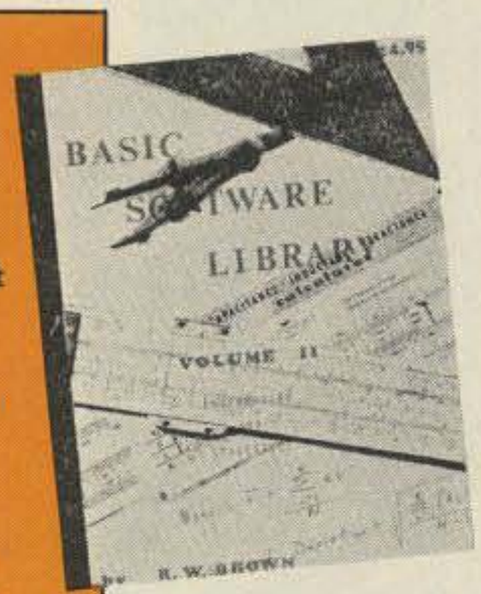
APPENDIX A
BASIC STATEMENT DEF



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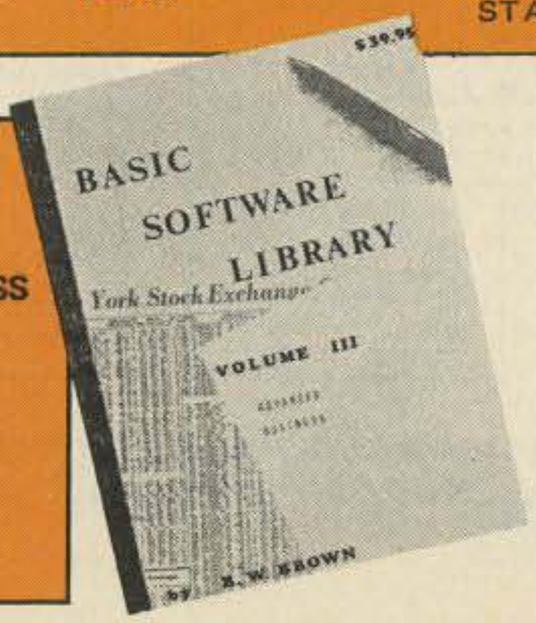

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- - the ST-6 TU and 8080 micro

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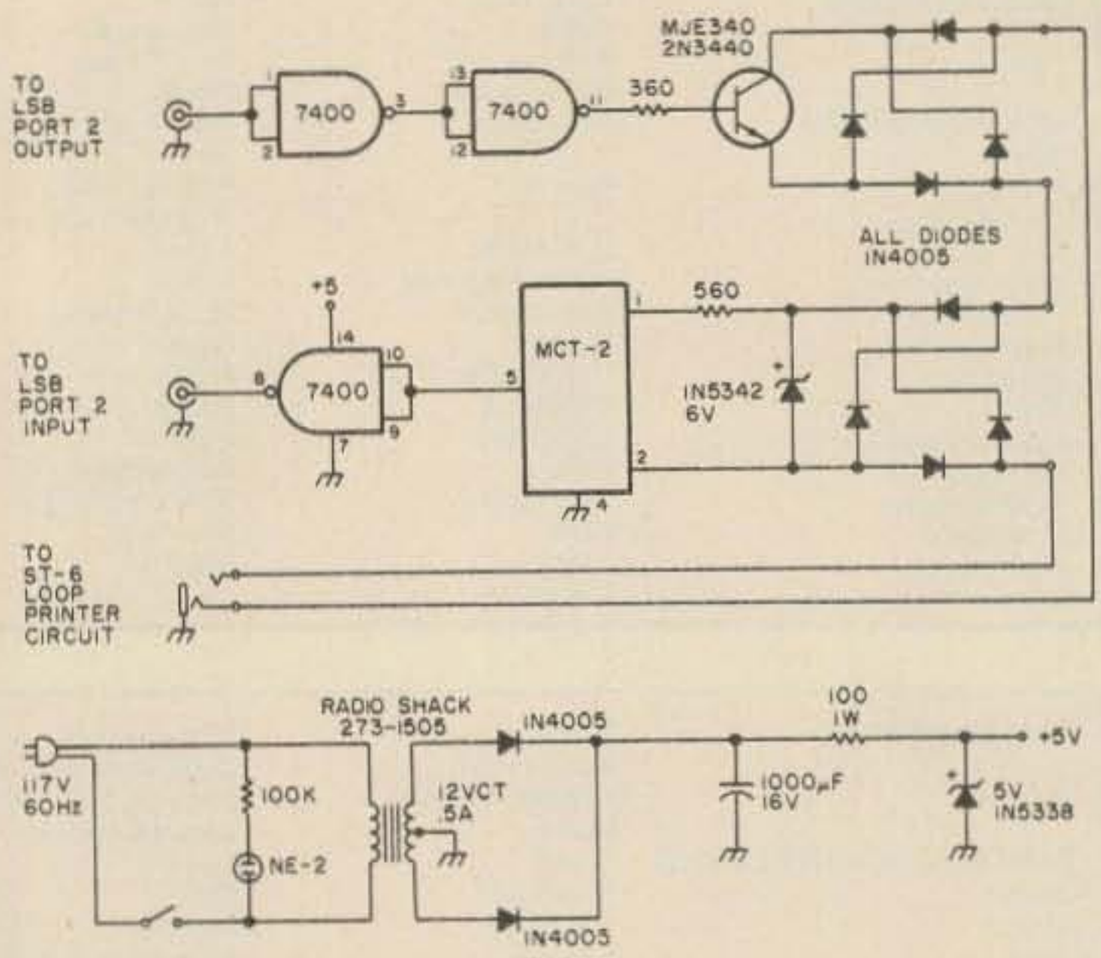


Fig. 1. The RTTY interface unit schematic diagram.

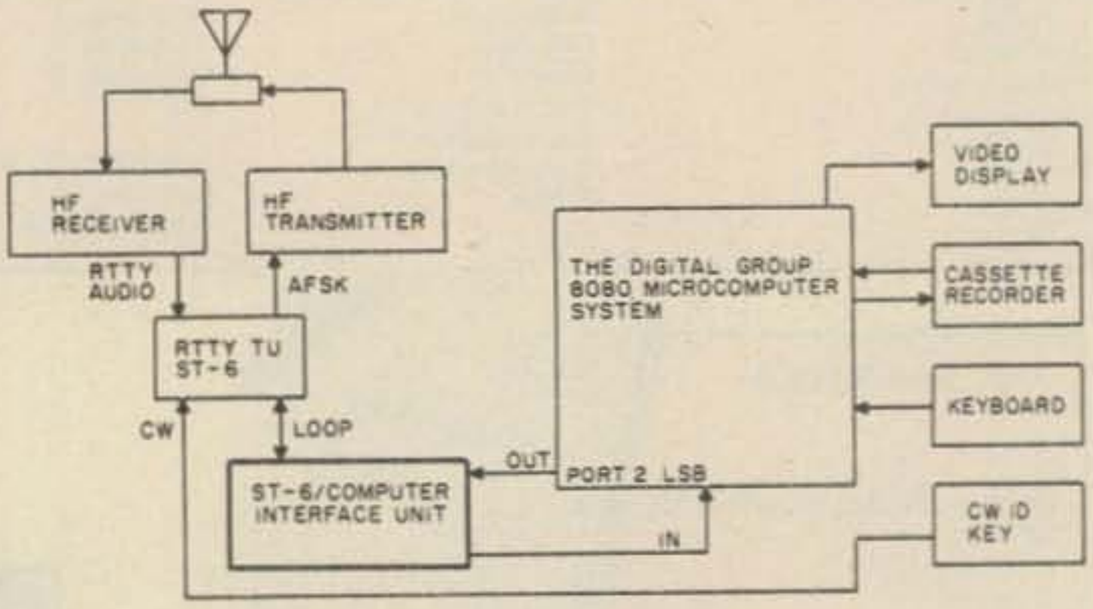
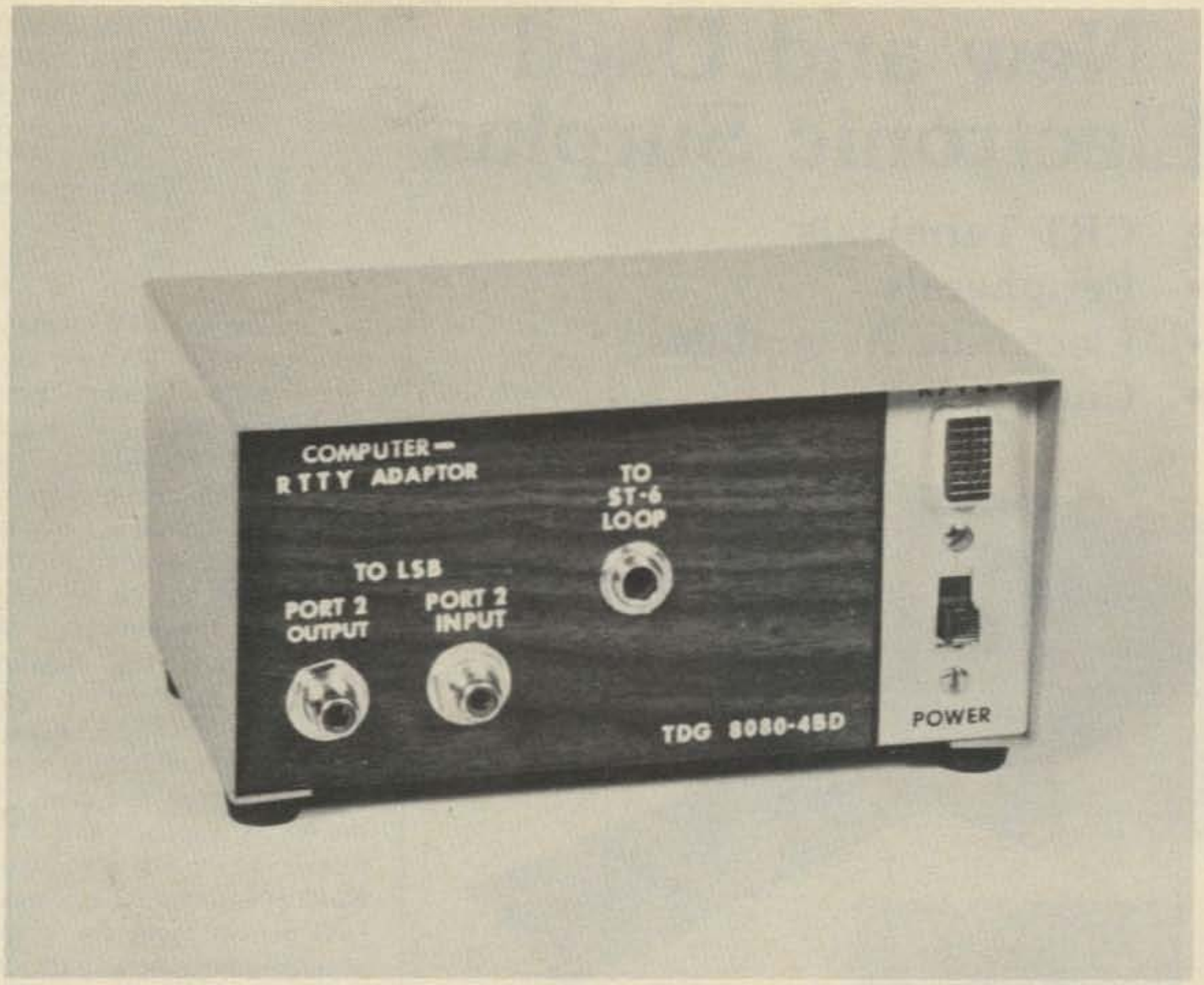


Fig. 2. System block diagram illustrating how adapter is used to interface the ST-6 to computer.

how to use the machine for something other than playing games and doing simple math problems. Since I built my machine[1] with the idea of using it in my ham shack, I decided that after several months of playing and writing games, I would move it from the living room down to the ham shack and see what could be done to get the thing to talk to my transmitter and listen to my receiver on RTTY and CW. This article will describe my efforts in connecting it to my ST-6 RTTY TU and programming the computer to act as a "Model 28 KSR."

I ordered a copy of the HAM-1 audio cassette program for the 8080 system from The Digital Group Software Systems[2], and when it arrived a few days later, I studied the written material that came with the tape recording. The HAM-1 cassette enables the operator to program the computer for operation in two modes, one as a TTY keyboard and video terminal (TTY-TVT), and the other as a CW keyboard with message storage buffers and a CW reader with the characters appearing on the video display (CW-TVT).

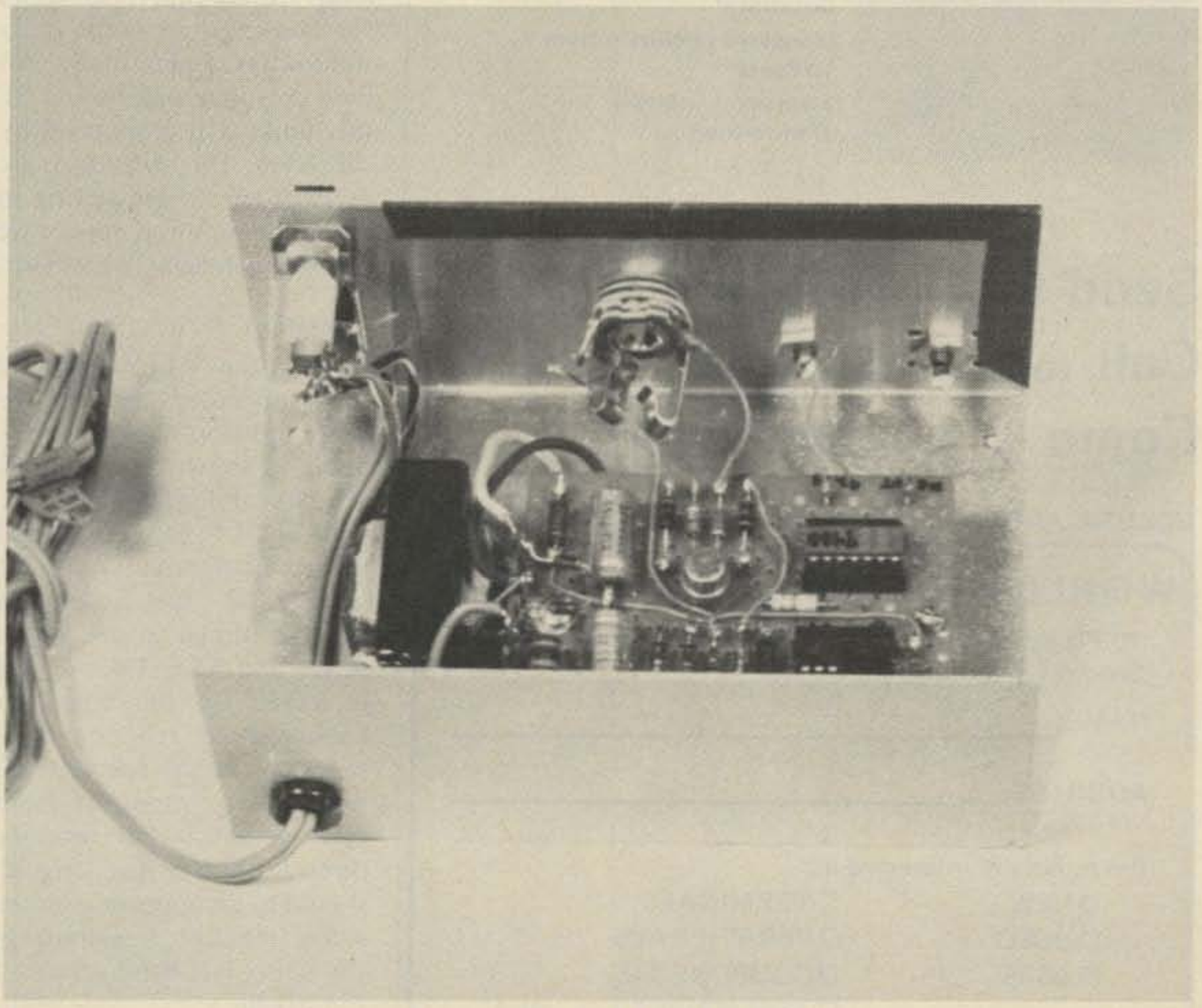
In the instructions, I also found information on how to modify the HAM-1 program to connect the output of the TTY data to port 2 or 3 input and output terminals. I modified the program on my machine to use the least significant bit terminal of port 2 and made a new copy of the program using the "Cassette Write" function. I plan to use the port 3 terminals for a CW system. TTY output signals appearing at these selected ports are in a Baudot coded, serial bit stream, at TTL logic levels. That is, a MARK as plus 5 volts and a SPACE as 0 volts. TTY speeds may be selected from keyboard commands for 60, 66, or 100 wpm. Once the program had been modified as suggested in the HAM-1 data package, the next step was to determine how to connect it to my ST-6 TU to receive and send RTTY.



The completed RTTY adapter.

The ST-6/Microcomputer RTTY Interface Unit

The RTTY interface unit shown in the schematic diagram of Fig. 1 performs two functions. The first is to take



Interior view of RTTY adapter.

```
H011 L140   303 320 011
H011 L320   376 240 302 340 011 315 372 000
            076 004 315 242 011 303 135 011
            376 215 302 145 011 026 002 076
            010 315 242 011 025 302 347 011
            076 002 315 242 011 303 135 011
```

Fig. 3.

the incoming TTY signals from the ST-6 TU loop circuit and isolate them from the low voltage TTL logic circuits in the MCT-2. The TTL level Baudot signal from the MCT-2 optical isolator is buffered and inverted in the 7400 and is sent to the least significant bit terminal of port 2 input. This Baudot signal is processed in the microcomputer and displayed on the video monitor.

The second function of the RTTY interface unit is to receive keyboard generated, Baudot encoded, TTL logic level signals from the computer and feed them to the dc loop keyer transistor stage of the RTTY interface unit. The keyer transistor keys the ST-6 loop through the diode bridge. The ST-6 converts the loop signals to AFSK tones for transmission to the radio transmitter audio input. No loop dc supply is required for this unit, as it is supplied by the ST-6. Diode bridges are used to keep from having to worry about loop supply dc polarity damaging the circuit.

Operation

With the RTTY interface unit connected between the ST-6 and port 2 of the computer as shown in the block diagram of Fig. 2, the modified HAM-1 tape is loaded into the computer. A RTTY signal (60 speed, narrow shift) is tuned in on the receiver and ST-6 TU. A 7-1-1 is keyed on the computer keyboard to tell the computer to set the speed at 60 wpm, receive mode, in upper case letters. The resulting decoded Baudot signals should begin appearing on the video monitor beginning in the upper left hand corner of the screen.

To transmit the TTY signal, the RESET key is depressed, and when the monitor program appears an instant later, the 8 key is depressed. This calls up the computer in the TTY keyboard mode. The ST-6 TU is switched to the send mode and the transmitter is keyed. Typing on the computer keyboard will now send AFSK signals to the transmitter.

Modifications to the HAM-1 Program

During the testing of the HAM-1 program, it was determined that there was no method of sending the carriage return (CR) or line feed (LF) functions that are required when you are sending to a station equipped with only a mechanical TTY machine. This problem was brought to the attention of The Digital Group and the modifications shown in Fig. 3 were developed for the HAM-1 tape program. The listing will provide two carriage return and one line feed signal when the RETURN key is depressed on the keyboard.

Conclusions

For those who have an ST-6 or similar type RTTY TU, this little interface unit may be used to connect the microcomputer to the TU for computer generated Baudot RTTY communication. The next article will cover a low cost RTTY TU that is designed for direct connection to the computer and ham station equipment. ■

References

[1] "A Ham's Computer — CW/RTTY the easy way," Louis Hutton, *73 Magazine*, December, 1976.

[2] Digital Group Software Systems, Inc., PO Box 1086, Arvada CO 80001. HAM-1 Cassette, $5.00.

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Interrupts Explained!

- - getting a micro's attention

Robert Leyland ZL1TRM
113 Orakei Rd.
Auckland 5, New Zealand

For most microprocessor owners, the subject of interrupts is avoided like the plague. This should not be so. Interrupts are among some of the most useful options available to the microprocessor owner.

The very nature of interrupts (i.e., their unpredictability) accounts for the fear and mistrust of using them. My *Dictionary of Electronics* defines an interruption as: "In microcomputers: a halting of the main program followed by the starting of an interrupt subroutine, or returning from the subroutine to the main program."

Either way, it does not make much sense until you realize just how useful an interrupt is.

An interrupt is virtually a "Hey you" followed by an "I want this done now . . ." The loudness of the "Hey you" indicates its priority if more than one arrives at once. When an interrupt occurs, you drop whatever you are doing and go to the interrupter to see what he/she/it wants, and when this is completed, you are free to return to what you left.

A more useful analogy when considering interrupts is the telephone. Picture yourself sitting with some friends chatting (main program) when the telephone rings (an interrupt). You excuse yourself and go to answer the telephone (jump to the interrupt location). When you pick up the receiver, the telephone becomes engaged (interrupts are disabled), and you talk to the person calling (execute the interrupt subroutine). When you have finished, you hang up the receiver (enable interrupts) and resume the conversation with your friends (return from interrupt).

Priority and multiple interrupts can also be considered in this fashion, such as the doorbell ringing (high priority), the telephone (low priority, let the XYL answer it), or a call on your ham gear (high priority to you, but low to the XYL). The analogy can be carried much further.

In the following description, I have tried to be as general as possible, because with the wide variety of chips, each with its own unique interrupt system, the details are best left up to the programming manual for that particular chip.

However, the basic rules of interrupts are common to all systems. Interrupts were developed to handle a particular type of situation. This situation is when an external device, at some unpredictable moment, requires that the computer do something immediately.

When an interrupt occurs, the CPU (Central Processing Unit) must literally drop everything, but it must remember where it was before the interrupt occurred. To do this in most systems, all of the contents of the registers are pushed onto the stack (an area of memory or other hardware storage) before the CPU jumps to the interrupt location (the interrupt subroutine). Then the CPU will perform the subroutine at the interrupt location. During this time, the CPU does not want to be interrupted again and, for this reason, most microprocessors have a Disable Interrupts instruction (e.g., DI, hex F3 on the 8080A and SEI, hex OF on the M6800) which allows the CPU to ignore any "Hey you" no matter how loud, while it performs the current interrupt subroutine.

Systems of interrupts are generally unique to the chip and/or the machine's implementation, but generally there are three main categories:

Single Line Interrupts:

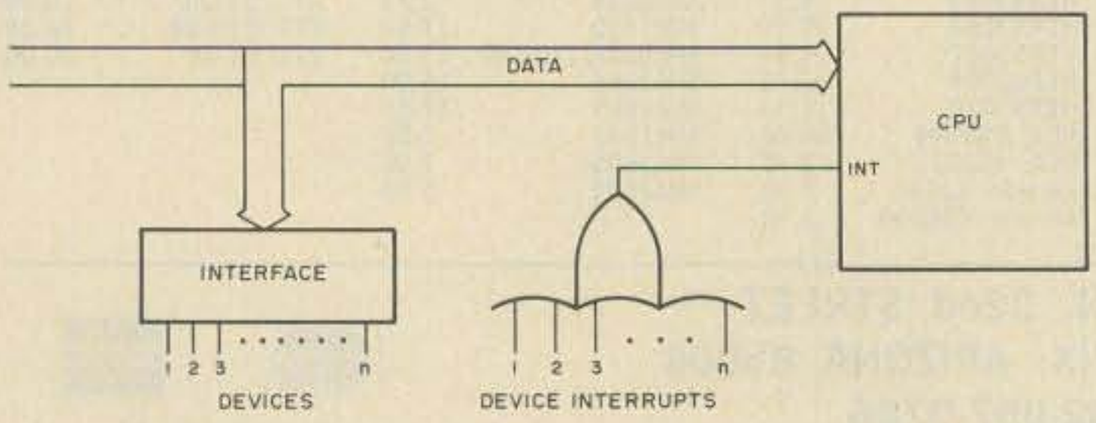

Fig. 1. Single line interrupts.

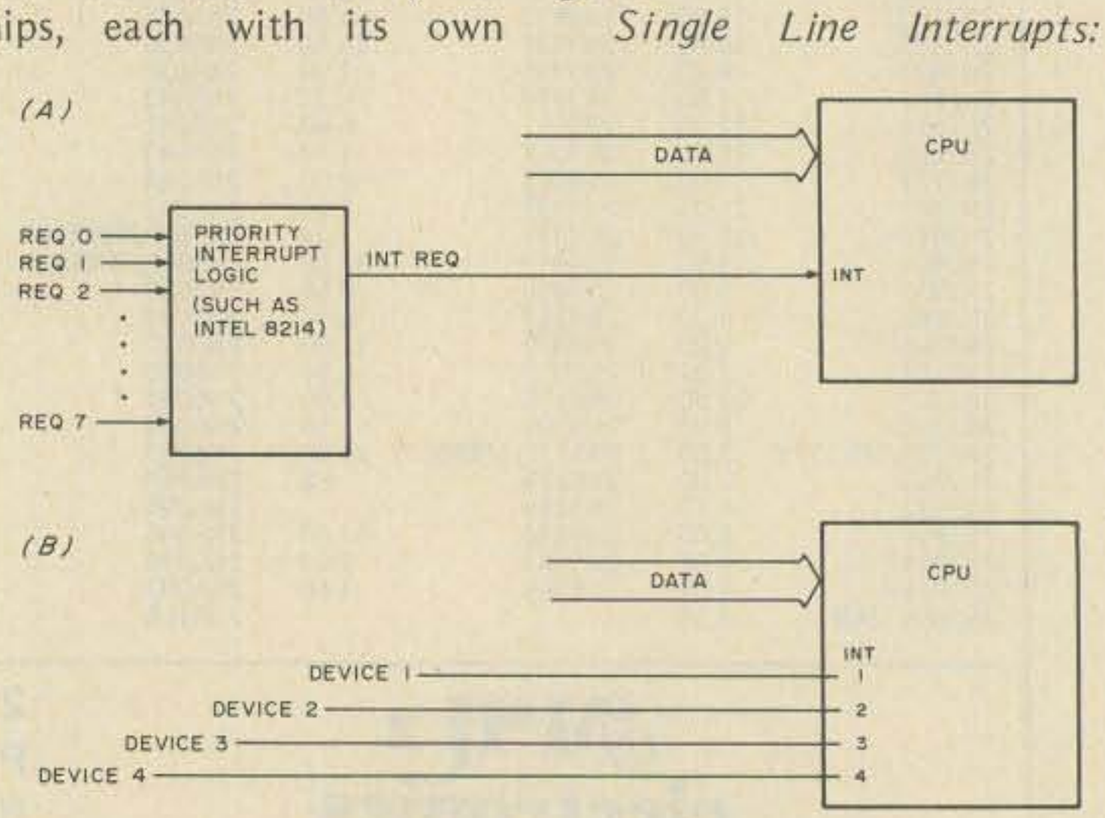

Fig. 2. Multi-level interrupts.

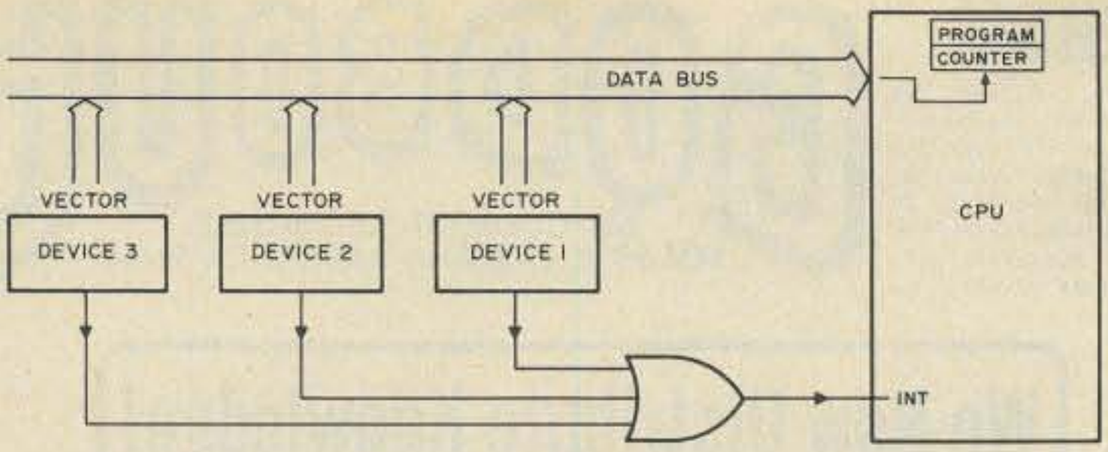

Fig. 3. Vectored interrupts.

Here the processor responds to an interrupt on one line (see Fig. 1). For more than one, the devices are tied to an OR gate and the individual devices must be scanned by the processor to find out which one generated the interrupt (also referred to as "polling"). Because of this, single line interrupts are slow.

Multi-level Interrupts: Here the interrupts could occur on one or several lines going into a priority determination chip or logic (see Fig. 2a). If the number of devices generating interrupts is greater than the number of lines, then some lines must be used as in single line interrupts. The M6800 has two multi-level interrupts within the chip, such as in Fig. 2b.

Vectored Interrupts: In this case, only one line is used, but the interrupting device generates an instruction onto the data bus which causes the CPU to jump ("vector") to a predetermined subroutine. The device priority must be resolved in hardware external to the CPU (the 8080A has a limited form of vectored interrupts). Fig. 3 is a block diagram of a vectored interrupt configuration.

On return from an interrupt, the CPU must be returned to the state it was in before the interrupt occurred. This is often done by a specific instruction, Return from Interrupt (RTI, hex 3B on the M6800). This brings the contents of the registers (especially the Program Counter) back from the stack, so that return to the main program can be accomplished.

With a microprocessor, control lines other than the interrupt lines may be used as specific purpose interrupts, and in most systems they are. The control bus lines, HOLD and WAIT (or their equivalents), are normally used for slowing down or synchronizing the CPU to slow memories. They can also be used as Halts for DMA (Direct Memory Addressing) applications.

The RESET line is a major interrupt line which returns the processor to some initial state to halt the execution of a program. This line could be set by hardware devices any time a major catastrophe occurs (such as a tape drive failure).

Such control lines are normally used to provide versatility for the microprocessor in different machine implementations of the chip and to allow it to be used with a wide variety of devices, e.g., in parallel processing, where several processors are using the same memory (Fig. 4) and switch each other off or on along the HOLD/WAIT lines. Although these lines were designed for interface with slow memories, they are particularly well suited to allow parallel processing and other DMA applications.

An example of the use of DMA would be for slow to fast scan conversions using a microprocessor. The SSTV analog could be digitized (analog to digital conversion) and stored, and the wideband ATV scanned off the same memories by DMA for display on a normal TV set. Think of the graphics facilities this would allow for both SSTV and ATV!

Similar examples of the use of interrupts can be considered by multi-user computers. An example would be to put the microprocessor up near the local repeater and have it accessible to amateurs with RTTY gear. In this case, the use of interrupts would be essential (for timing users, I/O transmission control, etc.).

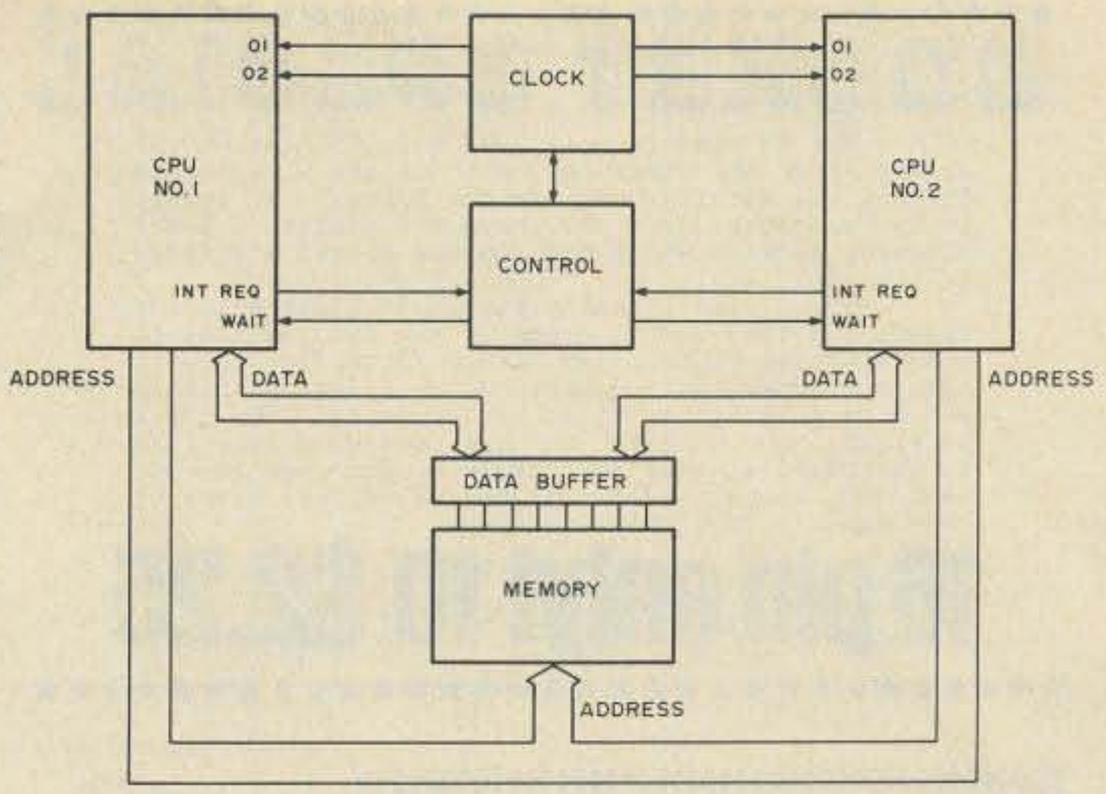

Fig. 4. Parallel processing.

Closer to home, interrupts allow the user to have input and output to several devices occurring simultaneously (or almost) and not wasting time while doing this. As in most computers, the actual processing time is very short in comparison to the input/output time; this means the more time taken for input/output during the processing, the less efficient your programming will be (which may not be a major consideration with home systems today, but will be in the years to come). ■

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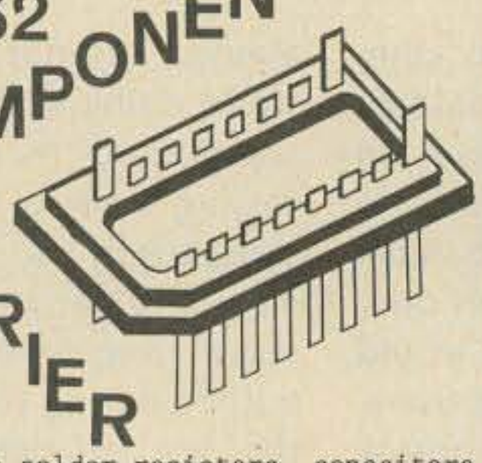

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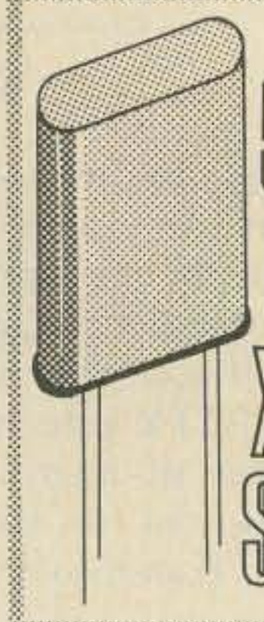

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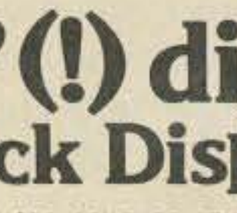

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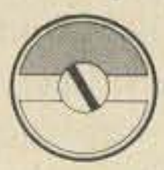

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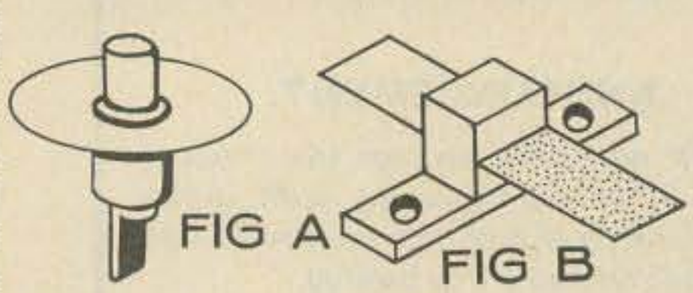

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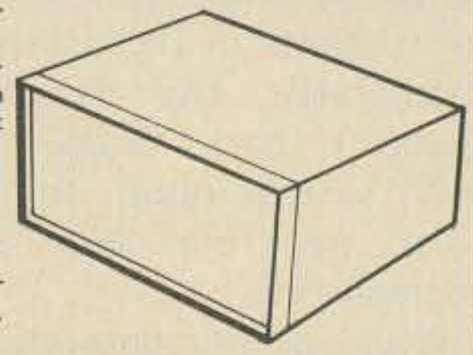

CW for the 6800

- - it works!

L. C. Wells WA4FMZ
Route #2
Calvert City KY 42029

What? A Morse code reader? And it hasn't been four months since Wayne Green frothed all over his *73* editorial page because another computer mag, in covering computerized Morse code, suggested that 1000 wpm Morse QSOs were possible, and apparently not unlawful. At the moment, anyway.

OK, so I agree with Wayne, at least partially. For one thing, I would probably pay an admission fee just to watch two hams wax extemporaneous at 1000 per. For another, if high speed data transmission is needed, Morse and on-off CW is definitely not the best modulation scheme.

That brings us to this particular Morse reader. It is not designed for high speed, but instead for 5-20 wpm. Its main purpose is to take a subject that a ham has some familiarity with (Morse), and demonstrate what happens as it is processed, decoded, and displayed by that enigmatic box (an SWTP 6800 computer) said ham got for Christmas. If, in the process,

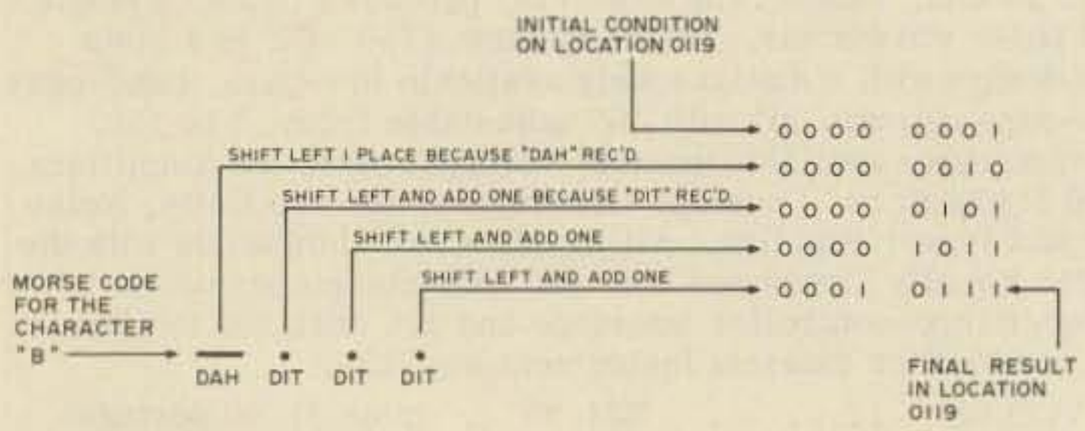

Fig. 1. Example of address generation for decoding table.

Loc.	Data	Remarks
0000	20	Long mark fix
0001	H20	H 20= Space
0002	54	H 54= T
0003	45	H 45= E
0004	4D	H 4D= M
0005	4E	H 4E= N
0006	41	H 41= A
0007	49	H 49= I
0008	4F	H 4F= O
0009	47	H 47= G
000A	4B	H 4B= K
000B	44	H 44= D
000C	57	H 57= W
000D	52	H 52= R
000E	55	H 55= U
000F	53	H 53= S
	***	
0012	51	H 51= Q
0013	5A	H 5A= Z
0014	59	H 59= Y
0015	43	H 43= C
0016	58	H 58= X
0017	42	H 42= B
0018	4A	H 4A= J
0019	50	H 50= P
	***	
001B	4C	H 4C= L
	***	
001D	46	H 46= F
001E	56	H 56= V
001F	48	H 48= H
0020	30	H 30= 0 (Zero)
0021	39	H 39= 9
	***	
0023	38	H 38= 8
	***	
0027	37	H 37= 7
	***	
0029	21	H 21= ! ($\overline{KN}$)
	***	
002D	2F	H 2F= / (Slant sign)
002E	2D	H 2D= - ($\overline{BT}$)
002F	36	H 36= 6
0030	31	H 31= 1
	***	
0035	25	H 25= % ($\overline{AR}$)
	***	
0037	3D	H 3D= = ($\overline{AS}$)
0038	32	H 32= 2
	***	
003C	33	H 33= 3
	***	
003E	34	H 34= 4
003F	35	H 35= 5
	***	
004C	2C	H 2C= , (Comma)
	***	
006A	2E	H 2E= . (Period)
	***	
0073	3F	H 3F= ? (Question mark)
	***	
007A	5D	H 53=] ($\overline{SK}$)
	***	
00FF	23	H 23= #(Error)

Fig. 2. Decoding table.

said ham discovers that machine language programming agrees with him, and he then goes on to improve and modify this program until it is really good, I shall be happy.

My system consists of an SWTP 6800 with 8K of memory (I plan on a minimum of 16K), CT1024 TVT interface, a surplus full ASCII encoded keyboard which has a lower case lockout key, an AC-30 cassette interface, a 12" Zenith black and white TV converted to a monitor, and one extra general purpose parallel interface board, which is plugged into location 8000.

This is the first programming I have ever tried, so go easy on the criticism; you are definitely not shooting at big game.

I will attempt to answer any questions that my limited technical expertise will allow, and welcome anyone to drop in for a gab session if you happen by my QTH.

Fig. 3. Morse code receive program listing.

```
0105   00              COUNTER
0106   12              AV DOT
0107   28              FIXED DELAY
0108   B6  0106  LDA-A
010B   F6  0107  LDA-B
010E   5A        DEC B
010F   26  FD    BNE
0111   4A        DEC A
0112   26  F7    BNE
0114   7C  0105  INC COUNTER
0117   39        RTS RETURN
0118   00        (Not used for anything now.)
0119   00        RMB TEMP CHAR STORAGE
011A   86  04    LDA-A  }
                         } Initialize Interface
011C   B7  8003  STA-A  }
011F   86  01    LDA-A  }
                         } Initialize TEMP CHAR STORAGE
0121   B7  0119  STA-A  }
0124   7F  0105  CLR     COUNTER
0127   B6  8002  LDA-A  Get input
012A   81  00    CMP-A  Still high?
012C   26  F9    BNE    Back to 0127 if no input
012E   BD  0108  JSR    To TIMER
0131   B6  0105  LDA-A  Have mark count
0134   81  30    CMP-A  Check for long mark
0136   25  0D    BCS    If not, go to 0145
0138   B6  0000  LDA-A  Get fix
013B   B7  0105  STA-A  Put in COUNTER
013E   B6  8002  LDA-A  Check input
0141   27  FB    BEQ    Recycle if still active
0143   20  25    BRA    Call it a dash
0145   B6  8002  LDA-A  Check input
0148   27  E4    BEQ    Back to 012E while active
014A   B6  0105  LDA-A  New count
014D   44        LSR-A  Div new count by two
014E   B1  0106  CMP-A  To AV DOT
0151   24  17    BCC    To ENTER DASH at 016A
```

The Program

This program will run in as little as 2K of memory, but you do need the extra parallel interface card. Wire the input plug so that I-1 through I-7 are grounded and your hand key (or any make-break keyer) connects between I-0 and gnd.

With the key open, the input line (I-0) floats high like any TTL input. This means the program expects a logic 0 as evidence of activity.

The program does a pretty good job of reading my hand key (very sloppy) or my home brew "accu-keyer"[1] which is reed relay output. It will compensate for speed changes from less than 5 wpm to more than 20 wpm. But, here resides one bug for you to work on. It will not swallow that much of a speed change in one gulp. It must have a couple of letters input at mid-range to bring AV DOT (average dot) closer to agreement with what is actually coming in.

How does it distinguish between a dot or dash? The decoder is based almost entirely on dot length. Why? Did you ever hear an ancient brasspounder on a vibro-plex? A "V" usually comes out sounding like a spooked deer crossing a narrow meadow: three staccato dits and a dah that floats for an impossible time. So, if a single dah lasts for half a day, the decoder will simply call it a "T" and make an adjustment to COUNTER, assuming that the next dit will be of proportionate length.

If the incoming mark is any number less than twice the AV DOT, it is called a dot, added to AV DOT, divided by two, and inserted back in AV DOT as a new average. This is the way it makes speed adjustments. Immediately following a mark, it must decide if the ensuing silence is an element space, a character space, or a word space. We do this by cycling through TIMER, incrementing COUNTER each time, comparing COUNTER to AV DOT each time, and checking for more input each time. If new input occurs before two AV DOTs, it is called an element space, and goes back to process the new input for insertion in TEMP CHAR STORAGE with the last insertion.

If COUNTER gets as high as two AV DOTs, it is a character space, and falls through to the output subroutine, prints the character, then reenters the space routine to determine if a word space is necessary. If it again reaches two AV DOTs without interruption, it again falls through to the print command, but this time a reinitialized TEMP CHAR STORAGE contains only a binary 0000 0001, which, when translated to an LDA-A direct from location hex 0001, loads A with hex 20 (stored there). Hex 20 is an ASCII space, and that's what is printed. At this point, having been through the space decode more than once without interruption, the program jumps back to the beginning, and waits for more input.

Now, how is decoding and storing accomplished? There have been several different methods published. Most involve dual input registers, complementing, adding, and so on. Being somewhat simple to start with, I prefer a simple method. And, if you can call a dit a logic 1, and a dah a logic 0, what could be simpler?

Only one slight hitch: How do you distinguish between an S, M, T, and zero? These would all give an

[1] *QST*, August, 1973, J. M. Garrett WB4VVF.

```
0153  48          ASL-A   Restore
0154  F6  0106   LDA-B   Get old count
0157  C4  7F     AND-B   Restrict to 7 bits
0159  1B          ABA     Add accumulators
015A  BD  01A2   JSR     See count doesn't get too short
015D  78  0119   ASL     Prepare to enter dot
0160  86  01     LDA-A
0162  BB  0119   ADD     0119 to A
0165  B7  0119   STA-A   ENTER DOT
0168  20  03     BRA     To space decode
016A  78  0119   ASL     ENTER DASH
016D  7F  0105   CLR     Clear counter
0170  BD  0108   JSR     To timer
0173  B6  8002   LDA-A   Check input
0176  27  37     BEQ     If active, was element space, go to 01AF
0178  B6  0106   LDA-A   Get AV DOT
017B  48          ASL-A   Mult by two
017C  B1  0105   CMP-A   Compare to counter
017F  22  EF     BHI     If less than 2 AV DOTS, go to 0170
0181  F6  0119   LDA-B   Get temp char storage
0184  F7  0188   STA-B   Store in OFFSET (0188)
0187  96  00     LDA-A   Direct from loc specified
0189  BD  E1D1   JSR     Now print it!
018C  86  01     LDA-A   Prepare to print a space
018E  B7  0119   STA-A   Store in temp char storage
0191  7C  01A1   INC     Increment space storage
0194  B6  01A1   LDA-A   Get space storage
0197  81  01     CMP-A
0199  23  D2     BLS     If same or less, go to 016D
019B  7F  01A1   CLR     OK, clear it now
019E  7E  011F   JMP     Go wait for new input
01A1  00          RMB     SPACE STORAGE
      **********
01A2  44          LSR-A   Div by two (from 015A)
01A3  81  08     CMP-A
01A5  23  04     BLS     If same or less, go to 01AB
01A7  B7  0106   STA-A   Store new av dot
01AA  39          RTS     Return
01AB  86  14     LDA-A
01AD  20  F8     BRA     Back to 01A7
      **********
01AF  7F  01A1   CLR     Clear space storage (from 0176)
01B2  7E  0124   JMP     To 0124; it was element space
```

identically empty register. Or worse, how about N and E? Both would give a binary 0000 0001. There would be other similar mix-ups, and changing to calling a dit 0, and a dah 1, is the same situation viewed from the backside. OK, it looks like we need a "place marker." Bingo! That's it. All we have to do is pick a place for temporary storage (we'll use memory location hex 0119), and initialize the data there to binary 0000 0001. Now, when we have a dah to store, we instruct hex location 0119 to "arithmetic shift left" (ASL). This moves everything left one bit, and puts a zero in the least significant bit (0000 0010). When we have a dit to store, it's just a bit more complicated: We shift location 0119 left (ASL 0119); then we store a 1 in the A accumulator. We then add H0119 to the A accumulator and then store the A accumulator in location 0119. In this case, with a single dit and nothing else entered, 0119 would contain 0000 0011. After keying in a properly spaced B, the data in 0119 would be 0001 0111 (see Fig. 1).

Now that we have numbers we can work with, how do we get them on the screen?

With the SWTP 6800, you can use the existing MIKBUG output routine located at hex E1D1. The literature says that to use this routine, the ASCII equivalent of the character to be printed must be in the A accumulator when the routine is entered. All we need do is convert our binary gibberish to ASCII and store it in the A accumulator, then execute a BD E1D1. The ASCII conversion works like this: We need another temporary storage register to put a completed binary character in. We'll use hex 0188. Now, remember that B (0001 0111 in binary)? Since the computer uses hexadecimal notation, let's see what it is in hex:

$$\underbrace{0001}\ \underbrace{0111} = \text{B in binary}$$

$$1 \quad 7 = \text{hex}$$

We tell the computer to load the information found in hex 0119 into the B accumulator. Then we store the B accumulator contents in hex 0188. At this point, we have a hex 17 in location hex 0188 (still dah di-di-dit). Next, we use base page addressing and say: (refer to the program listing, 0187 & 0188) 96 17. This is an instruction which says load the A accumulator with the information to be found in hex 0017. In this mode of addressing, we can specify hex locations 0000 through 00FF. You guessed it, that's where the decoding table is stored (see Fig. 2). At location 0017, the stored information is hex 42, which is an ASCII B.

At hex location 0001, we have stored hex 20, which is ASCII SPACE, so when the program prints a character, then makes two more TIMER runs through space decode without interruption, it prints the information pointed to by location 0119 (which is 01). Then it goes back to wait for more input.

You will note that blanks occur in the decoding table. These are unassigned in the Morse code. Morse was evidently not assembled from a logical base. I would not recommend assigning and using these blanks over the air. The FCC might take a dim view of that.

However, I do urge you to try to follow the program through a cycle (Fig. 3 is a full listing of the program). Armed with that much familiarity, I'll bet you can make changes that will improve it.

Conclusion

After you load the program, set location A048 to 01, location A049 to 1A, then G. To play with the decoding speed, go back to MIKBUG and change the values located at 0000, 0106, 0107, 01A4, 01AC, and 0135. The numbers located there now are not a result of calculations; they were just selected as something that seems to work.

As a suggestion, perhaps two dit lengths is a bit long for an element space, as Morse is actually sent. How about one and a half, and keep two for a character space?

I have tried the NE567 tone decoders for input from my transceiver and haven't had much luck. The 567 takes a few input cycles to lock on, and if the copy is not crisp, or there is QRM, it will often not drop out at all.

Good luck, and may you become more proficient with machine language programming by trying to understand this. ■

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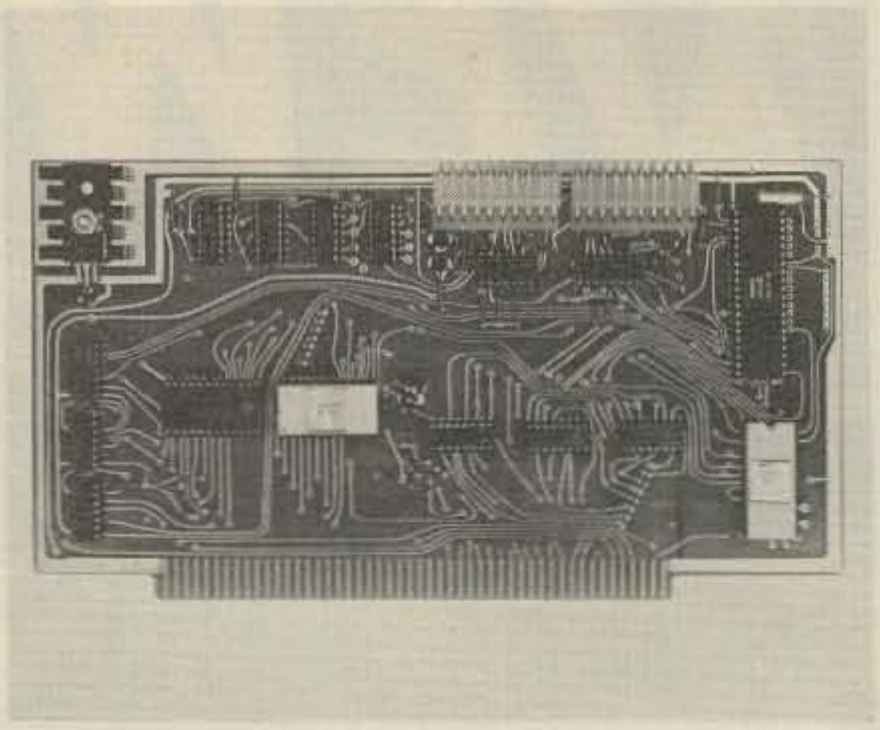

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For 6800 Users: Software programs and I/O board for SWTP are under development. Limited software available now. Ask for 6800 data with $3.00 Documentation package. These programs will provide full software control.

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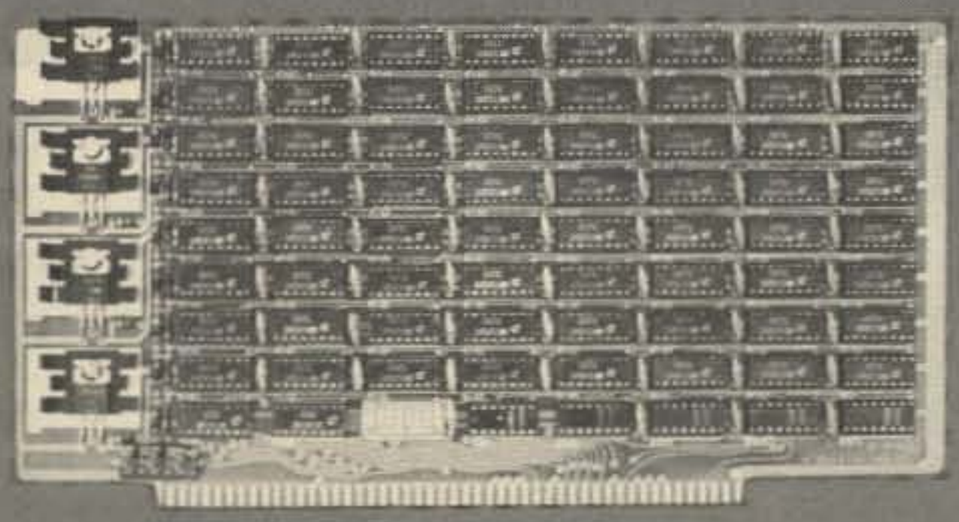

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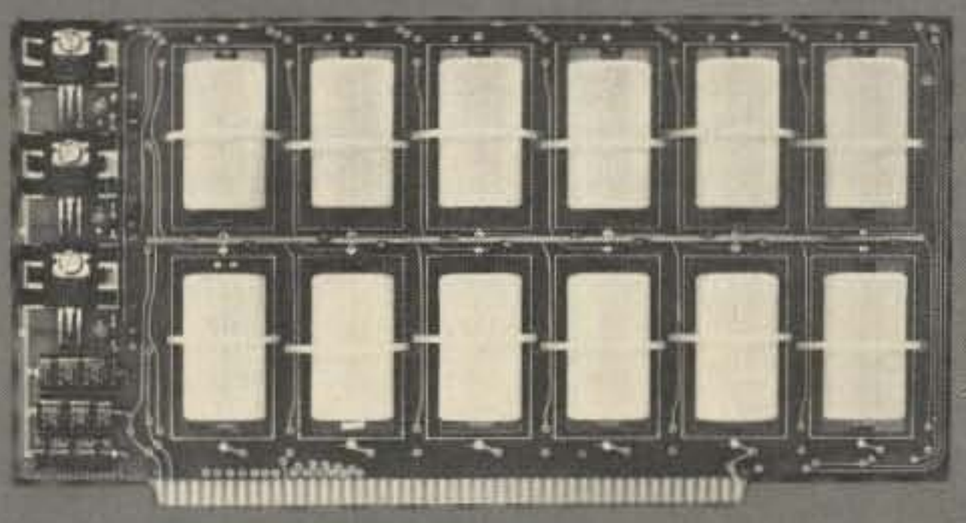

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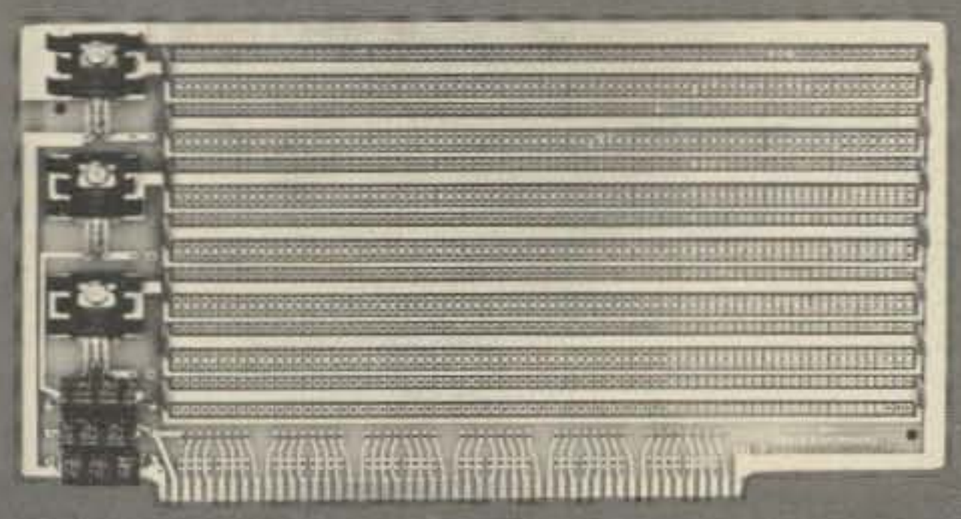

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The Super Clock

-- what'll they think of next?

Geoffry W. Kufchak WA1UFE
15 Fourth Ave.
Westover AFB MA 01022

Here is a really unique digital clock. Using the Cal-Tex CT7001 MOS/LSI integrated circuit gives you a 12 or 24 hour clock, four year calendar, 24 hour alarm, 9 hour 59 minute timer, 50/60 Hz operation, failsafe battery operation, and will drive either common cathode or common anode seven segment LEDs. The basic circuit is built on a PC board only 3.3" by 5" and will fit in Radio Shack's wood grain utility cabinet. By using a larger enclosure, a back-up battery pack may be added, along with a relay to operate external loads with the timer. Construction cost should be around forty dollars with careful shopping.

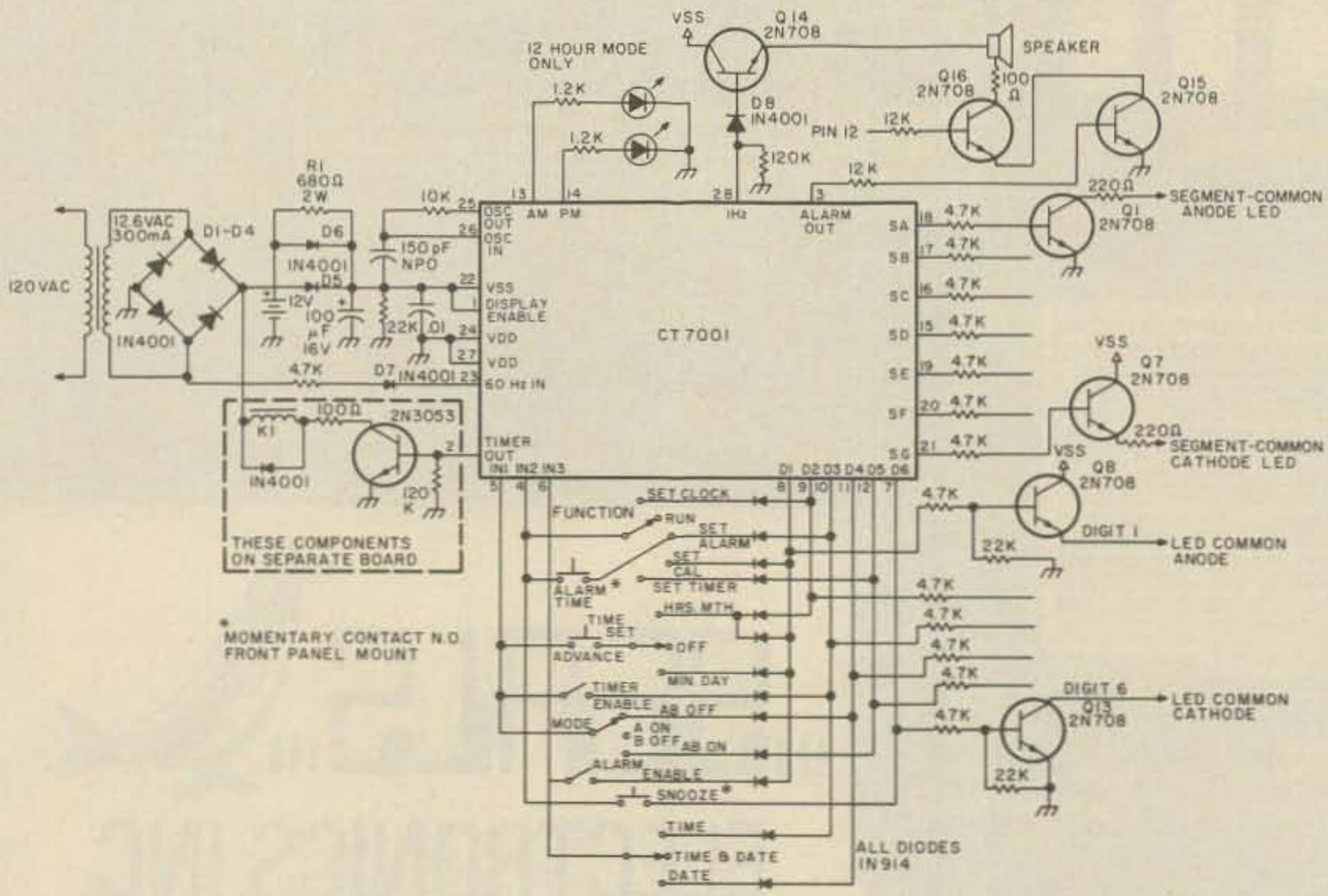
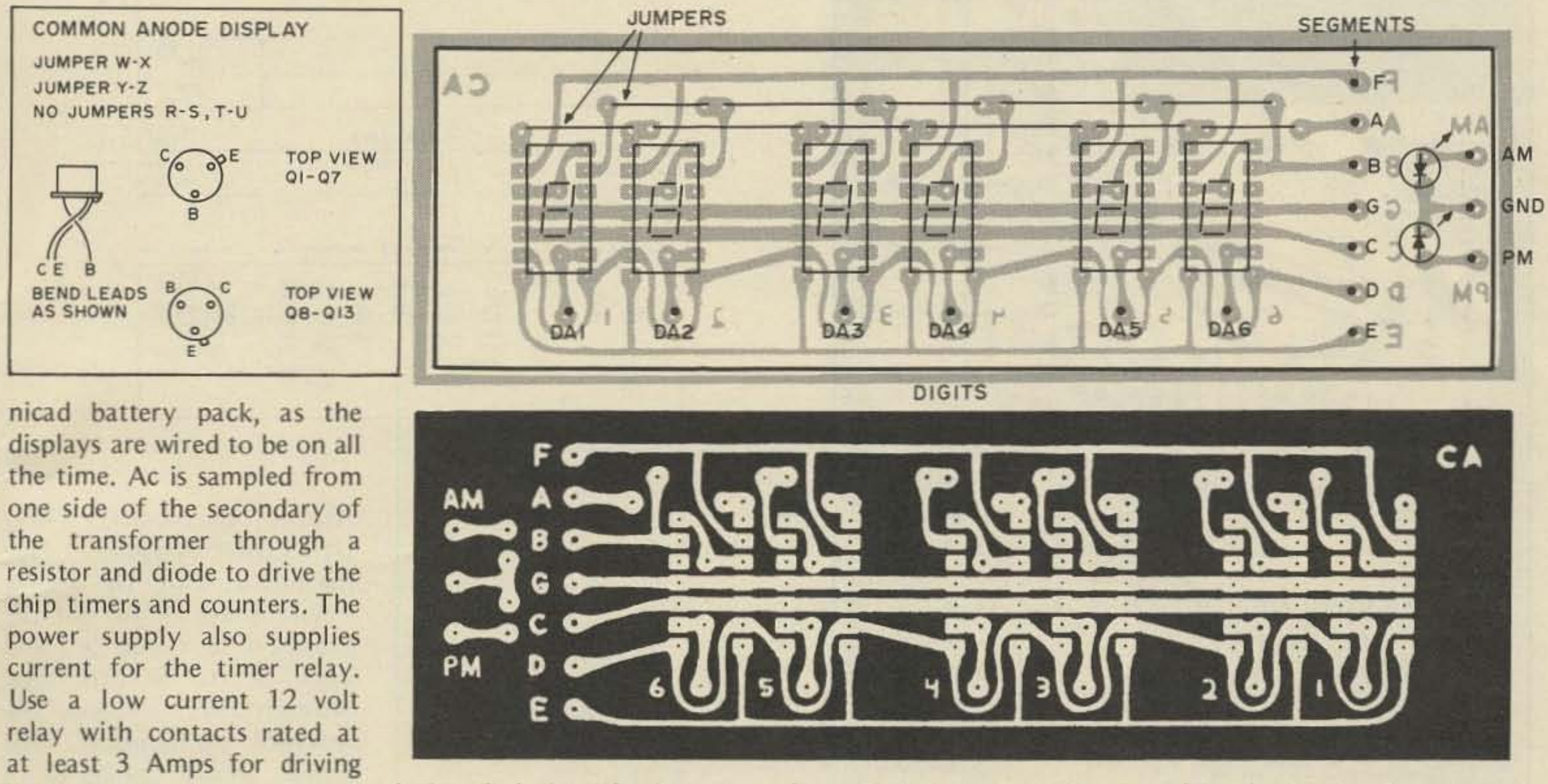


Fig. 1. Select appropriate switching for LED display being used. See Fig. 4.

The schematic shown in Fig. 1 is adapted from both the Cal-Tex and Radio Shack data sheets, plus my own ideas from past (unsuccessful) experience. The alarm circuit shown, Q14, 15, and 16, is quite annoying in the early hours of the morning. (Anyone want to beat my record of 5 seconds hitting the snooze from across the room?) I'm using an earphone element from an old telephone for the speaker, and it's loud. The display drive circuit can be programmed with jumpers for either type of LED. Fig. 2 is the board layout for multiplexed common anode, and Fig. 3 is for common cathode.

The power supply is simple and straightforward. However, use a heavy duty

Fig. 2. PC board and parts layout for common anode LED display. Board is multiplexed for Monsanto LEDs: MAN 1, 1A, MAN 5, 7, 8, MAN 51, 52, 71, 72, 81, 82. Cut pin 6 on LED (decimal point) as it is not used. Board is 1.5" x 5".



nicad battery pack, as the displays are wired to be on all the time. Ac is sampled from one side of the secondary of the transformer through a resistor and diode to drive the chip timers and counters. The power supply also supplies current for the timer relay. Use a low current 12 volt relay with contacts rated at at least 3 Amps for driving external loads.

The am and pm indicators will only operate in the 12 hour mode. They may be omitted if you wire for a 24 hour clock.

Fig. 4 is the parts layout for the main board. Please note that an insulated washer must be used at the mounting hole next to Q13 if you use common anode displays. It is not needed for common cathode.

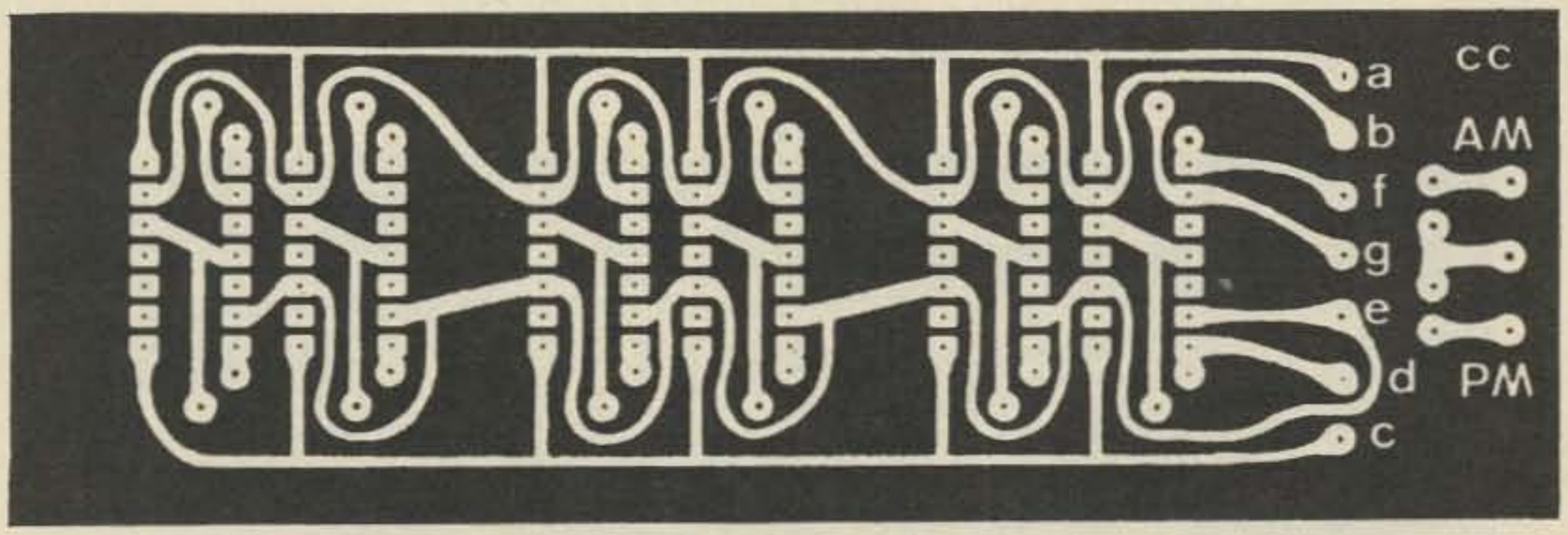
Fig. 5 is a full size negative layout for the main board. Single-sided G-10 is best, but bakelite may be used.

Be very careful with the IC as it can be damaged by static discharges. Once in the circuit it is relatively safe, but can still be destroyed by excessive charges (I found out the hard way).

Fig. 6 is the front and back panel layout for the clock and should be followed if the same cabinet is used; otherwise things just don't fit. The only one that's not critical is the size of the front panel cutout for the display. It may be slightly smaller or larger.

Setting the Clock

First, before installing the IC, check for approximately 15 volts at pins 1 and 22. If you don't get 15 volts, look for a bad diode in the power supply. Disconnect the line cord and carefully plug the IC in the socket. Set the switches on the back as follows: Function-Run, Time Set-Off, Timer Enable-Off,



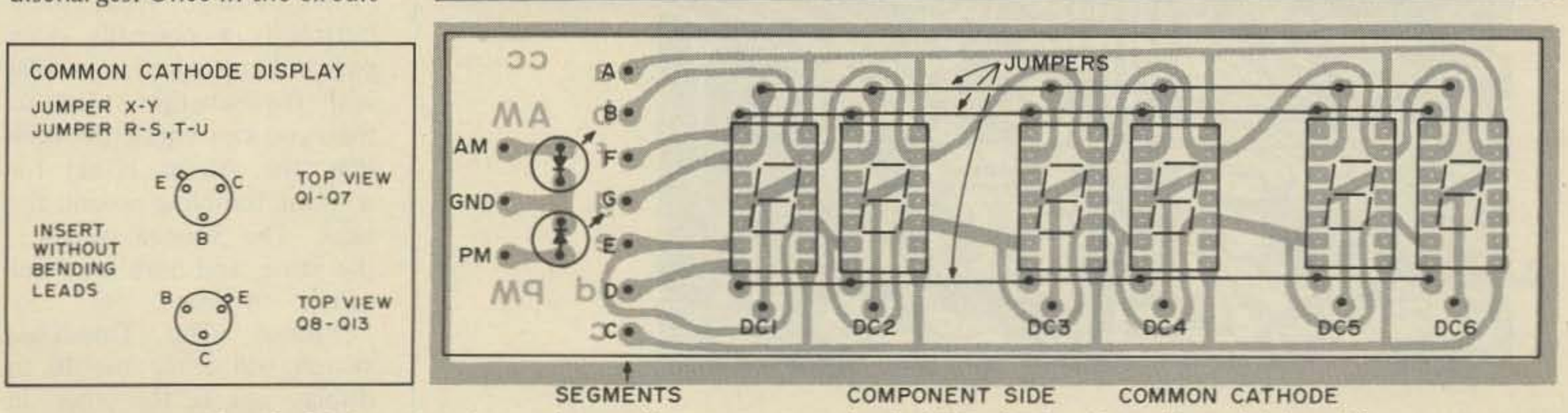


Fig. 3. PC board and parts layout for common cathode LED display. Board is multiplexed for Monsanto LEDs: MAN 54, 74, and 84. Board is 1.5" x 5".

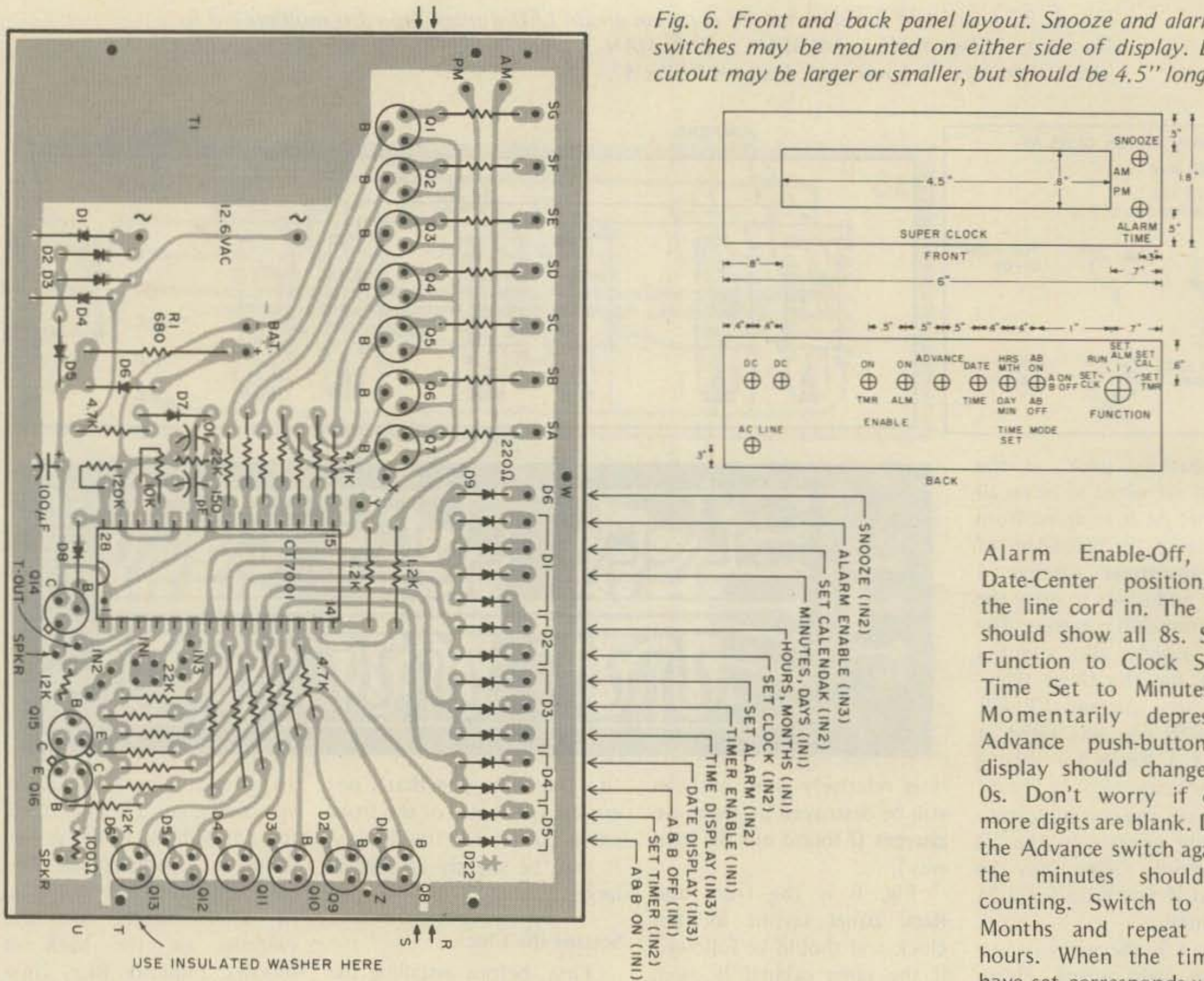


Fig. 4. Main PC board and parts layout. All resistors ¼ W, 10% except R1 — 680Ω 2W. D1-D8 are 50 volt, 1 Amp 1N4001 or similar. D9-D22 are 1N914. Displays are mounted vertically at points marked by arrows, secured to main board with plastic glue, such as Duco cement.

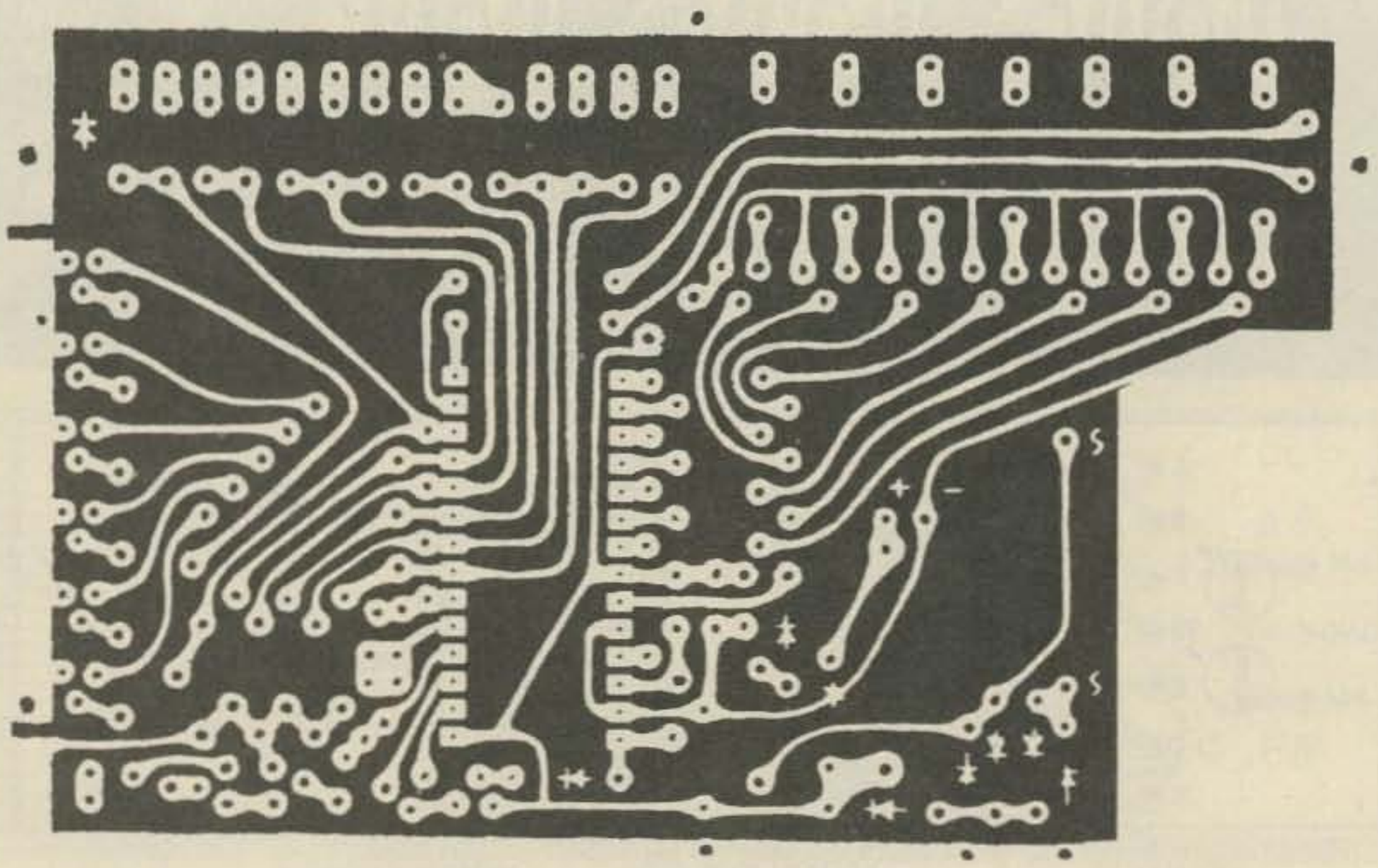


Fig. 5. Full size negative of the main board. When mounting T1 to the board, be sure the base of Q1 does not short.

Fig. 6. Front and back panel layout. Snooze and alarm time switches may be mounted on either side of display. Display cutout may be larger or smaller, but should be 4.5" long.

Alarm Enable-Off, Time/Date-Center position. Plug the line cord in. The display should show all 8s. Set the Function to Clock Set and Time Set to Minutes/Days. Momentarily depress the Advance push-button. The display should change to all 0s. Don't worry if one or more digits are blank. Depress the Advance switch again and the minutes should start counting. Switch to Hours/Months and repeat to set hours. When the time you have set corresponds with the actual time, turn the Function to Run and the clock should start counting. Pay attention to the am and pm indicators when setting the time, as the calendar changes days at midnight. Set the Alarm, Calendar and Timer in the same manner. The Alarm may sound as you rotate the Function switch, but will stop as the times are set.

The Alarm Time push-button is a normally open switch that is wired in parallel with the Function switch so that you can check the time that the Alarm is set for without fumbling around the back. The Snooze switch is the same, and both are front panel mounted for convenience. The Time/Date switch will force the IC to display one or the other. In the center position the time will be displayed for 8

seconds and the date for 2 seconds. The Mode switch controls how the Timer will function. In the A Off, B Off position, pin 3 will be high for the preset time when Timer Enable is closed.

A On, B Off, pin 3 will be high for the preset time and at the Alarm time. A On, B On, pin 3 will be high for the preset time at the Alarm time. The Timer will only function when Timer Enable is closed. Opening the switch stops the Timer counting, and disables the output.

This IC also has a back-up oscillator to keep time when operating from a battery. If you really want to get it accurate, substitute a 25k pot for the 10k resistor and adjust it as close as you can. Then wire in a fixed precision resistor of the same value.

Parts List — "Super Clock"

1	CT7001 IC
16	2N708 NPN
1	100 Ohm ¼ W
1	680 Ohm 2 W
2	1.2k ¼ W
14	4.7k ¼ W
1	10k ¼ W
2	12k ¼ W
7	22k ¼ W
8	1N4001
13	1N914
2	LED — Discrete
6	LED Seven segment displays
1	12.6 V ac 300 mA Transformer
1	150 pF NPO
1	.01 uF Disc
1	100 uF 16 V Electrolytic
1	5 position non-shorting rotary
3	SPDT Center off sub-miniature
1	SPST sub-miniature
1	DPDT sub-miniature
3	SP N.O. momentary contact
1	Ac line cord
1	Cabinet — Radio Shack #270-260
1	28 pin DIP socket
6	14 pin DIP sockets
1	Main PC board
1	Display PC board
	Hardware, wire, plastic window

Most of these parts are available at Radio Shack. If you use the above cabinet, get the sub-mini switches, or they won't fit. The seven segment LEDs are from Poly-Paks (common anode).

General Information

Once the clock is working properly and the back-up oscillator is fairly accurate, you may get the idea to use the clock in your car. That is also the reason for two dc inputs on the back: one plugging in a battery to carry it out, and one for operating off the car's electrical system. One word of warning: In some states it is illegal to use red indicators for anything except an emergency condition, so use a different color for the display if you ever plan to use the clock mobile. (All you people with digital tachometers, take note.)

If a larger case is used, the timer relay circuit may be added. With it, you can do a number of different things, such as turn a lamp on and off, turn the rig on at sched time, etc., as long as the relay contacts can handle the load.

If you use a DPDT switch for Alarm Enable, an LED can be wired to indicate when the Alarm is active. This could save you from jumping through the ceiling on Saturday morning.

The only time you'll have to manually set the calendar is Feb. 29th. February is programmed into the IC for 28 days. Oh, well, setting a clock once every four years isn't hard. ■

Add Class to Your Mobile

- - a handset for the rig

Henry Ruh WB9WWM
Box 1347
Bloomington IN 47401

With the popularity of autopatch and other accessories being added to the repeaters, it is little wonder that the touchtone pad is in such demand. While mobile operation is greatly enhanced by a pad in a box on the dash, it is a lot nicer and more convenient to add a complete handset with speaker, mike and touchtone in one handful.

The Trimline™ phone and other similiar designs seem to have been made with mobile operation in mind. With a few modifications they will work with any of the popular transceivers available.

The phone handset has all the goodies necessary for conversion, the base can be discarded along with the cord. You will need a microphone cord with two wires, mike lead and shield. The rigs with electronic switching may need another wire.

To disassemble the handset, pry out the name just above the dial with a screwdriver; this exposes the light and two screws. Remove the light and discard, and remove the two screws and save. Slip the back cover out and down to remove it from the main portion of the handset.

Looking at the cord end with the dial facing down you will observe five prongs. You will also notice where they are attached to the printed circuit. Number them one through five, left to right. Solder the shield from the mike cable to #3, which will be ground (-). Solder a small jumper from #5 to #3 for the dial light return. Solder a 47 Ohm 1/8 Watt resistor from #2 to #4 for lamp power. Solder the mike hot lead to #2.

Now remove the two screws holding the PC board to the earphone element. Carefully pry up the PC foil away from the element. Use the same screws and run a twisted pair of wires from the earpiece terminals down the right side of the handset into the vicinity of the incoming mike cable. Place a layer of black tape over the screws and wires. Now remove the earpiece cover by removing the two screws which hold it in place. With this removed, decide where you will want your push to talk button, and install it appropriately, running the wires down the left side of the handset. Again use a twisted pair of wires.

At the bottom of the handset, join one of the earpiece wires with the "ground" lead from the PTT switch and solder them to #3. The other earpiece wire will go to the black mike cable lead, and the other PTT lead will go to the red mike cable lead. Your handset is now almost finished.

Pull out the earpiece unit carefully and you will notice that it also is the holder for the dial lamp. Install two LEDs of your color choice, one to each side of the lamp clamp. The reason to replace the lamp with LEDs and a series resistor is so you can see the dial in the dark and not have the "short" across your mike lead which the lamp would be if left in. The handset power will come in the hot mike lead.

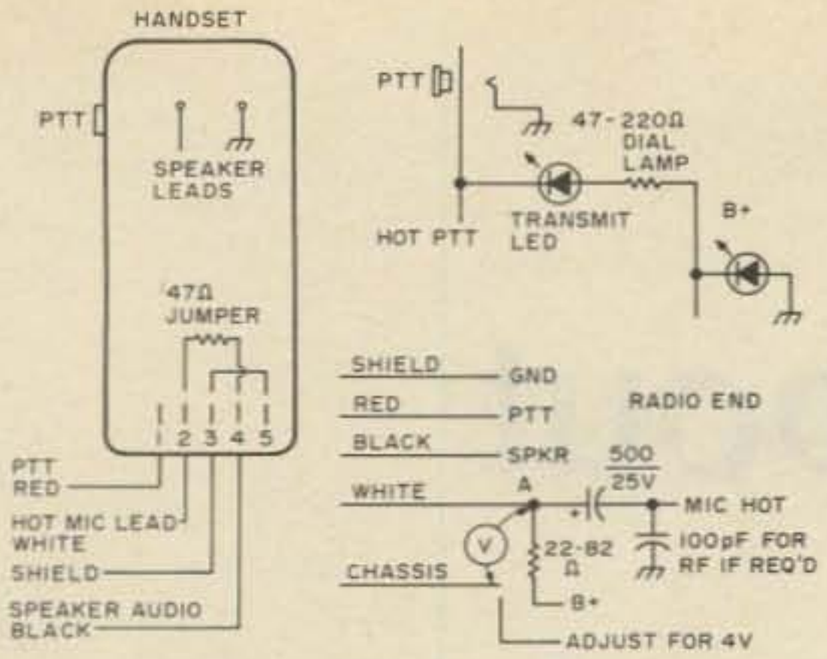
Now observe your transceiver. Either replace the mike connector with one with enough pins for all necessary connections, or throw it away and push your new cable through the hole. It is often more convenient to discard the old mike connector and install a terminal strip nearby, firmly attached to a ground, to hold the end of the new cable. Now it is assumed that your circuit boards have a common ground (not like the Drake ML-2), and one side of your speaker goes to ground.

The shield goes to ground. The hot mike wire goes to its normal place in series with a 500 uF 25 V electrolytic; use short leads. The PTT wire goes to its normal connection, and the hot lead of the speaker goes to the remaining mike cable. Now, find a source of voltage which is greater than 6 volts positive in transmit. Insert a small pot in series with the voltage source and the junction of the capacitor and the new hot mike lead. Adjust the voltage at the junction until you have 4-6 volts. Replace the pot with the closest fixed value *over* the value of the pot reading. This will typically be 22-68 Ohms. A ¼ Watt resistor is sufficient.

Using a Clegg FM-27B, a 56 Ohm resistor was used. No additional adjustment of the deviation was necessary.

The handsets with the integrated circuit produce the best audio and tones when operated from 4-6 volts. Voltage levels above and below this result in low or no audio and distorted, low or no tones from the pad.

For real class, you could use green LEDs for normal dial lights and red LEDs from the PTT to show transmit! Again place a series resistor in the LED lead and run it from the hot side of the PTT switch and the hot side of the



other LEDs, but in reverse so grounding the PTT lead turns on the LEDs. Now that's class.

Also, if you have a Clegg FM-27B, you can improve the receive audio intelligibility and get rid of the annoying speaker rattle by replacing the .1 uF capacitor with a .01 uF capacitor (C-62) and thus roll off the low frequencies.

Now button up the handset, clamping the mike cord so it won't fall out, and put the case back on the radio.

In case you are wondering what to do with the old mike connector: If you have a Clegg, use it to replace the power connector on back for a vibrationless tight connector that won't fall off when you go over the razorback roads. While you're at it, put a couple of miniature (imported) 470 uF electrolytic capacitors across the connector inside the radio. It seems to help if you are having alternator whine on your audio and also smooths out voltage fluctuations.

Happy motoring and QSOing with your new telephone handset. ■

Bill Kleronomos WA9OZC
RR 2, Box 41
Maple Park IL 60151

The Final Feeder

- - driving a high power amplifier

Hey Bunky: Building that new contest amplifier and worried about cooking those grids with excessive drive power?

Tried to find neutralizing capacitors lately?

Don't have enough drive for that pair of 4CX5000s in grounded grid?

Well, this article just might be what you need!

Several months ago I was involved in building up a pair of 4CX350As and wanted, out of sheer laziness, to keep the grid circuit as simple as possible. The thought of operating the tubes in grounded grid came first, but Eimac's maximum grid current rating of 2 mA put the kibosh on that idea fast. The only alternative was to feed the grids, but the thought of tuned circuits and neutralization was enough to make me try to find a better way.

Most SSB amplifiers are operated in class AB1 and theoretically don't need any driving power, just voltage. If you look at Fig. 1 you will see a nice 50 Ohm dummy load to soak up the power from the exciter. The power rating depends on the drive; I have 200 Watts available, so I used 20 1k 11 Watt glass resistors in parallel, sandwiched between two pieces of PC board.

The spec sheet on your tube(s) should now be consulted to find out how much peak grid voltage is needed to drive them to full output. Next, calculate the rf voltage across the dummy load, using:

$$\frac{E^2}{R} = W$$

where W = drive power, E = voltage and R=50. If you have 200 Watts available, for example, your available voltage is about 100 volts rms. R1 and R2 form a resistive divider to adjust the drive voltage to the desired level. 4CX250Bs need about 40 volts rms of drive so R1 and R2 should be 1k. This puts 50 volts on the grid which insures enough drive and lets a bit of grid current flow. The actual values of R1 and R2 aren't all that critical. For example, I replaced one of the 1k resistors in the dummy load with three 330 Ohm 2 W carbon jobs in series which gave me a range of adjustment. You could probably use much higher values, say 4700 Ohm jobs in series, and get a little better match to the high impedance input of a tube which should reduce IM products somewhat. The only important factors are the ratio of resistances, and the wattage rating of same. The entire input network loads the grid circuit down so that the chances of the tube taking off are minimal.

When all is put together, watch the grid current. If you get an occasional flicker on voice peaks, you've got it on the nose. If you have too much current indicated, increase R1 some and try again, Good luck. ■

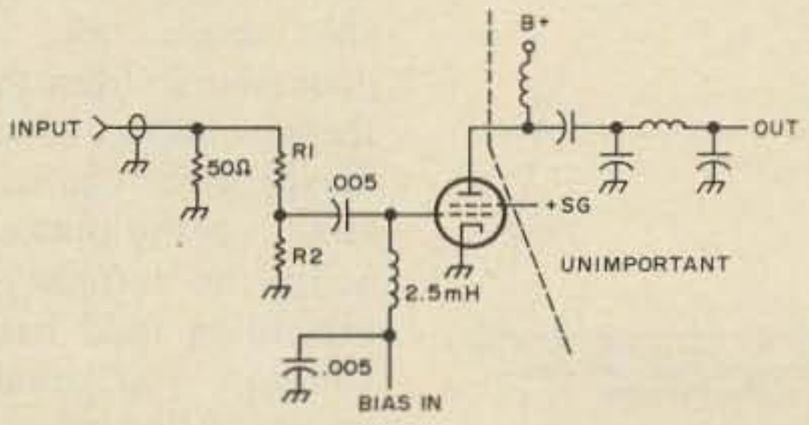


Fig. 1. Power amplifier using resistive grid circuit.

What About Surplus Nicads?

-- how to test and repair them

Alvin E. Ericson W9JTQ
10834 S. Washtenaw Ave.
Chicago IL 60655

If you are the proud owner of a hand-held two meter transceiver, you are aware of the need of a battery pack that is in good condition, particularly when transmitting. Weak or defective cells in the battery will cause the transmitter to lose power rapidly. If your transmitter dies after only 10 or 20 minutes of use after charging, read on. A Motorola HT-220 transmitter will put out 1½ to 2 Watts plus with a fully charged 15 volt battery. When the battery voltage drops to 12 volts, the output of the transmitter will drop to ½ Watt or less. The receiver will continue to operate on 9 or 10 volts with reduced audio output. A good battery should be able to give about one hour of transmitter operation before its voltage drops to 12 volts. In commercial use, the 15 volt 450 mAh Motorola nicad battery is rated at 48 minutes of transmitter operation, 48 minutes of receiving, and 6 hours 24 minutes of standby operation per 8 hour day before recharging. If you purchased a new nicad battery, you should be able to get results similar to these with no problem other than the severe jolt to your pocketbook from the cost of the new battery. They are not inexpensive. You can ease the strain on the pocketbook by going the surplus route and rebuilding used batteries. In addition, you should find it an interesting project to work on.

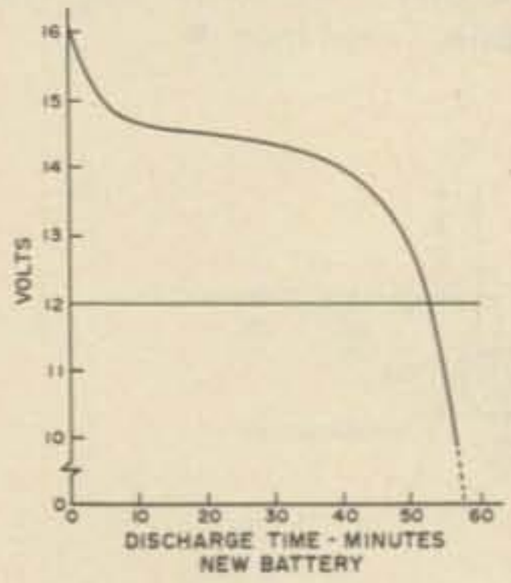


Fig. 1.

To test a nicad battery pack, charge it for 14 to 16 hours at 10% of its mAh rating (i.e., a 450 mAh battery should be charged at a rate of 45 mA, and a 225 mAh thin pack should be charged at 20-25 mA). Rapid charge batteries can also be charged at this slower rate or in a special rapid charger at its recommended time.

After charging, connect a voltmeter across the battery and a load resistor to discharge the battery at the same rate as the transmitter. The load resistor should also match the size of your battery. For a 450 mAh 15 volt Motorola battery, the load resistor should be 32.5 Ohms, and for the 225 mAh Motorola thin pack nicad battery, the proper load resistor is 65 Ohms. Resistors can be connected in series or parallel combinations to get these values and should have a 5 or 10 Watt rating. Take readings of the voltage every minute starting when you begin discharging the battery through the load resistor. After the first 10 minutes, take readings every 5 minutes until the voltage begins rapidly dropping. At this point, take readings every minute again until the voltage drops to about 10 or 11 volts. A nicad battery has reached its fully discharged voltage at about 0.9 volt per cell (i.e., a 12 cell 15 volt battery is fully discharged when it drops to 10.8 volts). To discharge it below this value may damage cells in the battery. Plot a curve on graph paper of the battery voltage vs. discharge time in minutes. New batteries will have discharge curves as shown in Fig. 1. You can see that after the first few minutes of discharge, the battery voltage stays almost constant between 14.7 and 14 volts for quite a period of time. As it nears the end of its discharge, the voltage drops off quite rapidly until it reaches its discharged voltage of 10 to 11 volts. Note that the 12 volt point where the transmitter power has begun to drop drastically is very near the fully discharged voltage as well.

What are we likely to find in a surplus nicad battery? Figs. 2 and 3 are typical. The battery in Fig. 2 appeared almost normal for the first 23 minutes of discharge and then dropped abruptly, decreasing rapidly again at 33 minutes. It has two cells that only take a partial charge and become completely discharged at the points of sudden voltage drop. Locating and replacing these cells with good ones will likely result in a battery almost as good as new. You can elect to use it as is if you are satisfied with recharging it after about 20 minutes of transmitter time, since it will deliver almost full power the first 20 minutes. Fig. 3 is more typical of what you will find, however. Here the battery voltage never did come up to full voltage when charged, and it dropped off to below 14 volts rapidly, going below 13 volts after 25 or 30 minutes of use. This lower voltage results in decreased transmitter output almost from the start. The fact that this battery never charged up to 16 volts indicates a shorted cell. Replacing one cell almost brought it up to par, but it still would not last for more than 48 minutes. Locating and replacing the cell that was weak resulted in a battery almost as good as new, as can be seen by the curve just below the new battery reference. You might try Peter A. Stark's (K2OAW) method of "Zapping Dead Nicads to Life" which appeared in January, 1976, *73 Magazine*, to rejuvenate the shorted cell in this last battery. The battery in Fig. 2 does not have shorted cells so would not respond to his suggested treatment.

This method of testing should enable you to identify the type of problem your surplus battery is plagued with: dead cells, weak cells, and cells that accept only a partial charge. Some batteries charge up to normal voltage but lose it overnight or in a

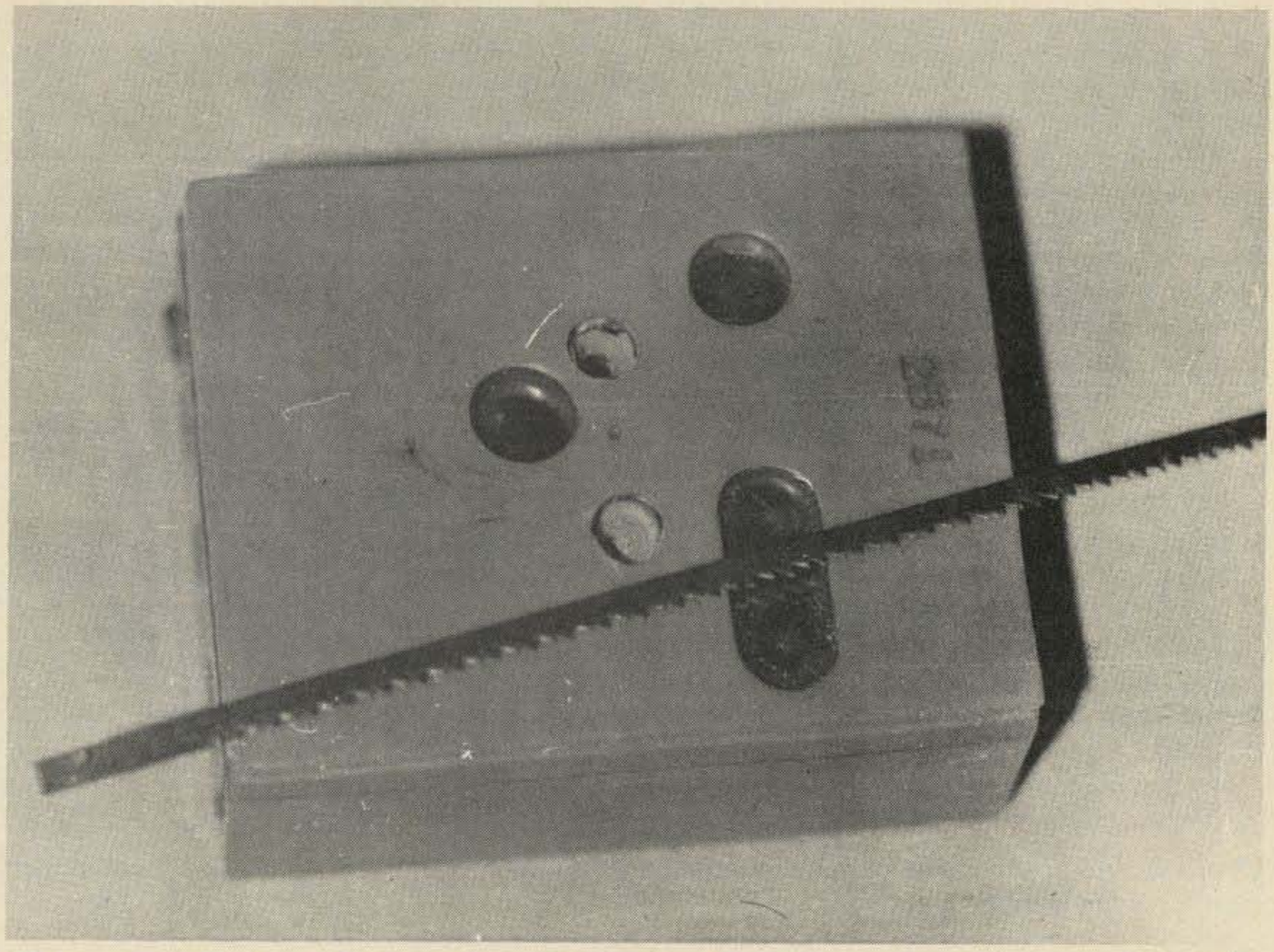


Photo 1. Motorola HT-220 nicad battery with posts drilled out and showing a coping saw blade used to saw around the edges of the top of the case.

few days due to high internal leakage from electrolyte vented from a cell. After opening a battery with this defect, the cells should be washed in running water to dissolve the electrolyte and, after drying, should be charged and load tested to determine the good cells in the battery. I personally have not had much luck rebuilding this type of defect.

The next problem to solve is how to get inside of the plastic case of the battery. I use a thin blade coping saw to just cut through the plastic without sawing into the cells as shown in Photo 1. The two plastic posts near the center of the battery must also be drilled out before the plastic face of the battery can be removed. Most batteries show a dimple where the posts are located. Drill into the center of the dimple with a 1/16" drill. They are hollow and the small drill will feed into the hollow part. Then use a ¼" diameter drill to just drill through the thin plastic. Do not drill too deeply with the large drill because there is danger of drilling into the cells and damaging them. Use the sharp point of a knife to cut through the plastic along the sides where the saw did not cut through completely. It is better to do this than to saw too deeply and damage cells. While this is rather a delicate operation, it can easily be done with a little care and patience. The penalty for sawing into a cell is that you will have to discard it. If you try to saw the battery case apart on the sides along the lines where it was originally cemented together, you will almost surely saw into cells, damaging them.

Photo 2 shows the inside of the battery after removing the top face. You can pop the cells out of the case by holding the battery upside down over your hand and hitting the palms of your hands together. The cells should come partially out – enough to grasp them with your fingers to pull them out the rest of the way.

Measure the voltage of each individual cell of your discharged battery. To do this you will have to carefully lift the insulating sheet on the terminal connection side of the battery to get at the cells. Any cell that measures less than 0.9 volt on a discharged battery is probably defective.

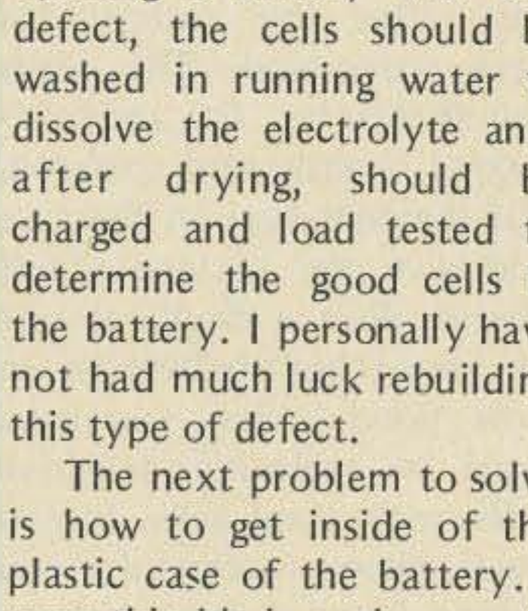


Fig. 2.

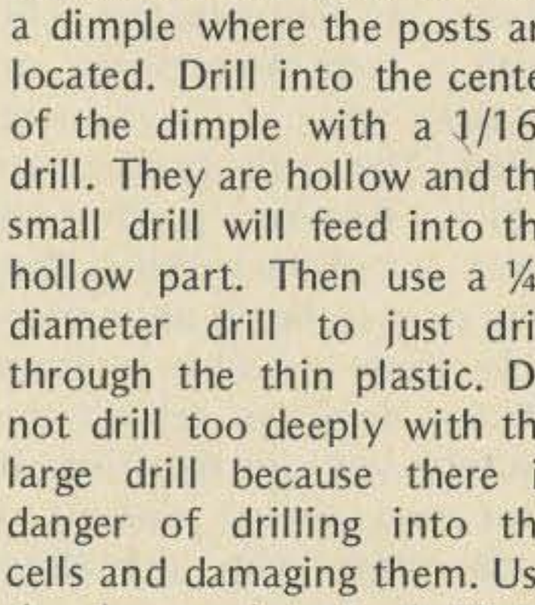


Fig. 3.

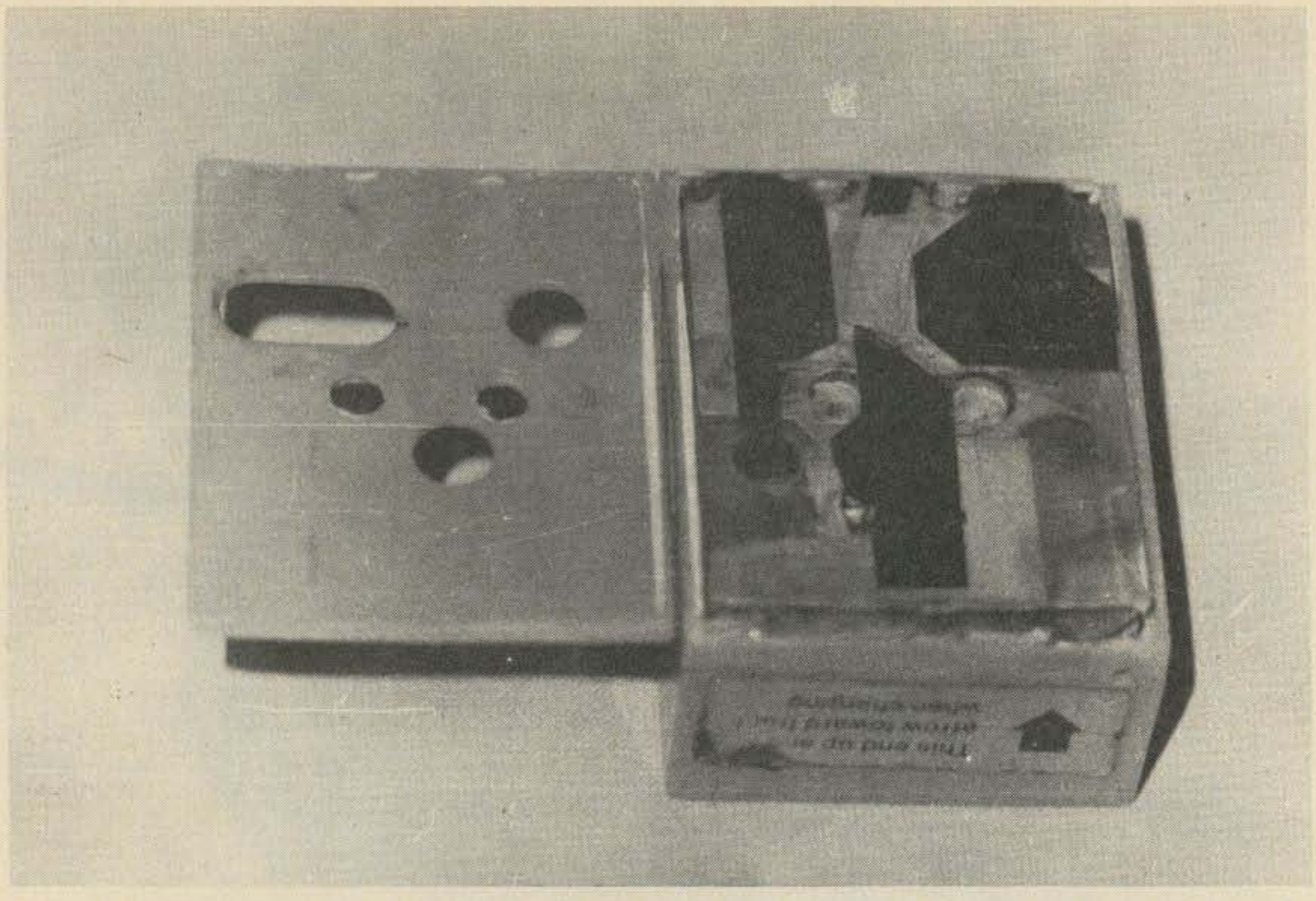


Photo 2. Shows the inside of a Motorola HT-220 nicad battery after separating the top of the case from the rest of the case.

Mark defective cells with a felt tip pen. To make sure that all defective cells have been identified, connect the load resistor across the battery and quickly measure the individual cell voltages. Mark any additional cells that are below 0.9 volt. Using clip leads, connect the battery to your charger and charge it completely. Discharge it with the load resistor and, as it is discharging, measure individual cell voltages to identify which cells discharge first, or are dead.

Repeat this testing procedure on additional used batteries, preferably three batteries. You should have enough good cells to rebuild two of the batteries having the fewest defective cells, and possibly have a few good cells left over for future repairs or for use in some other project.

Remove the defective cells by peeling the connecting straps off the defective cells with a long nose pliers, or better yet, a needlenose pliers. The welds break quite easily. Remove good cells from one of the batteries that you plan to break up, preferably from the same location as the defective cell in the battery you are repairing. If two good cells are adjacent to each other, clip the strap between the two cells, so both can be used. I have used two methods to connect the replacement cells in the battery. I bend the long lead and the shorter clipped lead to form hooks that interlock. When pressed together, they seem to make a satisfactory contact when held by the case after the battery has been assembled. The leads can also be left flat and overlapped slightly and soldered. Put the cells back in the case and give the battery a full charge. Run a discharge test on your rebuilt battery to see how good a job you have done in replacing defective cells with good cells. If you have been successful, you should have a rebuilt battery that meets 80% of the required 60 minutes, or 48 minutes, before it drops to 12 volts. It should also have remained above 14 volts for 35 minutes or more, with a smooth drop-off to 12 volts in 48 to 50 minutes. Starting with three used batteries, you hopefully have been able to rebuild two good batteries and have a few cells left over. In many used batteries you only have to replace one or two defective cells. Use transparent adhesive tape to fasten the cover tightly in place. The pressure from the cover plus the pressure from the battery cover on the hand-held transceiver seem to provide contact between the interlocking straps.

Just a few hints on selecting your surplus nicad batteries: Avoid batteries with distorted, partly melted cases. Most of the cells are usually damaged or in poor condition, probably because the electrolyte has been boiled out of the cells by excessive heat. Select batteries with smooth cases. Many of the pull-outs from commercial service have failed to pass the load test because one or two out of the twelve cells have gone bad. Surplus nicads are available from Spectronics Inc., 1009 Garfield St., Oak Park IL 60304. Surplus Motorola batteries that take a charge and test in the OK zone on a nicad battery tester sell for $10, and those that do not test OK are sold at a bargain 3 for $5. These are the ones I used, so good luck in rebuilding batteries for your transceiver. ■

April - 1977

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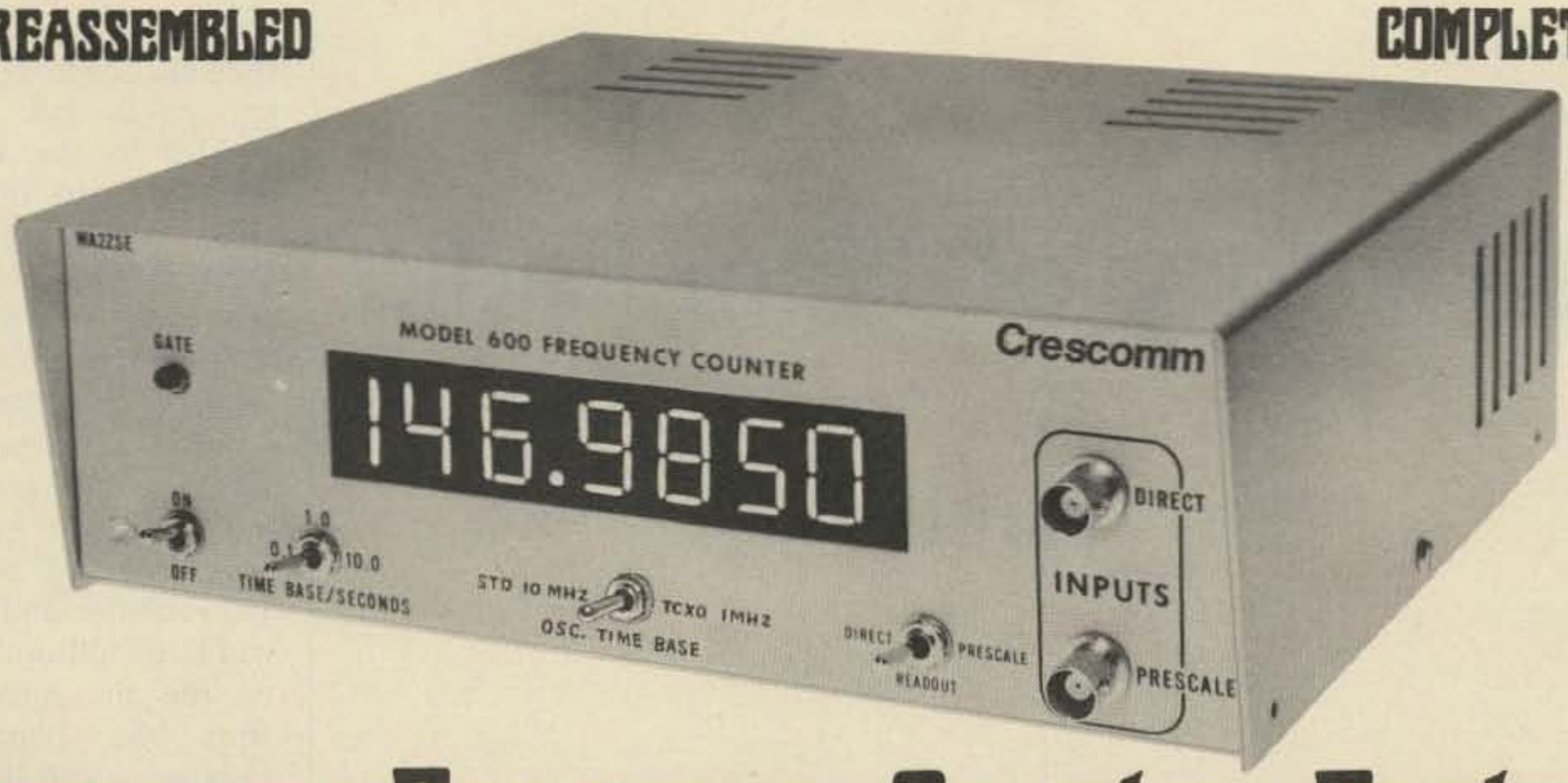

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C25

The History of Ham Radio

- - part II

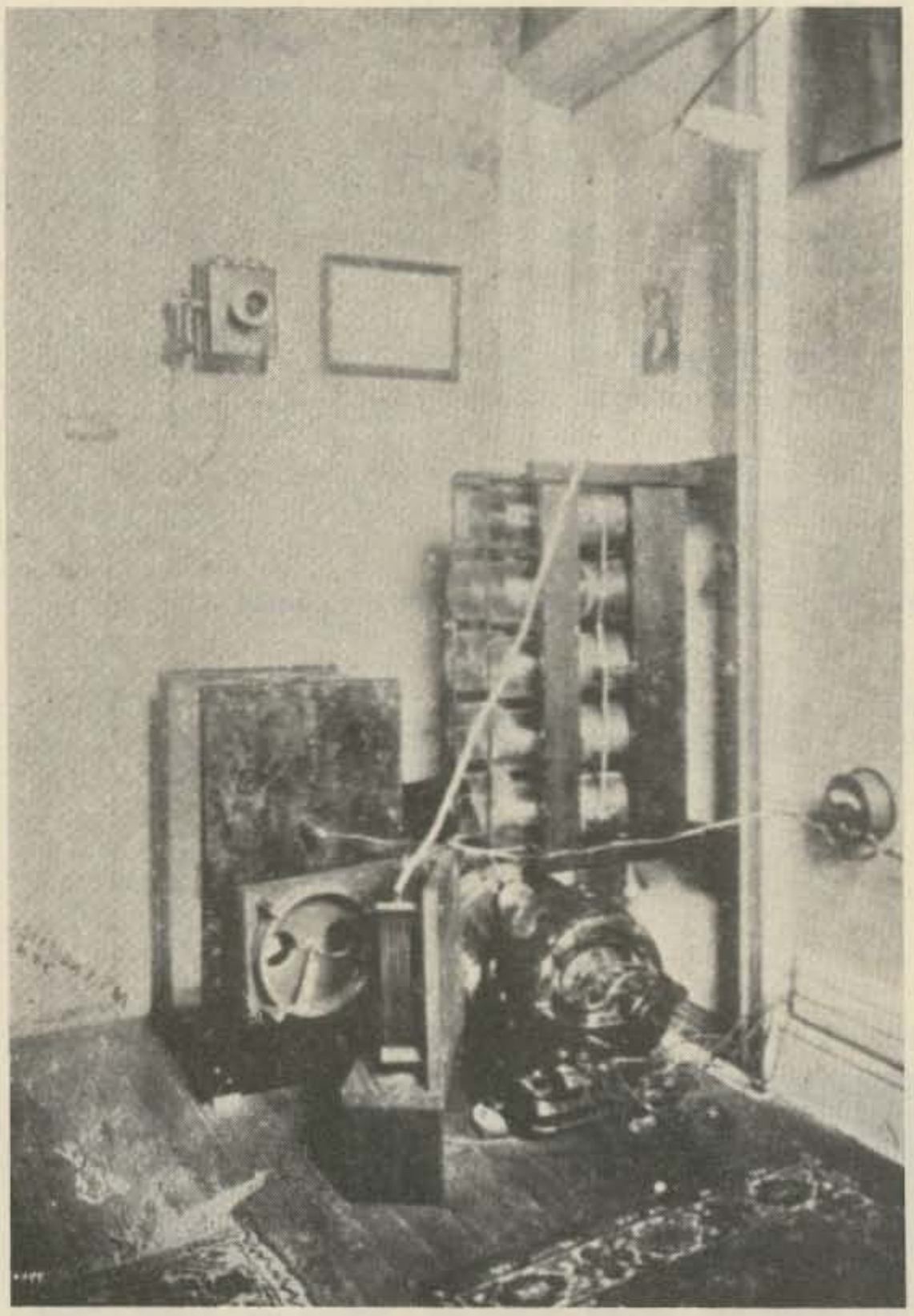
Eric G. Shalkhauser W9CI
527 Spring Creek Road
Washington IL 61571

Reprinted from QCC News, a publication of the Chicago Area Chapter of the QCWA.

1917

During the hostilities of World War I, in which the United States was involved from April, 1917, to November, 1918, there were no amateur activities on the air. After the armistice was declared, amateurs still had to wait almost a year before permission was granted to dust off the old equipment, make repairs, catch up on the many changes to be made due to advancements in the art, and become active again.

It is interesting to follow the trend in activities among amateurs during the lull, due to the war. *QST*, the publication of the Amateur Radio Relay League, continued to appear every month until September, 1917. Then followed increased government restrictions, rather severe. The edict: "No radiation, no ground connections, no capacity or inductance to hook-up!" Amateurs were told, "You may read radio books, think radio thoughts, and learn the Morse code, until the call comes to join up." Many amateurs enlisted in the Signal Corps, the Navy, or found employment with the services.



The transmitter of station "2PM", which produced the first transcontinental signals.

1918

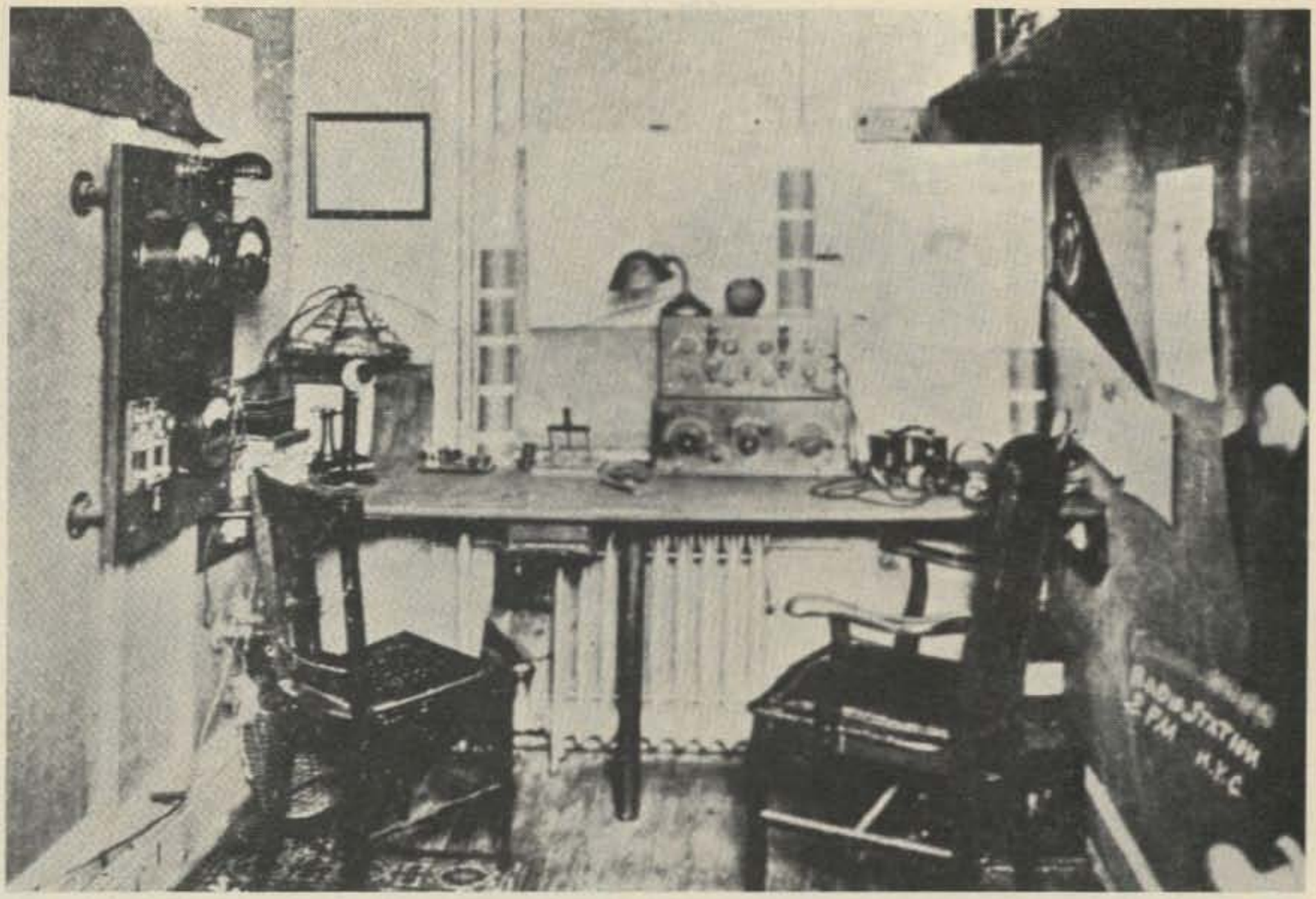
Although the amistice was signed on November 11, 1918, amateurs waited some months before radio publications were again available. The first postwar edition of *QST* appeared in July, 1919, and other periodicals made their appearance, notably *Wireless Age* and *Radio Amateur News*. Restrictions on amateur transmission were removed by the government on October 1, 1919. Here it should be noted that an attempt was made through the introduction of a bill, known as HR 15159, requested by the Secretary of the Navy, to turn over all radio control to the Navy Department. This bill received very strong opposition from the amateur radio fraternity and was defeated.

What were the regulations which now governed the radio amateur? All licenses were cancelled as of April 1, 1917. Rules and regulations had to be followed to go back on the air. Amateurs knew that the Department of Commerce still had complete jurisdiction with William Redfield, Secretary of Commerce, at the time. A publication issued by the Bureau of Navigation, Radio Service, dated August, 1919, entitled "Radio Communication Law of the United States," indicated that no additional radio regulations had been added to those in effect as of the beginning of hostilities. In fact, no changes were made in the radio law during the interim between the introduction of the Act of June 24, 1910, and the ratification of the International Convention of Communications, finalized and signed by Woodrow Wilson, then President of the United States, on July 8, 1913.

1919

Applications for amateur radio operators and station licenses soon had the fraternity by the hundreds back into the swing. The spark coil, the rotary gap, and the old receivers had to be brought up from the basement or down from the attic, unpacked from storage bins, and put back into service. As soon as restrictions were removed, activity started with a vengeance. Radio shops blossomed everywhere. The old wireless bug put everybody to building loose couplers, variometers, honeycomb coils, simple detectors, and a host of new devices.

Along came the newly developed three element vacuum tube. Here was the beginning of the real revolution in reception and transmission of wireless signals. The VT-1 by Western Electric gave the amateurs their first chance to analyze its possibilities. There also were Morehead and Marconi tubes available, but they were very unstable as receiving as well as transmitting units. No two alike would respond equally in a circuit. We were all looking for the advent of larger and more powerful vacuum tubes, and anxious to replace the old spark transmitter. The amateurs knew that it was possible to do away with the noisy spark discharges with their interference problems due to wide bandwidths, and put a new kind of signal into the ether using vacuum tubes.



"2PM" operating position located at 808 West End Avenue in New York City.

At ARRL headquarters in Hartford, Connecticut, where *QST* originated and where our newly appointed secretary and editor, K. B. Warner, took over right after the war, it was decided that the entire body of amateurs be organized into local and regional clubs and associations. The objectives were to foster and promote complete control of all ham activities such as relaying messages, establish relay routes across the country, and keep abreast of all governmental legislation pertaining to amateur radio activities.

K. B. Warner, the new secretary, came from Cairo, Illinois. A very active amateur, he operated under the call 9JT in 1915, using a 1/2 kW fixed gap transmitter.

All amateur radio stations were supposed to be operating on the 200 meter assigned wavelength. Adherence was not too strictly enforced. In fact, some stations were operating well above 200 meters. A few, with special permission, were well into the 375 meter range. So little was known about radio propagation that the erroneous assumption persisted, "the longer the wavelength, the greater the distance waves would travel." August, 1920, *QST* said, "For short wavelengths (below 200 meters) the signal strength is a function of the wavelength, and it may be said that the shorter the wavelength, the weaker the signal." *How strangely the ether waves behaved in those days!*

Everybody was still using interrupted CW, some straight, some quenched, with the only noticeable difference being in the pitch, the whine, and the characteristic interruption of the dots and dashes. Some found satisfaction in a 500 cycle note, if a 500 cycle generator could be found as the prime source of power. Interference created bedlam in many areas, especially before midnight, after which most of the spark coil operators quieted down and went to bed, giving the high-powered boys the ether. The maximum power transformer rating was one kW, usually a Thordarson or Clapp-Estham or equivalent rated at 25,000 volts secondary. The law was specific: "A transmitting wavelength not exceeding 200 meters and a transformer input not exceeding one kilowatt." The ammeter hot wire in the antenna usually was asked to register from 4 to 10 Amperes into an L or T type antenna configuration. It had to be designed and built to a measured length, specifically not over 100 meters, to be within the law. There were plenty of parallel wires, usually at least four, to form a ground network of copper conductors (or buried copper washboilers) for a counterpoise.

The amateurs had a standby pal, "The Old Man," delivering pertinent information to all through articles in *QST*. He kept all in good humor and within the straightjacket of operating procedures. As an example of what could be expected from the OM, here is an excerpt directed to the editor from June, 1919, *QST* under the heading "Rotten Starting":

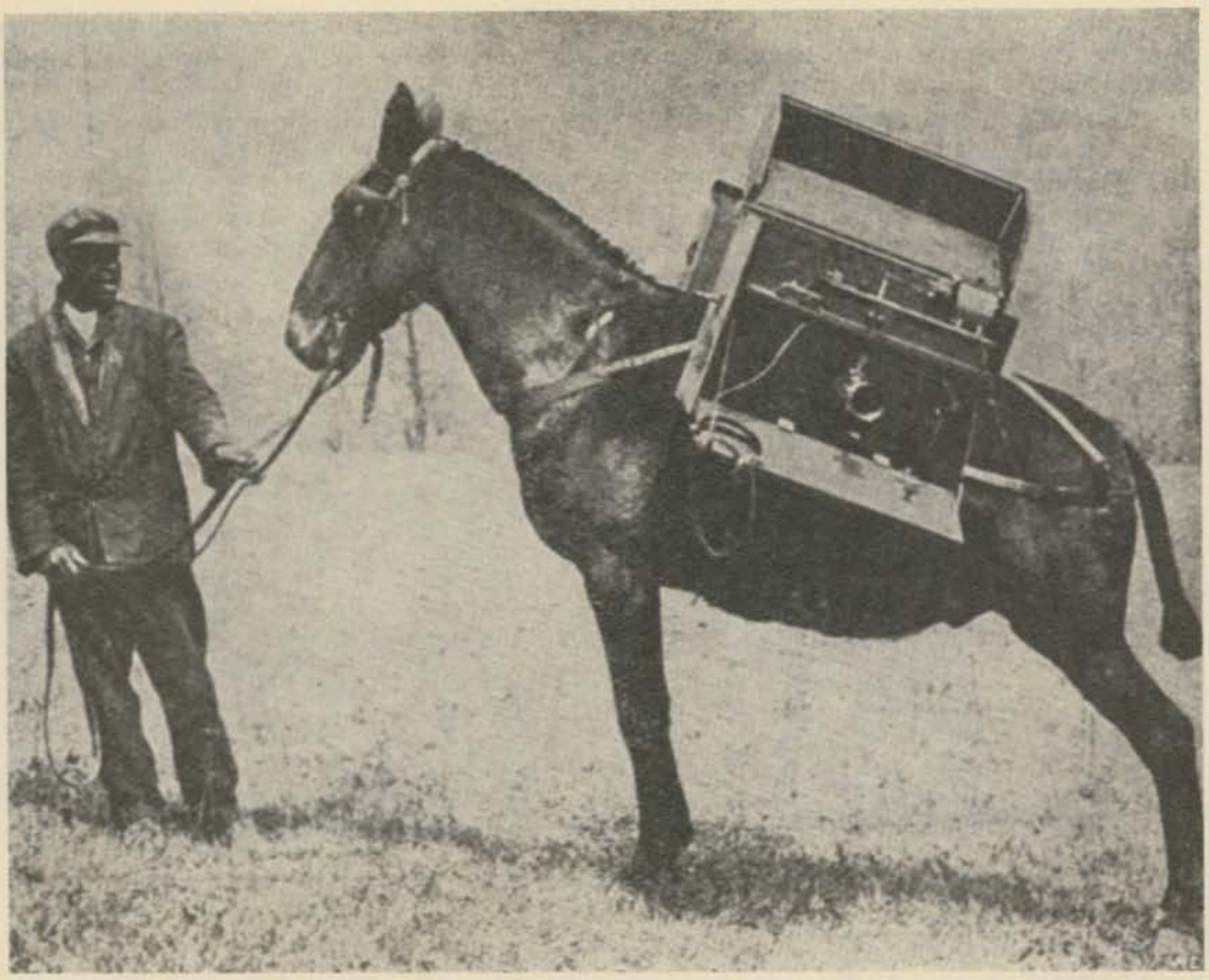
> "I am sending you a specimen of a *Wouff Hong* which came to light out here when we started to get our junk out of cold storage. Keep it in the editorial sanctum where you can lay hands on it quickly in emergency. We will be allowed to transmit soon and then you will need it."

Who does not know the *Wouff Hong*?

What most of the amateurs surmised and expected was just ahead. We read in November, 1919:

> "There will come a day when amateurs will not need to bother their heads about government or commercial stations, but THAT DAY HAS AS YET NOT ARRIVED. The radio millenium has still to come. We mean by this that with our present form of crude apparatus still in vogue, and when we are using quasi makeshifts, we cannot expect that we can tune our transmitters down to within the hundredth fraction of a meter. Usually the amateur wave is so broad that it can be picked up all over the scale. As long as we persist in sending out such waves, we must expect criticism from the big stations with which we interfere."

The junking of the radio spark gap was in the making. To actually let go was an-



"Mule Mobile" was used by the Signal Corps during World War I for carrying the not quite portable transmitting equipment.

other thing. Some of the old-timers in 1920 complained that there was no romance in tube transmission – that it has no individuality or traditional associations like the old spark. There was always a certain stalwart and hearty attraction about the old non-sink rotary, noisy and inefficient as it was. So the *Old Guard* had to finally succumb also to *the little bulbs that had nothing in 'em*.

This is what Dr. Lee De-Forest had to say at this time, the man responsible for the development of the three element tube, in November, 1919:

> "The average radio amateur knows enough of the extreme selectivity which the pure undamped wave makes possible, to realize that the problems of interference would largely vanish with the spark gap. Let the amateur urge upon his Congressman or Senator that if the government wishes to further legislate against radio interference, then legislate out of business the damped wave transmitter."

1920

So it became necessary that the amateurs gradually develop the use of the vacuum tube for the various modes of CW transmission, modulating via key and voice, and for better receiving possibilities. With better sensitivity and selectivity built into receivers, our efforts were now directed toward solving the *QSS Bugaboo*! What is QSS? The Q code gives no definition. So – take a look into the May, 1920, issue *QST*, page 25. Well, since you do not have a copy, this "new" abbreviation was added to the list, adopted by ARRL to fill a need. What does it stand for?

QSS? – Do my signals fade?

QSS – Your signals fade.

Although rarely used, this abbreviation, even in these days, makes sense.

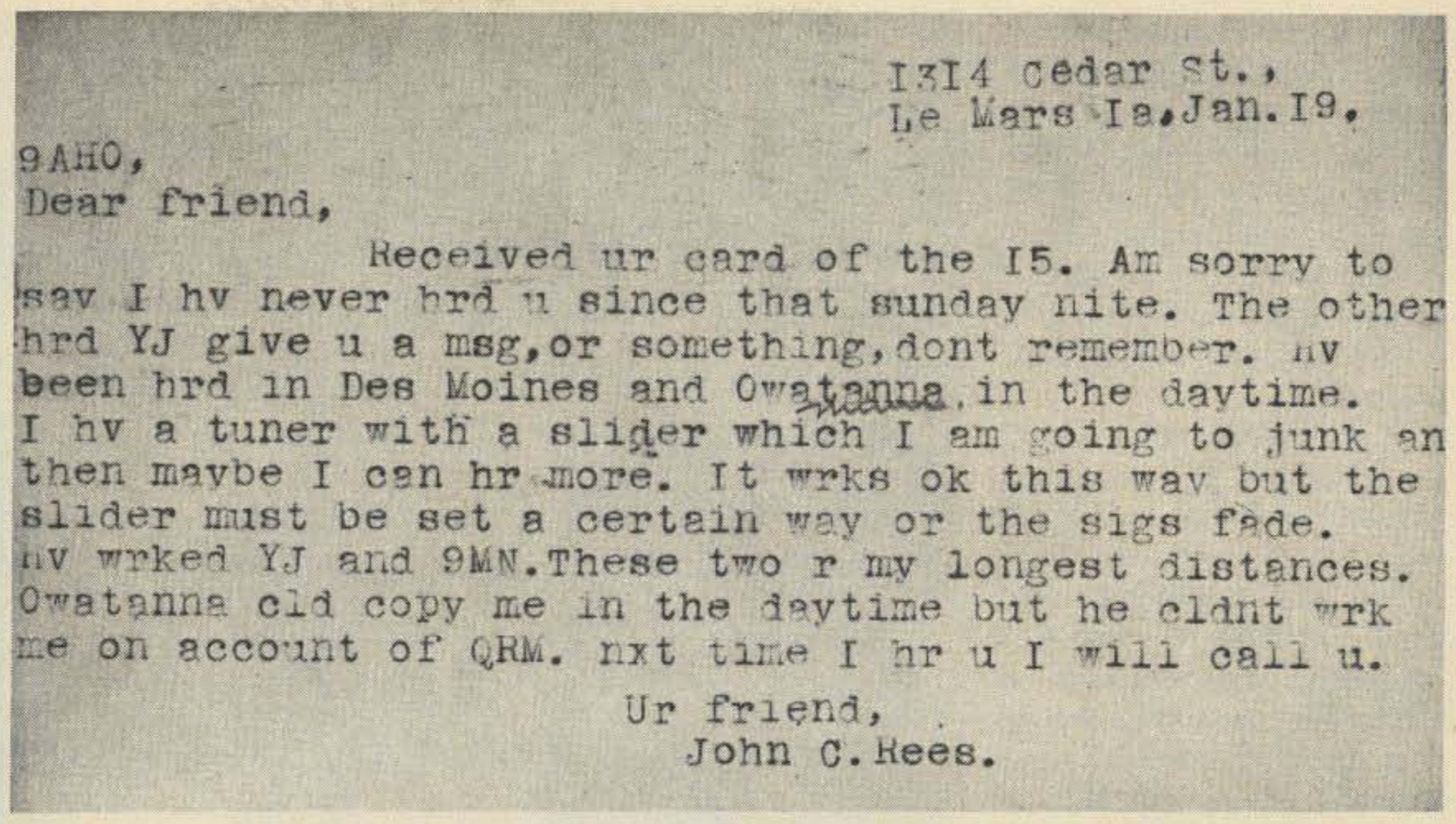
Amateur radio was not out of the woods regarding clear sailing without periodic attempts on the part of the government to curb their activities. The Poindexter Bill, originating as document #165 through a letter from the Secretary of the Navy, was in the hopper. It stood facing the amateurs later on as Poindexter Bill S-4038, and did not bode good news for the amateur.

The time loomed on the radio horizon in 1920 to be thinking about international regulatory legislation to bring radio communication the world over under better control. A meeting of the International Communications

The "latest" in ham equipment just before all amateur activity was banned during World War I.

Convention in Berne, Switzerland, was on the agenda. The radio amateurs had to have prominent representation. Intensive efforts were made to protect the rights and privileges belonging to the amateur. Charles H. Steward, member of the ARRL Board, was appointed legal counselor to speak for the amateur in these matters. In order to cement more firmly the ties that bind, amateurs decided that in numbers and in get-togethers there is strength, and much could be accomplished via this route. The thinking centered on having regional conventions, typical gatherings to meet each other personally, to set out program meetings, and to air mutual problems.

One of the early conventions took place in Chicago, sponsored by the Central Division Managers of ARRL. Held September 2 to 4 at the Edgewater Beach Hotel, there were about four hundred in attendance. There had been similar conventions held in Boston and Philadelphia, but this one in Chicago was to be of wider scope in quantity and quality to bring home to all amateurs what we were up against. The report issued from headquarters: "The convention out-conventioned anything yet pulled off in amateur radio."



1314 Cedar St.,
Le Mars Ia, Jan. 19.

9AHO,
Dear friend,

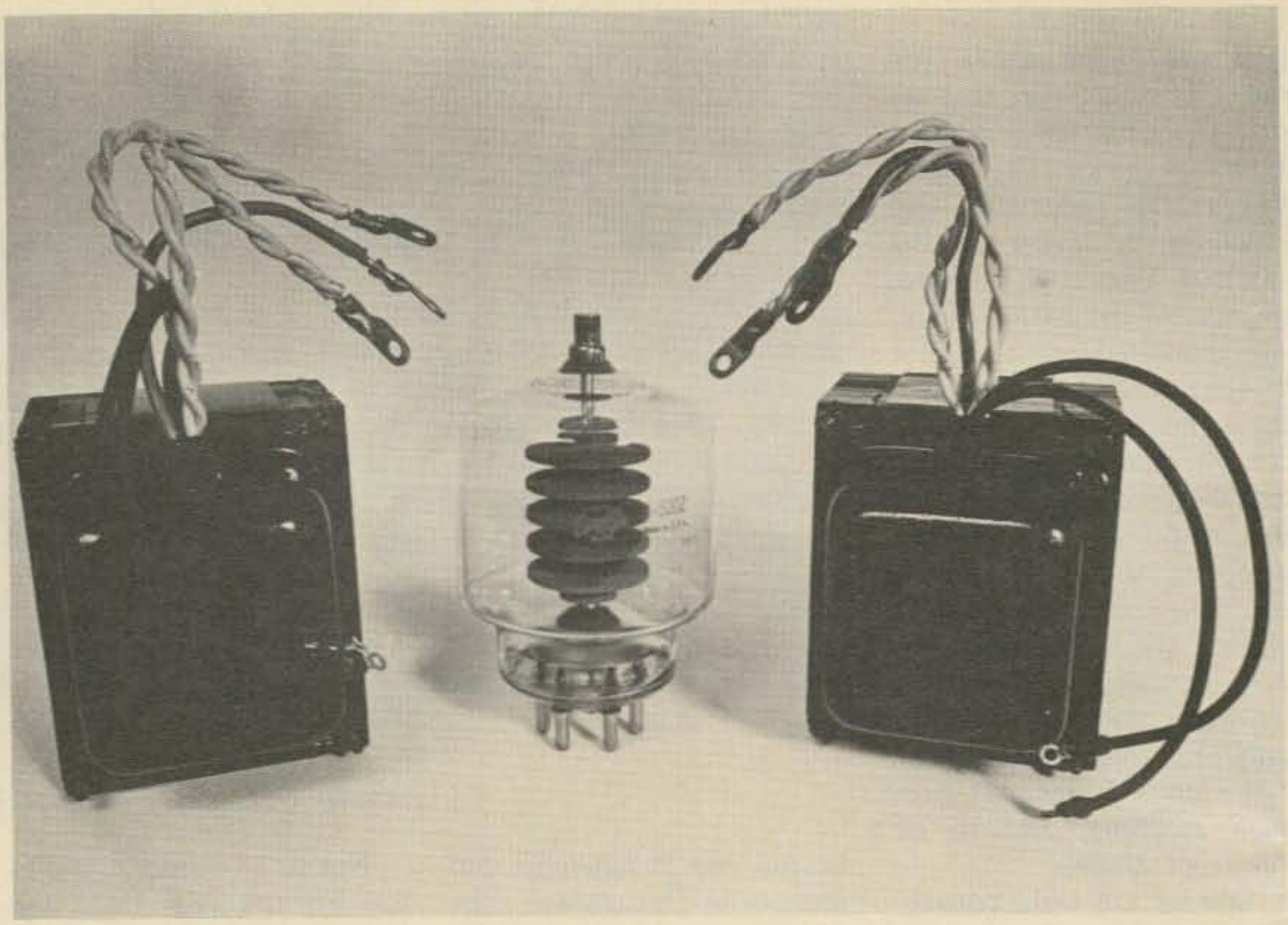
Received ur card of the 15. Am sorry to sav I hv never hrd u since that sunday nite. The other hrd YJ give u a msg, or something, dont remember. nv been hrd in Des Moines and Owatanna in the daytime. I hv a tuner with a slider which I am going to junk an then maybe I can hr more. It wrks ok this way but the slider must be set a certain way or the sigs fade. nv wrked YJ and 9MN. These two r my longest distances. Owatanna cld copy me in the daytime but he cldnt wrk me on account of QRM. nxt time I hr u I will call u.

Ur friend,
John C. Hees.

An early QSL card, sent in 1917.

Not to be outdone, and to top off the year 1920, the Midwest ARRL Division decided that St. Louis would be the next place for a meeting. The time, December 28 to 30, under the sponsorship of the St. Louis Radio Club. Everybody of note in amateur radio circles showed up, from the President Hiram P. Maxin, the Editor K. B. Warner, the Chicago gang, Paul Godley, M. B. West, R. H. G. Mathews, and of course, "The Old Man" himself, who gave a stirring account of the "joyous" and glorious" three days.

To be continued.



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Wind Your Own

- - cheap filament power for that linear

A major expense when it comes to building that linear is the price of the filament transformer. Fortunately, one or two of those obsolete tube power transformers can get you over that expensive hurdle with only a little time and a few cents invested.

First weigh your transformer to determine capability. Refer to Fig. 1, which illustrates the relationship between weight and filament power capability. For example, if the power transformer weighs 4 pounds, it should have a filament power capability of 60 Watts.

Next determine if the transformer is adequate for your application. Let's say you have a transformer with a recycled capability of 60 Watts and you desire a new secondary for a 4CX1000A high power ceramic-metal tetrode. As the 4CX1000A has a maximum filament power requirement of 59.4 Watts (6 volts x 9.9 Amps), you could indeed use this transformer for your filament supply. You could also use two thirty or forty Watt transformers in parallel.

Once you have selected your transformer, disassemble the outer case and note the location of your primary winding in respect to the core of the transformer. The primary leads are usually color coded black. Make sure your transformer has a 110 volt, 60 Hz primary, as some surplus transformers have odd primary voltages that operate at other than 60 Hz. Also, some transformers do have their primary near the outer core and, generally, this type of transformer provides little area for your new secondary. Transformers that have the primary wound tightly around the center core provide the most area and versatility for your new secondary.

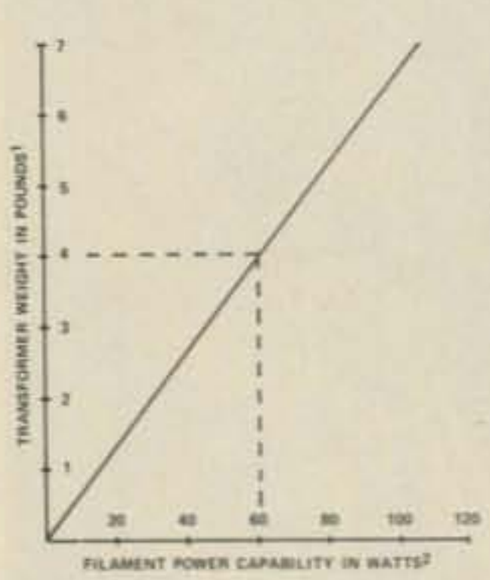

Fig. 1. [1] Weight excludes mounting fixtures. If case is of heavy steel construction, remove before weighing transformer. [2] Data based on an analysis of typical transformers.

After you have located the primary, cut off and remove with a hacksaw all secondary windings that are wound *around* the primary. Work slowly and take care not to cut or damage your primary winding.

After completion of your cutting, inspect the primary for damage. Next, wrap the primary winding with one layer of plastic tape. Securely attach and insulate the primary leads.

The number of load turns per volt must next be determined. Wind approximately 4 turns of no. 18 insulated wire around the primary as a temporary secondary. Apply the normal primary voltage (110 volts, 60 Hz) to the primary and measure the output voltage of your temporary secondary with an ac voltmeter. The voltmeter reading will determine the turns per volt. For example, if you measure 2 volts, you know it took 4 turns on the secondary to produce this 2

volts; therefore, the turns per volt is 2 turns per 1 volt. Keep in mind this is the no-load turns per volt.

After removing the temporary secondary, wind your permanent secondary. I use two no. 14 wires in parallel for my secondaries, as this is quite easy to wind around the primary. Two no. 14 copper wires will be adequate for secondary current levels up to 10 Amps, 5 Amps per wire. The insulation on the wire should be capable of withstanding at least 10 times your output voltage. Example: If the secondary output is 7 volts, the insulation should provide protection up to at least 70 volts or higher.

Always allow about 50% more wire than your turns per volt indicated, as you will have to increase the number of turns to compensate for the transformer resistance when operated under load. A filament transformer must have the correct output voltage under load; therefore you must load your secondary and take periodic measurements during its construction.

Let's say for example you require 6 volts at 10 Amps. According to Ohm's Law the load must be .6 Ohms.

$$R = \frac{E}{I} = \frac{6 \text{ volts}}{10 \text{ Amps}} = .6 \text{ Ohms}$$

Therefore you should load the secondary with a .6 Ohm resistor while measuring the output secondary voltage. Ohm's Law requires the power dissipation of the resistor be at least 60 W.

$$P = IE = (10 \text{ Amp})\ (6 \text{ volts}) = 60 \text{ Watts}$$

However, a much smaller wattage resistor may be used if you work rapidly and do not allow the resistor to heat up.

That's it; good luck on that linear. ■

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Flushing NY 11367

Discriminator Output for the HR-2A

-- check deviation and modulation

A very simple addition can be made to the Regency HR-2A and other FM receivers which will provide output for a frequency shift meter, scope, tape recorder or for whatever other purposes a discriminator output is required. A partial diagram of the HR-2A discriminator is shown in Fig. 1. Refer to the schematic diagram of your receiver to locate the equivalent takeoff point.

At test point TP-A, add a 10k resistor and a .01 capacitor to filter out low frequency variations of the discriminator dc output. The other end of this filter connects to an unused terminal on the speaker terminal strip. Fig. 2 shows the circuit of the filter and output wiring. To use the discriminator for meter operation, connect a VTVM to terminals 3 and 4 of the speaker terminal strip and set the meter to the 5 volt dc range. Turn the receiver to a channel that doesn't have a signal coming through and adjust the meter for center scale reference (2.5 volts). You can now switch the receiver to any station that you may wish to check, and see how far they are off zero by the amount of the meter deflection.

In this particular set, the frequency shift is .30 kHz per division of the meter. To calculate how far off zero a station is, merely count the number of divisions above or below the zero center position that the meter indicates and multiply this by .30 kHz. As the frequency shift per division can vary from set to set, it's a good idea to check your own calibration.

Another useful application for the discriminator output is to check the modulation (deviation) of received signals. To do this, connect an ac scope input across terminals 3 and 4. Set the sweep frequency to a low value and observe the modulation peaks on the scope. Set the vertical gain control so that a normal signal deflects the scope to some convenient height. Now, as other stations come through you can tell whether their modulation is excessive or too low. This same hookup can also be used to set the level of a Touchtone pad. Have the operator of the station that you are checking whistle into his microphone, and observe the height of the scope pattern. Now have him press one of the buttons of his pad and adjust the output level control for the same deviation as produced by whistling. Although this may not be the optimum adjustment, it is a good starting point.

When not using the discriminator for any other purpose, it can be left connected to the AUX input of a cassette recorder. Now anytime that you wish to record an incoming signal, merely start up the recorder and adjust the record level control for proper operation. The volume control and tone controls of the receiver will have no effect on the discriminator, so it can be set to please yourself. There are many other uses for the discriminator output on a receiver, but only a few have been mentioned, just to start the mind working. ■

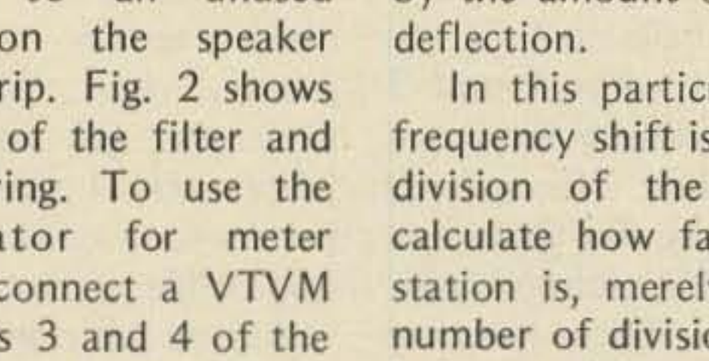

Fig. 1. Discriminator circuit.

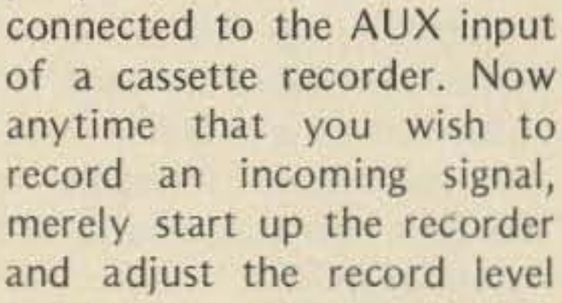

Fig. 2. Terminal connections.

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The Phantom Exposed

- - everything about crosstalk on Ma Bell's lines

By FCC regulations, phone patchers must be careful to avoid high levels when they connect to telephone lines. There seems to be a point where the effects boil over, but a little less makes no trouble at all. Some of us know that it is crosstalk that bothers Ma Bell and the FCC, and this must all come from the conductors in the cable. So why is this effect so abrupt? For that matter, why crosstalk at all? Hasn't Ma Bell heard of twisting wires to eliminate coupling, and of coax?

Yes indeed, she has. In fact, the old girl invented these and a lot else besides. Trouble is, no method *eliminates* crosstalk; at best, it reduces it to a tolerable level. And nowadays, "tolerable" is the best you can afford, the "state of the art."

Fig. 1 shows the classic old farmer's line, the single wire working against ground. It works up to several miles, so long as it is the only circuit on the pole line. Of course, it is a good antenna too, and how many times has it been used as one! It picks up static and power hum on a clear day, and you can hear a storm coming while it is miles off.

Fig. 2 is the classic "full metallic" line. Both conductors are above ground, both literally and electrically. The center tap of the line transformers, or "line coils," may be center tapped with the center tap grounded or not. In any case, there will be lightning arrestors which offer a breakdown path to ground. Even on a clear day, a long insulated line may pick up several hundred volts of static charge. Ask any lineman! The signal is "push-pull" so that the two wires of the pair are always opposite phase.

Static and induction affect both wires in phase, and cancel out in the windings of the terminating transformers. That is, they affect both wires equally if the source of the interfering field is some little distance away, such as a paralleling power line. But string another pair of wires on the same cross-arm, and the coupling between them is both much closer and much less balanced, as is shown in Fig. 3.

Simple Balance Scheme

Fig. 4 shows a simple balancing scheme I have seen used by some radio stations, when they want to run two transmission lines together. The pair numbers are 1-2 and 3-4 and they share a common center point. If you made up two lines with ribbon leads, you would have to split the pairs so that wires 1 and 3 were in one ribbon and 2 and 4 in the other. The spacing would have to be close and critical, so that ribbon lead is not practical. These lines are always open wire ones. But it does work. Notice the bridge symmetry of the capacity couplings.

Transpositions

Untransposed lines are good for a mile or two. After that, you can't tell which line is being talked on – you hear either or both nearly equally well. They are still balanced so far as static and line hum are concerned, but violently unbalanced for the adjacent pair. Only one wire working against ground would be worse.

Fig. 5 is what we do about it. At the middle, you just interchange the wires on one pair, and immediately you're in business! Wire 3 is close to 2 for half its section, and 4 is close for the other half. 3 and 4 are out of phase, so the inductive effect cancels. Of course, 3 and 4 couple to wire 1 also – the coupling is less, but present, and cancels with it in the same way. The net result is, no crosstalk. Swell! Our telephone plant is growing, so let's add another pair, 5-6. Immediately, we're in trouble: If we transpose it, it will crosstalk with 3-4, and if we don't, it will crosstalk with 1-2.

The Transposition Plan

If Fig. 5 worked once, maybe it will again. Let's transpose 5-6 in the middle, so it won't couple to 1-2, and then transpose each half again, to break up the coupling with 3-4, which gives us Fig. 6. Now we're in business – until we add 7-8. If 1-2 has no transpositions, 3-4 has one, and 5-6 has three, it would seem that 7-8 would need seven. And that's exactly right. And by the time you got up to a full forty wire line, the whole scheme would be quite impossible – you'd have to transpose wires in the middle of the span. Oh yes, this has been done, too, but not for this reason.

The Phantom Group

No communication business ever has enough circuits. Ma Bell came up with a good trick generations ago – the phantom circuit, Fig. 8. Just connect an extra pair of line coils to the center taps of the 1-2 and 3-4 coils, and you get a third circuit,

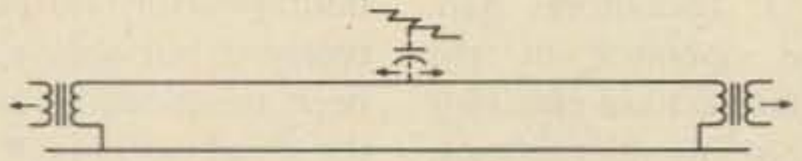


Fig. 1.

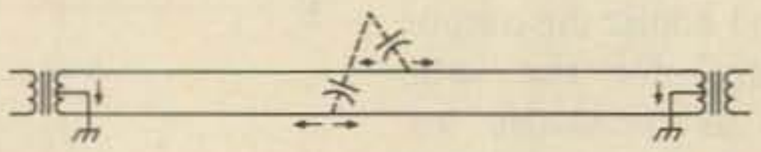


Fig. 2.

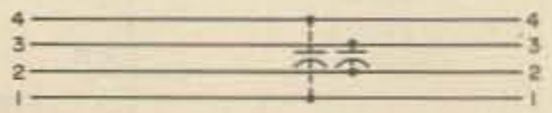


Fig. 3.

Fig. 4.

practically for free — three circuits on four wires. By means of the center taps, the phantom circuit uses 1-2 (side 1) in parallel as one wire, and 3-4 (side 2) as the other parallel wires. It is called "phantom" because you can't see any wires for the third circuit.

Ghost

The old girl got carried away for a time with the phantom idea. Here was another center tap on the phantom coil — why not go further and make a phantom of the phantom? It actually worked, and the "ghost" was born. Now you could get seven circuits on eight wires. Trouble was, the ghost circuit worked only an alternate Tuesdays — it was always too wet or too warm or too something, and they were the devil to keep balanced. So the ghost was soon kicked out and the standard became a number of phantom groups.

Phantom Group Transpositions

It may have occurred to you that, with two wires of a side circuit used in parallel for one side of the phantom, transpositions in the side would become ineffective so far as other phantoms were concerned. And that is exactly right. Fig. 9 was developed to cope with this effect — you just swapped the pair position bodily with its mate, which transposed the phantom just as a side would be transposed. But the solution worked for more than just the phantom group. By transposing the whole business in this way, the whole transposition plan was greatly simplified. Remember that it began to look as if the highest-numbered pair would turn out to be a continuous spiral, with hundreds or even thousands of transpositions in it? Every time you added a pair, it had to have nearly double the number of transpositions in it. Now you can divide your pole line into phantom groups and just transpose them. This is one case where the solution overshadowed the problem!

So far, we have four main types of transpositions. These are: Type 1 which turns over the low numbered side; Type 2, for the high numbered side; Type 3, which transposes the phantom; and Type 4, which transposes both sides *and* the phantom at the same point (Fig. 10).

Mules

Pole lines are installed by construction gangs, a group of non-sissies under the leadership of a gang foreman, who is no sissy himself. Remember that these men haul poles around and string wires on them over rough country, which takes rough men. The wires themselves are more like hard-drawn copper rods; the smallest is 1/10 inch in diameter and the largest is about 1/6 inch. The linemen delight in getting some engineering type to try cutting the wire with pliers. The men cut the wire snip-snip-snip like cutting toenails, and the indoors type can't even nick it. It teaches him who he is dealing with and saves trouble all around.

Such wire is very heavy and, in most cases, four reels of wire were hitched to a mule, who was as tough as any of the men. He pulled the wire off the reels while the men kept it from tangling and got it up on the cross-arms and later tied it to the insulators. They had to "cut" the transpositions at certain pole numbers, according to plan, as shown on a big blueprint. Mules are far from stupid, and they soon caught on to what was going on. Entering into the spirit of the thing, the mule would cock his eye at the pole and recognize it as a Type 4 transposition point. Then he would lie down, roll over, and get up, thus cutting his own Type 4 without human help. Many linemen have told me this, with perfectly serious faces, and who in his right mind would doubt the probity of a man who can hike a pole faster than you can climb stairs, with a hundred pounds, more or less, of tools hung on his belt! Not me!

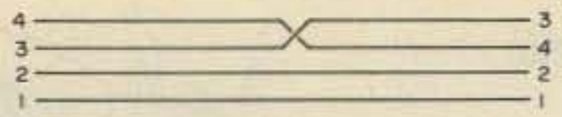


Fig. 5.

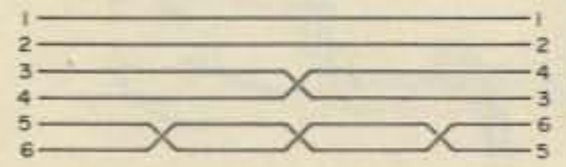


Fig. 6.

Foremen

In fact, back at the hotel or boarding house, there were frequent arguments about who was smarter, the mule or the foreman. Surprisingly, the foreman had his champions, too. Maybe out of sheer loyalty, maybe just to keep the argument going — what else is there to do in a strange, small town at night?

Carrier

Up to this point, we have ignored Fig. 7, but now the story has caught up to it. When you run out of circuits, the obvious thing is to build another pole line. This calls for another right-of-way and many times this is impractical or impossible. Just after WW I, Carrier Telephony was invented by Major General Squires of the Signal Corps. Or at least one variety of it was. He liked the high frequencies and one wire, while Ma Bell used two and frequencies between 7 kHz and 20 kHz or thereabouts, for her A, B, and the good old C-type carriers. The C lasted for a couple of generations — about as long as open wire lasted — and was an excellent system. On a phantom group that already carried three voice circuits, you could get an additional six with two C systems. This effectively doubled the capacity of the lines, at minimal costs.

Trouble

This unsolved the transposition problem, however. Fig. 7 shows why: The sine wave is an interfering carrier signal. It does not affect the lower side circuit 1-2 because as the phase reverses, it induces alternate plus and minus charges which cancel. But at the same time, it induces a plus charge on 3 and a minus on 4, because the line transposed at the same point the sine wave went through zero, and the charges induced *added in phase* instead of canceling. There was

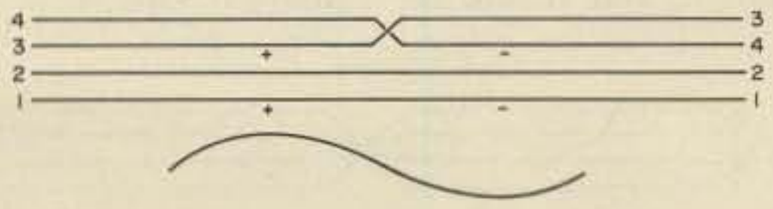


Fig. 7.

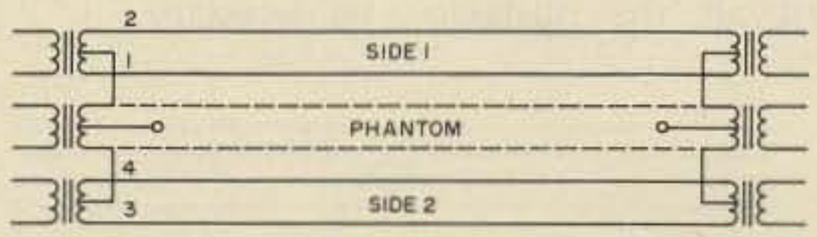
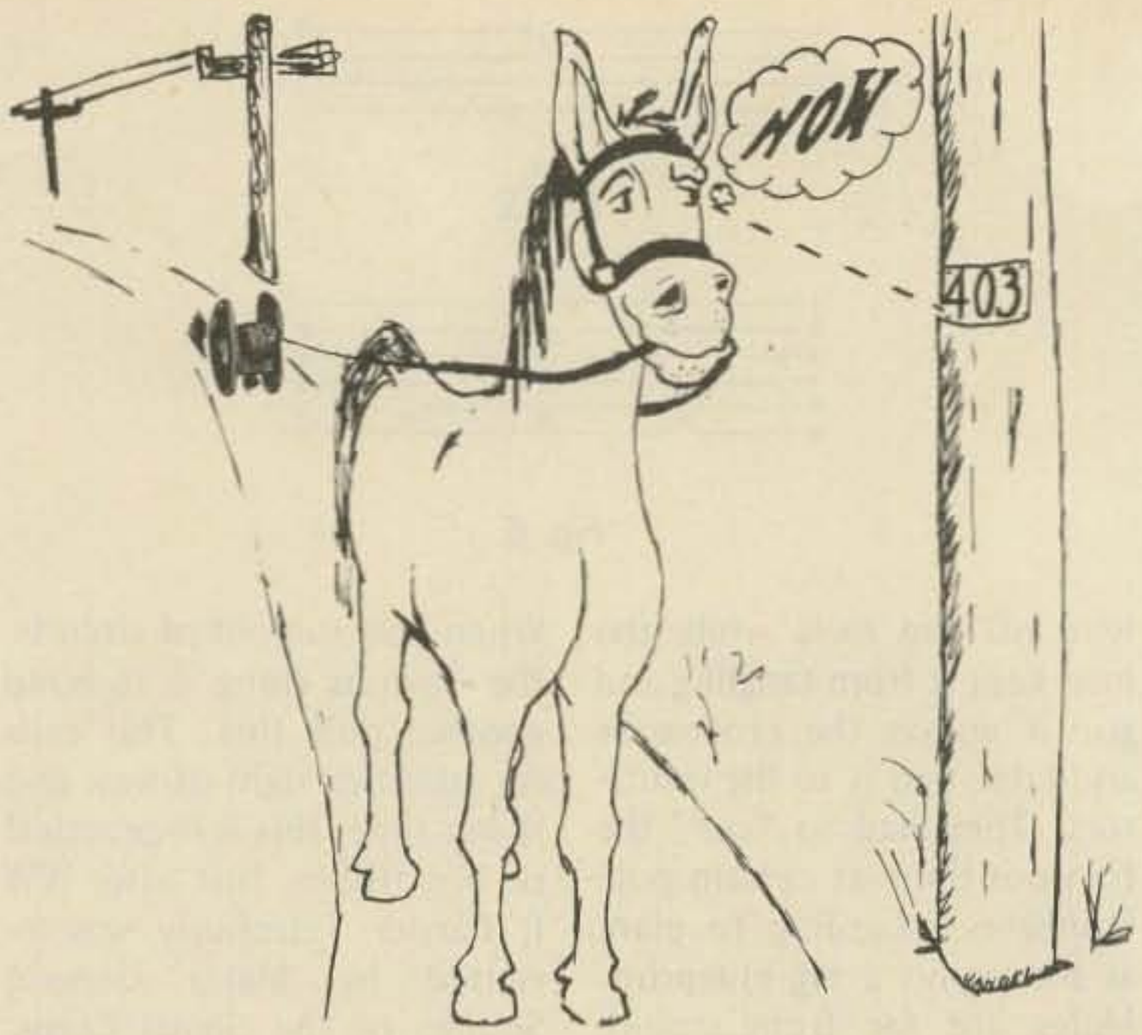


Fig. 8.



nothing for it but to retranspose the whole blooming shooting-match, which was costly and a lot of trouble, but the only way out. Carrier transpositions are just like the others, but are many times as often. The idea is to get several transpositions along just one of the highest carrier wavelengths. This means every pole or two.

Beacon Mountain

Across the river from Newburgh, New York, lies Beacon Mountain. At the bottom of the mountain, everyone puts his TV antenna on the highest mast he can afford, because it is a fringe area, and the fringe is marginal at that. Halfway up the mountain, however, the antennas are mounted directly on the roof, or even in the side yard, which must be an eye-hazard when mowing the lawn. Up near the top you don't see any antennas at all. Maybe they bury them to take advantage of the ground wave. It wouldn't surprise me any.

But under the crest, where there is still some mountain left, but the ground is nearly level, the TV set owners have to harvest all the obstacle gain they can, because the mountain seems to shadow more at this point. I remember one installation – house backed up to the mountain, long front yard extending, nearly level, away from it. Out near the road, a couple of hundred feet from the house, I saw a grubby old conical antenna mounted on a wooden platform which had sled runners on it. Obviously, the owner had hauled it around the lawn until he picked up a "commercial" signal. He used an ordinary ribbon line, supported on what looked like clothes-poles.

Now suppose his brother-in-law had moved in, complete with TV? He'd get the oscillator from the other TV into his own as sure as sin.

Me, I'd leave the original line alone and make him twist his at the rate of a turn in two feet or so – anything shorter than the shortest half wave would do. Instead of threatening him with mayhem, I'd just mention that the spiraling effect made the signals auger their way into the TV set, making a better picture. No argument would be necessary.

Cable

Open wire illustrates the crosstalk problem and its solution as nothing else could, but cable is the facility today. All you have to do is twist the pairs like old-fashioned lamp cord and you can forget about transpositions, isn't that right? Isn't it?

No. Cable pairs come in phantom groups also, but here they are called "quads." If you lay two twisted wires together, they nestle like spoons and you wind up with a swell case of crosstalk. So you have to use different twists for different wires; you have to twist the pairs around each other, you have to interleave the quads, you have to even swap layers in the cable. A cable is one devil of a complex thing! And always, no matter what, there is a little crosstalk that gets in.

If the average level of the circuits at that point is, say, minus 10 dBm and the crosstalk is minus 50, you can forget it. The conversation will drown it out handily. But if the crosstalk comes from a pair with a minus 7 instead of minus 10 level on it, three dB high, the crosstalk will also be three dB higher and you can hear it – just. In fact, the residual noise you hear is mostly the babble from many circuits. But another three dB and it begins to be serious.

Hello

The English word "hello" can be recognized when no other word in the language can. Telephone men can let a hello go by, but any other crosstalk that can be understood requires that the cross-talking circuit be disabled. This is Telco rules and FCC rules, to protect privacy. I have even cut broadcast lines when I heard understandable crosstalk on them, and got away with it. Ma Bell wasn't happy about it, but it had to be done. So if YOUR line crosstalks into others, it will be cut too, as soon as Telco can find it. You won't be reconnected until you fix the level.

Coax

Why not go to coax and get the improved shielding? Simply because coax is a high frequency line. The shielding works at frequencies where skin effect is important. You have cable with a single outer braid where flexibility is important and crosstalk permits. For more severe conditions, you have double braid cable. Next is solid tubing, and if that doesn't work, move it somewhere else.

Shielded Pair

You don't see much of it, but Telco uses a lot of 135 Ohm shielded pair, which is operated balanced just like cable pairs are. It is especially effective at lower frequencies. The shield is grounded at one end, usually, but maybe at both and sometimes in between. You have to insulate the shield, then ground it at a point where ground potentials are least, since ground currents goeth where they listeth and no man knoweth where that ith. Sometimes you're better off letting the shield float; you just have to stay loose and see what works best.

Some preamps have to be laid out with the output next to the input, usually to match other equipment or to pick up the connector, or for some engineering but non-theory reason. Here you have to use a solid tube, with either a coax wire or even a balanced pair in it, to take the output back to the connector. Just like anything else, you just do the best you can with what you have. But isn't that where it's at? ■

Fig. 9.

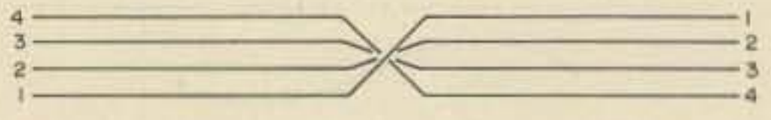


Fig. 10.

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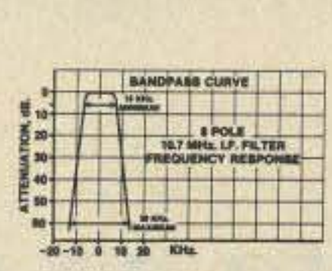
True FM

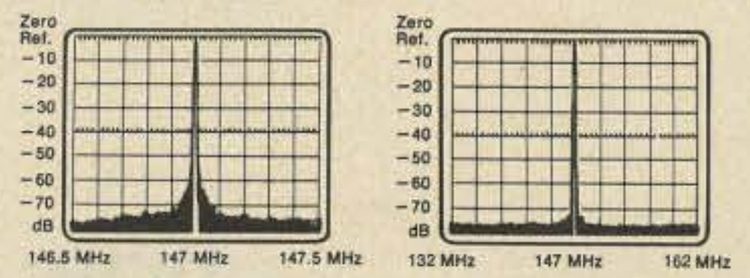
Careful attention to the transmitter audio circuitry and the use of true FM gives exceptional audio quality. A Schmitt-trigger squelch circuit with a threshold 0.3 μV or less provides positive, clearly-defined squelch action. Other design advantages include diode-protected dual-gate MOS FET's in the front end, IC IF and dual-conversion receiver.

Outstanding Specifications

The HW-2036 puts out a minimum 10 watts and operates into an infinite VSWR without failure. Receiver sensitivity is an excellent 0.5 μV for 12 dB Sinad making the HW-2036 ideal for use in crowded signal areas. We think you'd be hard-pressed to find a comparably-priced 2-meter transceiver that gives you the features and performance of the HW-2036.



An 8-pole IF crystal filter greatly reduces adjacent channel interference.



Actual spectrum analyzer photos of the HW-2036 transmitter output operating at 147 MHz. Spurs within 20 MHz of carrier are down a full 70 dB!

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Retire to a Ham Heaven

- - how to go on a permanent DXpedition

George Brumley KØWTM/OA6CV
Apartado 825
Arequipa, Peru

Most of my rag chewing is done with hams in the States and the most common subject is, "What do you do when you retire and where do you do it?" We usually get started when the stateside fellow says, "Uh, you sound like an American; I mean like you're from the States. What are you doing down there? Maybe in the copper mines or in the oil business? Or a missionary?"

"I'm retired, old man; I came down here to live over four years ago, in July of 1972." That usually brings on some other questions: "Well, say now, that's interesting. Do you have friends down there? What made you pick Peru?" Now that I know the man is interested and not just making conversation, I give him the details.

My wife and I went to Africa, to Ethiopia, in 1952, and I built a 31 meter broadcast studio for Haile Selassie. I had the privilege of being on the air as ET3GB most of the seven years we were there. We loved Addis Ababa, high up in the mountains and with all the tropical fruit you could eat in the greatest variety. Living was cheap there in those days. We always said that if we could afford it when I retired, we'd go back. But when the time came, our three children (all born in Addis Ababa, by the way) were getting old enough to think about getting married and we hated to go so far from the States. (The girl is married; the boys are still thinking.) So, we decided to go to South America, even if it meant learning another language. I was 53 and the XYL 54. We had friends in Quito, Ecuador and Arequipa, Peru. We wrote several letters to both places and finally chose Arequipa.

Does that mean that we "just went down there"? Yes, it does. And no, I did not fly down first or visit first and find out about Arequipa. I trusted my friends and read everything I could find in the library in Wichita, Kansas. Then we had a garage sale, sold off everything we could, and gave away the rest. What we couldn't part with we put in six (six!) big crates and shipped them down by sea; we got on a plane and flew to Arequipa. Admittedly, that is not the way I would recommend to someone who has never lived in a foreign country. But we had lived in Ethiopia for seven years and we *knew* there is only one United States of America. Those who expect to go to a foreign country and find conditions just like those in their own neighborhood are in for a shock. But the surprises can be nice pleasant tingling sensations, too.

"How's the weather down there?" Well, friend, we have the weather that California and Florida brag about; sun every day. It hovers around 65 degrees day in and day out and doesn't vary more than about 10 degrees from the hottest to the coolest of the day. Arequipa is about 8,000 feet up in the mountains in the desert part of the Andes. A lot of people have loved this place; the city is about 450 years old and has one of the oldest universities in this part of the world. The sun gets a little hot during the day, but just walk over to the shady side of the street; a bit of breeze will be blowing and you'll almost feel as though you had walked into an air-conditioned store. Most of the natives carry or wear a light sweater. Use it if you have to stay in the shade and take it off if you're in the sun. The poncho is very popular, of course.

With the population explosion, housing can be a problem, but we do very well. A friend owns a huge house here but is living and working in the States. We have six bedrooms, a small fruit orchard, and a private swimming pool. The roof is a huge place, and that's where I have my beam, of course. It's easy to let down and play with. It's on a telescoping mast. The rent? Please don't cry . . . it's less than $100 and I can't tell you how much less but I don't mean what the advertising people do ($99.95)! And no . . . we didn't know about this house deal until we got down here.

Those who have had diplomatic or military assignments overseas and are used to eating out of the commissary should be careful about going to a foreign country to live on their own. It ain't the same! And those housewives whose main kitchen tool is a can opener will soon find themselves asking for a bigger food budget. Canned food is high and there are no TV dinners. But those who like to cook from scratch will find plenty of "scratch." Most foreign housewives go to

The author with more than 100 QSLs. About 150 countries are confirmed, but some of the rare ones insist on sending odd size cards that won't fit the plastic holders.

The XYL, Lucille, likes living in a foreign country, too. She likes all the pretty stamps I get on DX QSLs.

market every day and bring home fresh fruits and vegetables to cook. This is what the French cooks emphasize and they are supposed to be the best in the world. We have everything to eat the North American has, besides all the delicious fruits of the tropics such as papaya, mango, guava and delicious bananas ripened on the tree. You wouldn't believe these after eating those picked green and allowed to ripen while on their way north.

Although there is TV in all the world, we have been weaned because all the programs are, naturally, presented in Spanish. So when the band folds, we read or play cards or develop pictures or generally enjoy ourselves as in the old-fashioned pre-TV days. However, many of the TV serials from the States are presented here with Spanish dubbed in. It's a way to learn Spanish if you're a real TV fan. My youngest son is a TV fan and now speaks such good Spanish and did after only a couple of years that his young Peruvian friends sometimes ask him, "What part of Arequipa were you born in that I haven't met you before?" Or, "Your mother's Peruvian, isn't she?" Well, "Then your father is from Peru?" No, he was 14 when he came down here and he speaks Spanish in a perfect Peruvian way, absolutely idiomatically. But if there isn't an unusually interesting program on and we are tired of cards and reading, we go to a movie. It seems that at least half of the movies are from the States and in English. And the most expensive ones are less than a dollar and the cheapest a fourth of that.

As you may know, the US has reciprocal amateur radio agreements with dozens of countries and Peru is one of them. There probably will be more in the future since the obtaining of a license in the States by foreigners has been simplified and made more liberal. To get a license down here (and in most foreign countries, that is), you should have your own original license from the States and about a dozen photocopies. The process may take three months, but the speed with which most Americans get their ticket from the FCC leaves us little room to grumble. You'll also need a passport and usually some other papers which you can only obtain after you get there — a police certificate, for example, showing that you actually reside at a certain address. You need all of this if you plan to stay in South America for any length of time and operate. If you're just flying down, the best thing to do is write to the radio club in the capital of the country you plan to visit and ask them to help you get a temporary license. Write at least three months before you plan to leave and send along some IRCs. You'll get some forms back in a language you won't understand, but then how many of us can understand the forms Uncle Sam spews out at us every week? Don't we usually have to take them to some office and get official help? So when you get the forms back from the foreign radio club, take them to your friendly high school language teacher and let her put her ability in the language to a real test. Fill out the forms with the help of the teacher or someone else qualified to understand the language and send them off with the required fee. This means an international money order, not your personal check.

Sometimes you get a nice surprise. I did everything outlined in the previous paragraph but didn't get a reply before I planned to leave, so . . . I just said "Get on board, li'l children" and we flew down anyway. When I got to Lima I managed to find the man who was handling the amateur licensing and he personally typed out a temporary license for KØWTM/OA6. So, I could get on the air immediately. Only one little problem: I couldn't get my gear out of customs and didn't get it out until the temporary had expired some 90 days later. But there is an arrangement now to prevent such tragedies. You write to CARNET BUREAU, United States Council of the International Chamber of Commerce, 1212 Avenue of the Americas, New York NY 10036. The CARNET (pronounced kar-nay) is a little paper like a passport or vaccination certificate for your ham gear. So when you get to the foreign port of entry, the customs man takes a look at

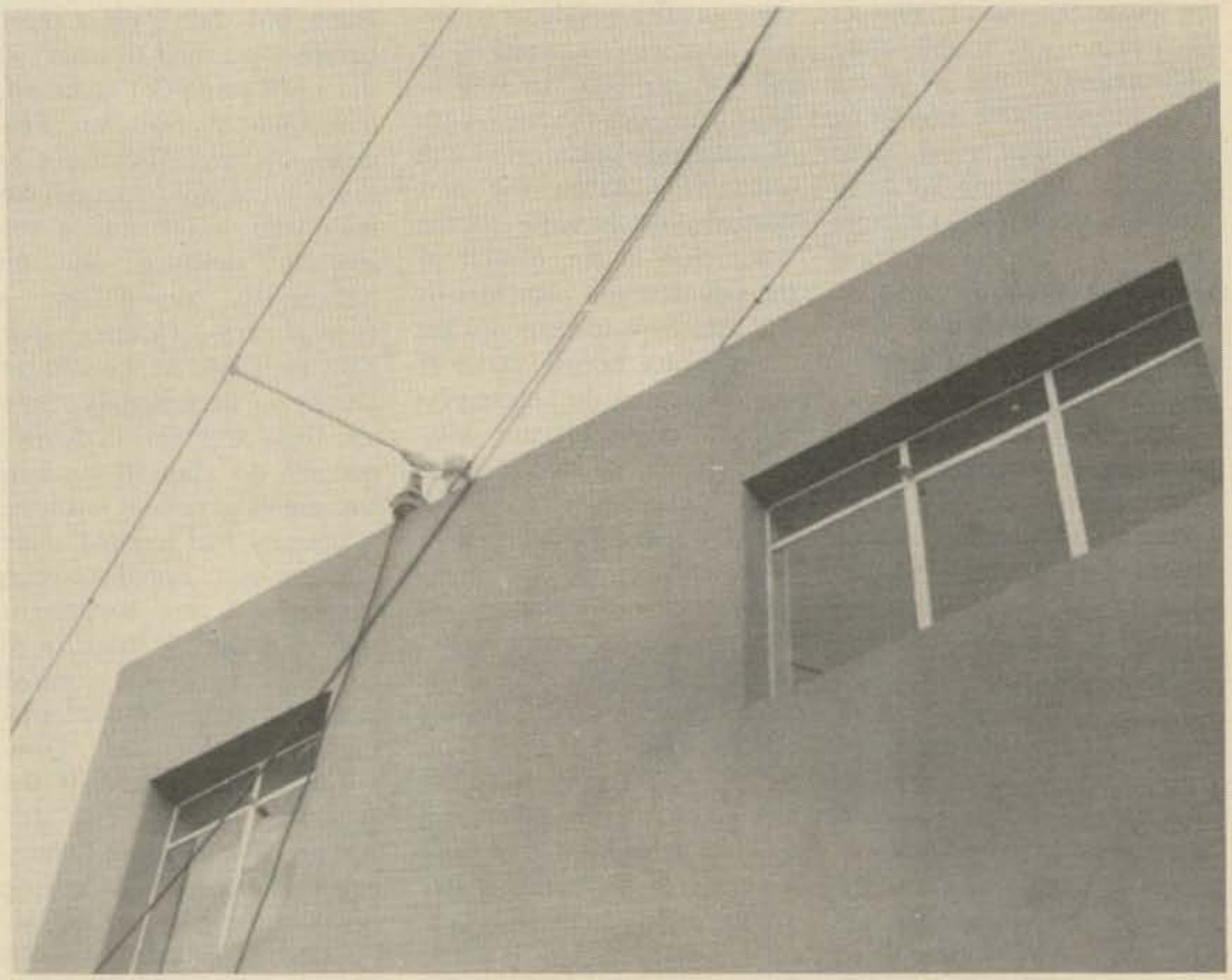
Cleaning up the dishes after a cookout on the patio is no trouble at all if you have a "dishwasher." Our maid costs less than the automatic model you use.

your little CARNET and looks at your equipment and you walk right on in. At least that's the way it's supposed to work. The CARNET is good in 30 countries and with it you aren't suppose to pay customs or post a bond to take your equipment into a country temporarily.

What kind of equipment you take to your foreign hideaway retirement place will depend on a lot of factors, like money and what do you have now. When I knew I was coming to Arequipa, I sold a perfectly good Swan 500 so I could get a Heathkit SB-102. Not that one is better than the other, but I wanted to know as much as possible about the rig I was going to depend on for my hamming. If a rig develops a problem, it is very probable that you are going to be the one to fix it. Sending it out of the country to have it repaired will drive you to drinking ... the customs hassles are unbelievable. And forget that "send in the card that's bad" bit, too. If everything goes well and a friend hand-carries the card to the States and another friend hand-carries it back, you still might be off the air a couple of months. So *know* as much as you can about the rig you're going to be using. While we're talking about it, remember such simple things as voltages and line current frequencies. The rig should be able to work on 220 as well as 117 and on 50 as well as 60 Hertz. And that "220" may well be as low as 190 or as high as 250, so keep that in mind, too. You need a rig that's not fussy about what it feeds on.

A linear is nice but most people in the world don't use one ... as a matter of fact, most hams are limited to less power. You won't find it a big disadvantage if you don't have one or can't afford to bring one along. But you will need a good antenna. In South America, in many countries, the houses have flat roofs. I can't resist trying out beams when they are so easy to get to. I built a homemade 3 element, 3 band quad and put it up on two 10 foot sections of TV antenna tubing I bought locally. For a motor I have a big heavy Ham M. But though there is a little breeze most of the time in Arequipa, strong winds are a rarity and I never had a bit of trouble with it. And what a joy to put the swr meter at the right end of the coax or use the grid dip meter where you should use it ... right at the antenna. Yes, I brought those two simple instruments and an old Simpson along. The grid dip meter is the first of that kind of instrument that Heath brought out years ago. The tube in it has never been changed though I've shocked the daylights out of it a time or two. It's made for use on 117 volts, but twice I've plugged into 220 and was intently measuring away when I realized what I had done.

You'd better bring along your own coax. You can get wire and insulators and you can find someone who can weld together TV antenna tubing for a boom and mast for a quad, if that's your taste, but as for a balun and coax – better bring your own. If you have a 12AVQ, you might enjoy that. I brought a 14AVQ, but the 40 meter band in South America is shared by myriads of shortwave broadcast stations and it takes a lot of courage and



I'm currently using a 2 element triband yagi. What looks like a middle element is the coax from my 80-40 doublet.

peculiar ears to separate the hams from all the crud on top of them. The old vertical works pretty well on 15 and 20 and I've had some use out of it on 10. The 75 meter band down here has a high noise level . . . as far as I'm concerned. The S-meter needle is usually right up there at S-9. However, I have a 75 meter dipole up and I tune across the band from time to time. Once in a while, fantastic things happen. I worked Iceland and South Africa within 15 minutes of each other one night. I often hear stateside signals, but you'd be surprised at how few people are interested in listening for a weak DX signal on 75 or 40. A linear on those bands is a real help.

But on 15 and 20 you can find lots of DX and have all the fun a retired ham's heart can stand. Assuming that, as an American, English is your native language, you'll find that is a big advantage. Most of the DX stations will be speaking English and if you'll learn to speak slowly and very distinctly . . . even exaggerate the pronunciation of the syllables . . . you'll find that you'll work lots of DX. (This will make up for that lost feeling the first few months when you go shopping and find that people look at you uncomprehendingly when you try some of those carefully rehearsed phrases on them.) And working the DX is just the first part, of course. You won't have to beg for cards; you'll find that people will be sending *you* cards with IRCs and begging *you* to send them a QSL.

And you'll learn some other things about QSLing. Some guys will send you a card via the "burro" and will include some IRCs. The card will finally get to you some six months later but it won't be in the envelope. The "burro" will have opened the envelope, taken out the IRCs, stamped "Courtesy such and such 'burro'" on the QSL and sent it along with a lot of others. Perhaps you'll never know the card was sent airmail or that the other fellow sent you some IRCs unless he mentions it on the card he sent you. But he expects to get your card back within a month or so. It doesn't work that way. He's probably swearing at you when he thinks of how that DX station (*you*) just kept his IRCs and didn't send a card back. So, one of the things you can truly enjoy when hamming from a more civilized DX location (rather than some uninhabited rock) is sending back QSL cards. I always say that I need at least *one* IRC to send a card back airmail. If you're retired and do much hamming, you'll go broke if you try to pay for all the cards. Even sea mail mounts up. So give the other fellow your mailing address (get a PO box as soon as possible) and tell him for quick results, send you some IRCs.

A cookout given for a group of commercial radio operators. Many are showing interest in getting on the air for fun as hams.

You're looking at young lamb and pork bought from the Indians out in the hills. The grill is homemade — welded in a friend's shop from scrap he gave me. Won't you come down and have a meal with us?

Since most XYLs are not hams, what will the wife be doing while you're having a ball with all this hamming? First of all, let me say that many, many countries in South America have third party agreements with the US and you'll be rather surprised at the interest your wife will begin to show in hamming after you get her in touch with all the kids and perhaps some relatives or friends she hasn't seen or written or talked to on the phone for years. I've been a ham since 1938 and my wife and I have been married for almost 35 years. Hamming has always been something she could definitely leave alone. But now she often says to me, "Why don't you see if the band is open to the States?" Or, if she hears me talking to someone in or near a city

where friends live, she says, "Ask the man if he has a phone patch." The way most people correspond today is not by letter . . . they'd rather pay a five dollar phone bill and talk to you personally than to take thirty minutes or more to write you a letter and then wait a month for you to get around to answering and have it get to you. So, your wife is going to be much more interested in hamming.

But what else can she do? Why should she let you drag her off to Timbuktu? If she has an ounce of "do good" in her, it can grow to full bloom. A nurse or a nurse's aide is really welcome in most of the so-called "underdeveloped" countries. She would be welcome in most any hospital, and though there aren't many orphanages, she would be welcome there, too. There's nearly always an American "Instituto Cultural" run by the US State Department and teaching English is a big thing with them. She won't need a teacher's certificate or even a high school education. They'll be so glad to have a "native speaker" that they'll show her just what to do and put her to doing it quickly.

But besides what she can do for them (it really is more fun to give than to receive, but some people never find that out), there are things the South Americans can do for *her*. There are usually several shops in any given city where guitars are hand made. They won't look as shiny and finished as a Gibson or Fender or what have you, but you'll be surprised at the beautiful sound they can produce. Haven't you always wanted to play the guitar? Well, you'll have a chance for lessons two or three times a week for what it would cost for one lesson in the States. You won't learn "cowboy" style nor "Beatle" style but remember, it was the Spanish who invented the guitar. You can have private lessons or join a class. You'll be practicing your Spanish and having a lesson at the same time.

OA6CV admiring some new QSLs just in. One IRC gets you an airmail QSL in the States. Turn-around is usually 24 hours.

Buying dresses off a rack is not so popular as in the States. If your XYL likes to sew, she'll find plenty of material, though she'd better bring her own sewing machine. Or she will find plenty of people who can just take a picture of the latest style and turn out an exact copy of a "Paris fashion" from it. The beauty shop bill will drop to next to nothing . . . or maybe it won't. She'll get over saying, "I wish I could afford to get my hair fixed more often."

You thought I was going to leave out your aches and pains, didn't you? Well, if you're truly infirm, you'd better stay home. But you can get good medical treatment in any large city in South America today. And you'll find that in most of them there is a doctor who speaks English and has had some training in the States. Your Blue Cross and Blue Shield won't mean a thing down here, and probably none of the other health insurance schemes will either. (Check, if it's a point with you.) But on the other hand, medical service is so cheap in contrast to that in the States that what you've been paying in premiums will probably take care of about anything you need. You might even be surprised at what you have left over from the money you set aside for medical bills. But if you need a special diet or special foods or a chiropractor, better stay home. On the other hand, if you're a reasonably healthy man for your age and have no unusual problems, don't miss out on all the fun worrying about what you're going to do when you need a doctor. Have a good checkup and ask your doctor what he thinks about your leaving the States.

What about education, if you still have some children in school? My daughter had graduated, but my two sons were still in high school when I took them out and brought them down here. What is education, anyway? Isn't it supposed to fit you for life? While we were uneasy about it at the time, my two boys now are very happy I brought them down here. They have learned to look at the basics of life and have participated in life at an early age. They now know two cultures. They speak Spanish far, far better than the usual high school or even college teacher of it. They read and do some studying on their own and when they went back for a vacation to the States, they took the GED examination and now have the equivalent of a high school diploma. If they want to go to college, I feel they will do better than if they had continued on in high school rather than come down here. It's an opinion, of course.

Part of the fun of working DX is thinking about where the ham you're talking to lives and how it would be to visit or live there yourself. But I can't answer all the questions or discuss all the angles even if Wayne Green invited me to expand this into a "Handbook For The Retired Ham Who Wants to Go THERE And Enjoy the Next Sunspot Cycle." But if

you'll send me your questions and doubts and a check for a couple of bucks to pay for the stamps and a cold beer while I'm typing out my comments, I'll be glad to help if I can. To travel you'll need a valid passport and getting an International Health Certificate is a good idea, too. They don't ask for them all the time any more, but you don't want to be in quarantine even a few days. So get it. And you might want to drive, so get your local auto club to get you an International Driving License. They'll do it even if you aren't a member. And for heaven's sake, get that CARNET for your equipment. You do want to ham, don't you?

Just because you've been told these are the "golden" years, it doesn't mean that you can hoard them. The days go by just as they always have and what matters is what you do with these years. If you've always wanted to ham from some exotic place I'd be glad to help you realize your dream. But if you don't . . . I don't want to talk you into something you'll regret. I've never wanted to run a hotel, but if it would help you decide, I'll be glad to have you and your wife come down and stay with me for a week. I'll charge you a hundred dollars and you'll have to eat Brumley home-style meals and generally entertain yourselves. You can use the rig. Your bedroom will be simple and you'll have to look after yourselves . . . you'll have a private bath. But don't just come down; write beforehand. There just might be two couples that want to come down and I'd rather have only one at a time. I only have one rig and I want to use it myself, too. Or, send me a letter with your questions. Come on, OLD MAN, don't just sit there and dream and wish. You can do it if you want to. Wake up and live the rest of your life! ■

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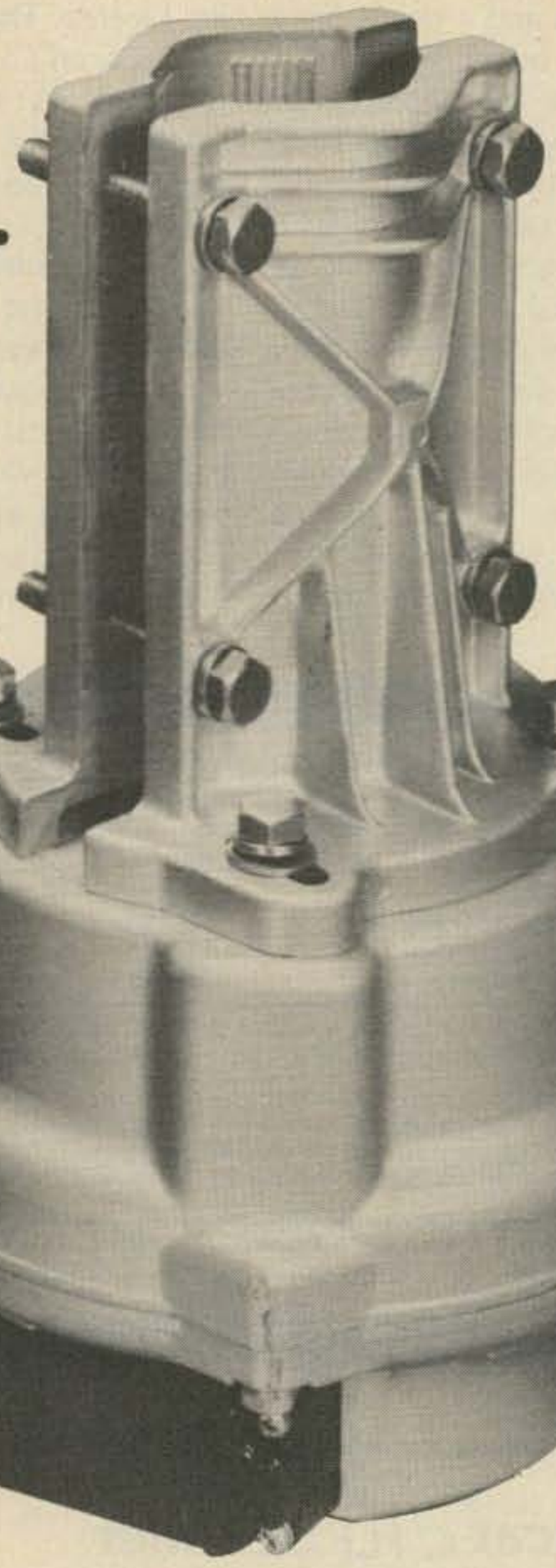

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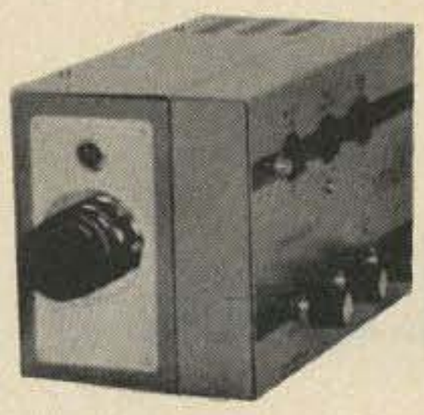

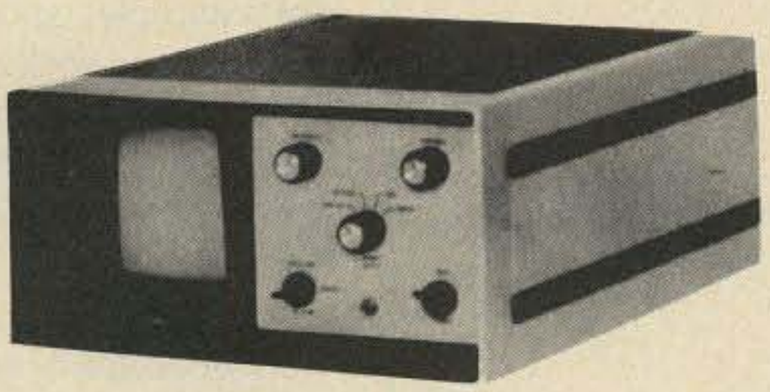

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Hamming the Buggy Sweepstakes

- - ham public service rides again

Photos by Glenn Meader

"And the *Streak's* ahead, followed by the *Delta Queen,* and the *Flying Buttress* is a close third. Around the turn of the chute, it's . . ." No, it's not a car race; it's the annual running of the Buggy Sweepstakes at Carnegie-Mellon University, and amateur radio was there.

Sweepstakes is the descendant of the 1920 interfraternity push-mobile race held on the Carnegie Tech Campus. Things have changed since those ponderous contraptions (one a bathtub on wheels!) rolled; today's buggy is computer-designed, costs upwards of $1500 and incorporates modern features. The buggies of Delta Tau Delta, for example, sport fiberglass monocoque shells, torsion bar suspension and pneumatic tires. This isn't for naught, as the best-designed buggies (engineering, appearance, safety, and special features) receive trophies and generally run better in the race, too.

Sol WB9IHC, "Course Closed!"

Andy WA2UDS, "Course Closed!"

The starting line — "Ready, Set, BANG!!"

Free-roll.

The Course

The race is run on Pittsburgh city streets. The buggies are pushed up a 5.9% grade from the starting line to the free-roll, 2400 feet of downhill, curving road. Turning the hazardous "chute" at speeds upwards of 45 mph, they again travel uphill, being pushed to the finish line. The entire course is 0.84 miles, and the record time (set by Pi Kappa Alpha in 1975) is 2:19.3.

Naturally we wouldn't want cars on the course while the buggies are running — imagine what a 2 ton car would do to a 175 pound (maximum, with driver) buggy! Up until last year a car with a signal flag would circuit the course prior to each heat, indicating to the "flaggers" stationed at each intersection that the course should be closed to traffic. This system had many problems, one of which was that there was no way to inform those in authority if a car ran a barricade, nor was there any way except sheer guesswork for the flaggers to know when to open the course.

Enter Amateur Radio

These problems disappeared when the Carnegie Tech Radio Club (W3VC) began providing communications for the practice sessions held at 6:00 am Sunday mornings. Two meter FM units operating on 52 simplex were stationed around the course with the flaggers, and a command post was established within easy earshot of the sweepstakes chairperson. Three minutes prior to each heat the "close course" was radioed to the flaggers, and each unit would respond by confirming "course closed" status. While buggies ran the course, their position was constantly relayed to the sweepstakes chairperson, and once they cleared the course, she authorized course opening.

Accident!

Buggy accidents can result in serious injury, so the CMU Security Van-Ambulance is kept at the chute at all practices and race days. During the practice last April 1st, a buggy's steering malfunctioned, sending the buggy careening into a tree. A quick radio call brought the ambulance to the scene, and an autopatch call over WR3AGJ alerted the hospital of the incoming patient. The driver was not seriously injured, but doctors at the hospital felt that if he had not arrived as quickly as he did, there may have been serious complications.

Race Day(s)!

April 9 and 10 marked the climax of the combined efforts of the many organizations racing — SWEEPSTAKES! Our setup was the same as that used at the practices, with the addition of a motorcycle unit (WB3AWT) and judges/backup communications provided by the CMU Ranger Company. Ever compare a HT to a PRC-77?

The timers on the judges' truck (HQ) required the starter's countdown and gunshot, so this was broadcast by the unit at the starting line. The Security Van, at the chute, was equipped with a PA system which was used to amplify the starting count for the benefit of the spectators there. Race times and other data were also announced in this manner.

Conclusion

The entire Sweepstakes ran smoothly, and for the first time in years, there were no accidents at all. Much of this has been attributed to the fine communications

The long hard push to the finish line.

The crew (l to r) – John WB3AWT, Karl WA3GSB, Andy WA2UDS, John WA2ZUL, Reed WA3JBQ, Connie W3HTL, Sol WB9IHC.

provided by W3VC.

Club members John Rose WA2ZUL, Sol Marcus WB9IHC, Karl Sieber WA3GSB, Don Gregg WA3KGT, Connie Hilpert W3HTL, Steve Salgaller WA3ZGT, Glenn Meader, Andy Funk WA2UDS, and Pittsburgh amateurs Reed Krenn WA3JBQ and John WB3AWT devoted their time and energy to the project, making it a success. A special thanks to Jerry DiGennaro and the members of the CMU Ranger Company for their participation.

This year the Carnegie Tech Radio Club will provide communications for Sweepstakes 1977, and everyone is invited to come down and watch the races or help out.■

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POWER CONSUMPTION: Transmit: 280 Watts
Receive: 26 Watts (heaters off)
DIMENSIONS: 13-1/8" W x 6" H x 13-3/16" D
WEIGHT: 35.2 lbs (16 kg)

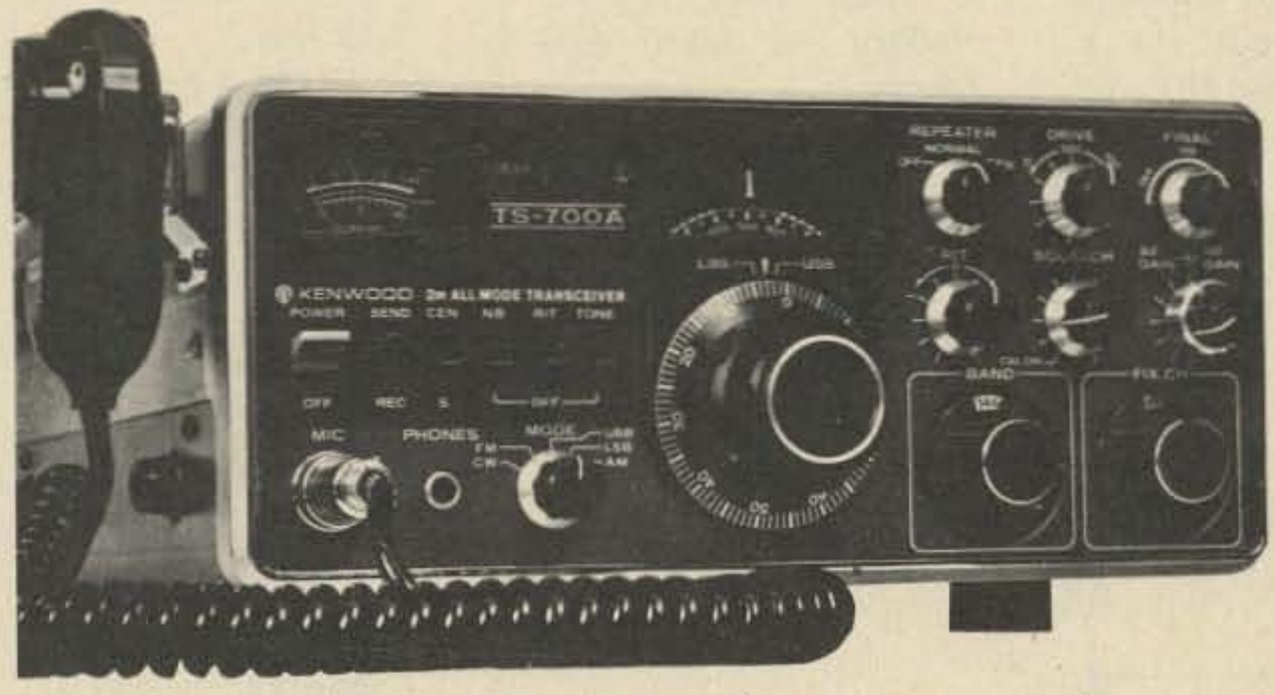
Kenwood's TS-520 has *sold itself* to thousands of amateurs the world over.

The value of its features and specifications are obvious. But just as important is the kind of quality that Kenwood builds in. Hundreds of testimonials on the air attest to its performance and dependability. You probably have heard of some of the same glowing praise.

The TS-520 operates SSB and CW on 80 through 10 meters and features built-in AC and 12VDC power supply.

TS-520 Specifications

MODES: USB, LSB, CW
POWER: 200 watts PEP input on SSB, 160 watts DC input on CW
ANTENNA IMPEDANCE: 50-75 Ohms, unbalanced
CARRIER SUPPRESSION: Better than -45 dB
UNWANTED SIDEBAND SUPPRESSION: Better than -40 dB
HARMONIC RADIATION: Better than -40 dB
AF RESPONSE: 400 to 2600 Hz (-6 dB)
AUDIO INPUT SENSITIVITY: 0.25μV for 10 dB (S+N)/N
SELECTIVITY: SSB 2.4 kHz (-6 dB), 4.4 kHz (-60 dB). CW 0.5 kHz (-6 dB), 1.5 kHz (-60 dB) (with accessory filter)
FREQUENCY STABILITY: 100 Hz per 30 minutes after warmup
IMAGE RATIO: Better than 50 dB
IF REJECTION: Better than 50 dB
TUBE & SEMICONDUCTOR COMPLEMENT: 3 tubes (2 x 6146B, 12BY7A), 1 IC, 18 FET, 44 transistors, 84 diodes
DIMENSIONS: 13.1" W x 5.9" H x 13.2" D
WEIGHT: 35.2 lbs.



KENWOOD'S TS-700A finally fulfills the promise of 2-meters... more channels, more versatility, tunable VFO, SSB-CW and, best of all, the type of quality that has placed the Kenwood name out front.

Allan S. Joffe W3KBM
1005 Twining Rd.
Dresher PA 19025

Taming the Wild Beta

- - how to make transistors behave

Transistors, like the ladies, are rather variable, and while the variability of the tender gender may be the spice of life, with transistors this can be just another electronic pain in the epizootic.

Getting sound through the average low powered stone, such as is used in mike stages or other moderate level use, can be a problem when you realize that transistors of the same type number by the same or different manufacturers may have a current gain variance of about 150% or more.

This means initial design problems or troubles when you go to replace a transistor in an already functioning piece of gear and find either too much or too little gain is being produced by the new unit.

A basic approach around this problem is to tackle it from the idea that the circuitry associated with the transistor might be rolled in such a manner that it could ignore the wide differences in transistors plugged into it.

Fig. 1 shows a unique transistor manufactured by the "Anybody's Transistor and Pool Table Mfg. Co., Ltd." It is NPN, will stand up to a 25 volt supply, and is rated at a few hundred milliwatts dissipation. Its beta or current gain is "tightly held" to a tolerance of between 40 and 200.

One key to the circuit is the lack of an emitter bypass capacitor which produces current feedback. Now for some basic rules of thumb that are not exactly gospel, but have enough latitude to make them work in a practical way.

1. Keep your supply voltage between 9 and 20 volts.
2. Make your emitter resistor at least 470 Ohms.
3. R2 should be about ten to no larger than 20 times the value of your emitter resistor.
4. You should have about 1.0 volt across the emitter resistor to ground. (One way of doing this is to utilize RX shown dotted in between the supply and the emitter resistor. Adjust the value of this resistor so that you do get about one volt from emitter to ground, which will solve your problem.)
5. You select your stage voltage gain simply by multiplying your selected emitter resistor by the wanted gain and using that product as the value of your collector load. Example: Emitter resistor=470 Ohms. Stage gain of ten wanted. 470 times 10 = 4700. So collector load = 4700 Ohms.
6. You can select the value of the R1 top leg of the base bias divider by making it a value that will give about one half the supply volts from collector to ground.
7. You should try to keep the base divider current in the 0.1 to 0.2 mil range. The lower values will tend to give lower circuit noise.
8. On a practical basis, try to keep R2 to 15k or less.
9. On a practical basis, the collector load should run between 4700 and 15k, the higher values for use with higher supply voltages.
10. You can assume that your undistorted output voltage (distortion 1% or less) will be about 20% of your supply voltage.
11. You can assume, on a practical basis, that your input impedance will be the value of the resistor from

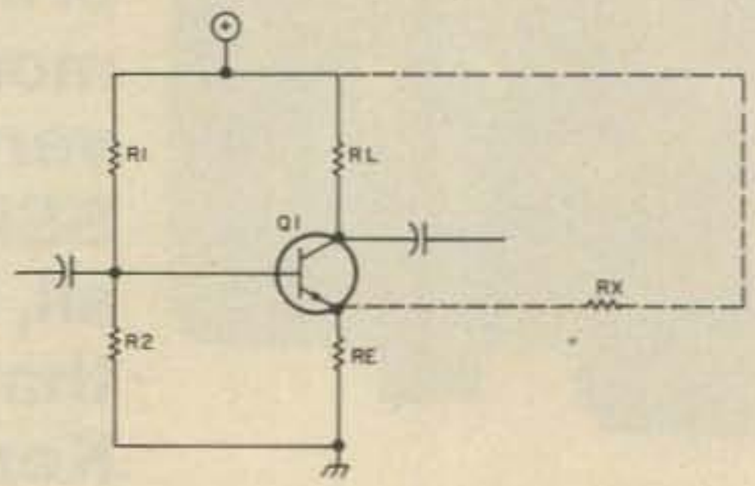


Fig. 1. If your circuit dc conditions are all OK but the emitter to ground voltage is too low, insert a value of RX, as shown, that will bring the emitter voltage closer to the desired one volt target value.

base to ground.
12. You can assume that your output impedance will be the collector load in parallel with the input impedance of the following stage.
13. If your final design does not show a measured three volts or better measured between collector and emitter, fudge your values until you do get close to the minimum three volt figure.

If we follow this series of approximations, what do we wind up with? We should have a circuit that will accept almost any transistor with reasonable approximations of the selected type and give stable gain and stable operation for the range of temperatures that a piece of ham gear might experience in a car.

This would run from freezing in the winter to perhaps 150 degrees in a closed car in the summer sun.

We have two types of stability we are really considering. One is circuit gain or ac stability, and the second is changes in circuit operation with changes in dc conditions in the circuit. This last item is particularly important to you fans of the nine volt battery. These circuit guesstimations should let this type of stage operate down to a six volt throwaway point, or well below the point where any associated power stages would have called for a new battery.

The basic factors for ac stability are the existence of the emitter feedback resistor and the ratio of the emitter resistor to the base to ground resistor. The basic dc stabilizing factors are the effect the bias divider has on swamping out changing base current and, again, the dc effect of the emitter resistor in keeping the base to emitter voltage reasonably constant with changes in collector current. ■

Fred Johnson ZL2AMJ
15 Field Street
Upper Hutt, New Zealand

A Combiner for Your 2m Whip

- - BC reception on your 2m antenna

The article "The Secret 2m Mobile Antenna" on page 44 of the May issue of *73 Magazine* brings to mind a similar unit that I have been using for some time. My requirement was the opposite of that of the article – in my case, to use the one 2m antenna for the 2m transceiver and simultaneously for the AM car radio.

The 2m antenna is a five eighths whip with a loading coil at the base. Fig. 1 shows this coil as L1.

Installation and operation of the splitter unit is a piece of cake. The coax lead from the antenna to the 2m transceiver is broken at some convenient point and the components C1 and L2 inserted in series with center conductor. C1 is adjusted for maximum signal on the transceiver S-meter. No change in the 2m transceiver performance will be noticed.

The AM antenna lead is taken off via a quarter wave stub arrangement. The stub L3 is connected to the antenna side of the C1/L2 assembly. An additional stub L4 is connected to the free end of L3. The AM receiver lead is connected to the junction of L3 and L4. The free end of L4 is left floating with the inner and outer on open circuit.

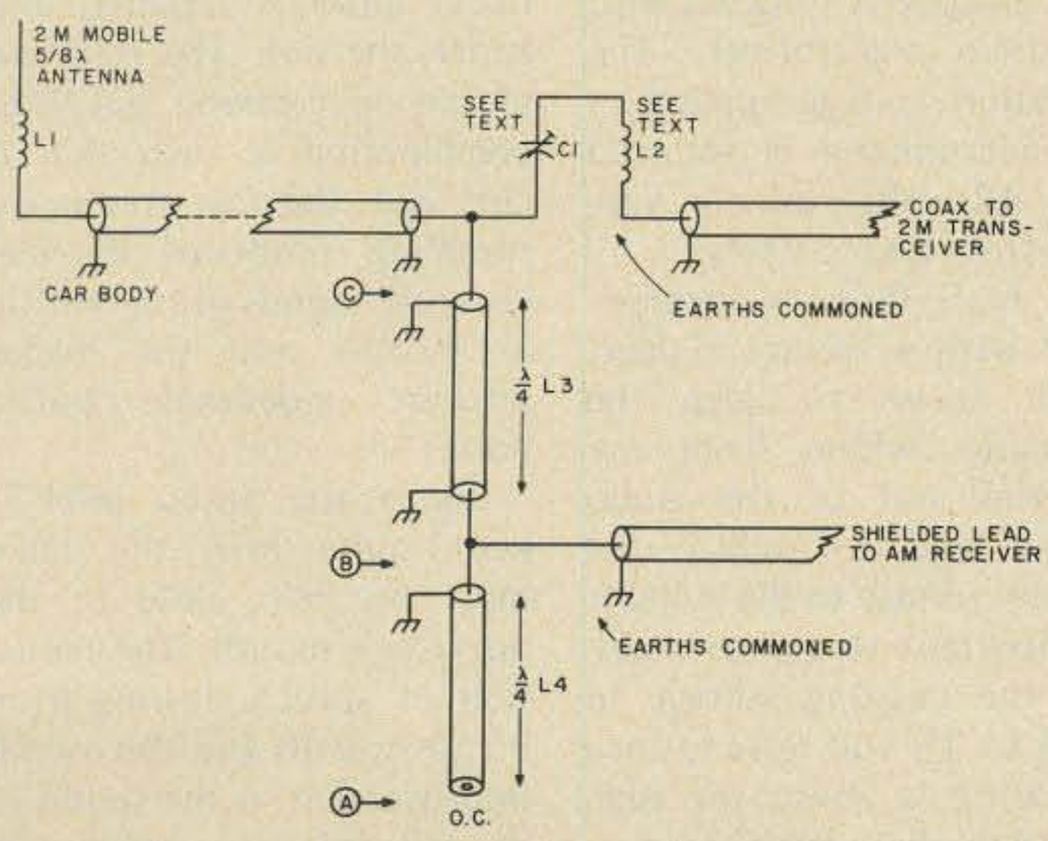


Fig. 1. Diagram of combiner unit for operating AM receiver simultaneously with a 2m transceiver off a 2m antenna.

The operation of the 2m quarter wave stubs is such that the open circuit at A puts an effective short circuit (for the 2m signal) at B. This short circuit at B puts an open circuit at point C. So the 2m signal from the antenna arrives at C and sees an open circuit when "looking down" L3. It sees a low impedance path looking towards the 2m transceiver because C1 and L2 form a series-tuned circuit at resonance. The result is complete isolation of the two operations on the one antenna – 2m mobile with AM music in the background if required.

The five eighths wavelength antenna must be of the variety with a series loading coil at its base (i.e., not the type with a grounded parallel-tuned circuit with a tapped feed). Note that there is a dc path from the AM receiver right through to the antenna.

The coax lengths L3 and L4 depend on the type of coax used. Either 75 or 50 Ohm is suitable. I used solid dielectric type with a velocity factor of 0.66, so the lengths L3 and L4 are each 12.5 inches. C1 is a 27 pF trimmer. L2 is 3½T, ¼ inch diameter, ½ inch long, #18 wire. Both these components should be mounted in a small box to effect good screening.

This combiner has been very effective and certainly improves the appearance of the car (from the XYL's viewpoint, anyway) by reducing the antenna complement by one! This also means that the original AM radio antenna can be replaced with something more useful – such as a collinear for 432!! ■

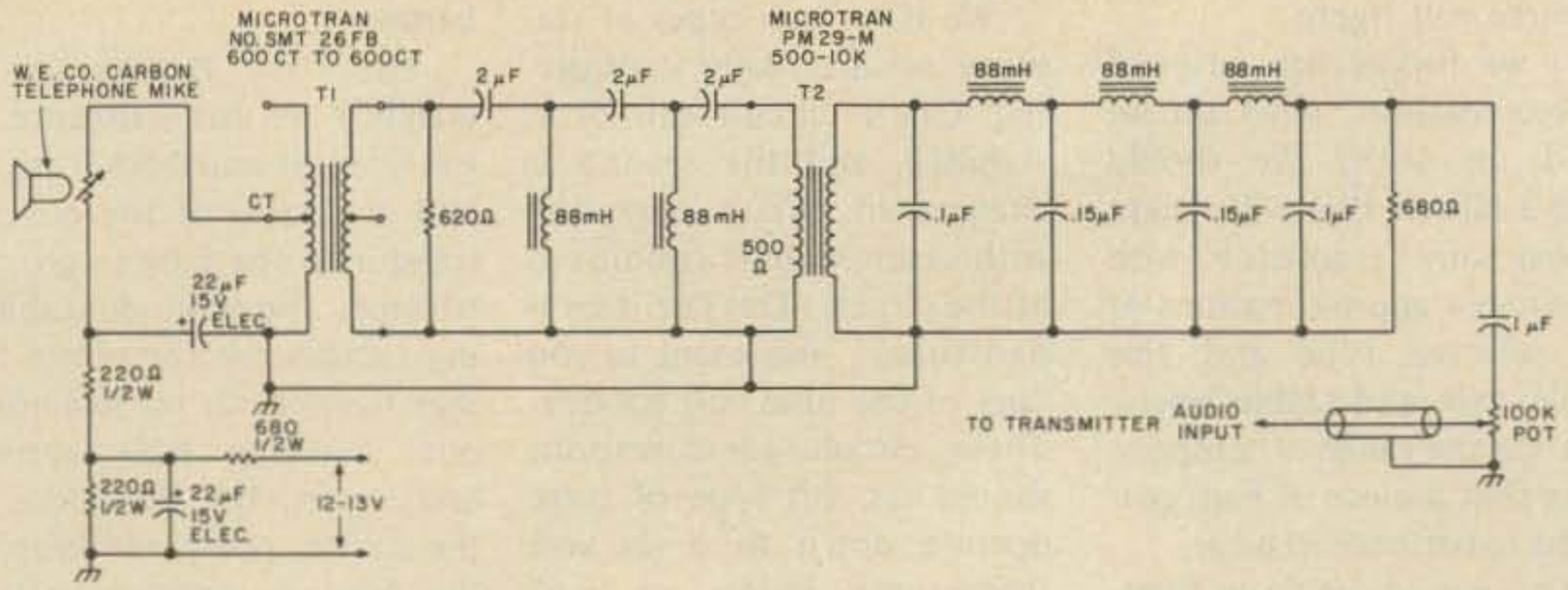


Fig. 1. Unless otherwise specified, all capacitors are non-polarized, preferably Aerovox type V146R aerofilm mylar caps.

Stirling Olberg W1SNN
19 Loretta Road
Waltham MA 02154

The Carbon Marvel

- - best mobile mike yet?

A carbon microphone is one of the most reliable forms of a voice transducer. The carbon microphone can be made to sound natural and, in most cases, the listener will not know one is being used. Listen to a YL on an autopatch; the voice sounds very natural and it is fed into the transmitter via a telephone. Ma Bell has to accommodate many services and, therefore, has given much attention to the carbon mike — in particular to the manner in which it is incorporated into telephone circuits and to the acoustical response of the device.

Carbon microphones can take a fair amount of mechanical punishment. Great excursions in temperature do not degrade their operation and, best of all, they are cheap. They are found in abundance on the surplus market. They make excellent mobile microphones.

This type of mike requires a small exciting voltage. It is a variable resistor which varies the exciting voltage at an audio rate. The audio response is determined by the mounting of the carbon button to its acoustic resonator. This is the diaphragm and cavity in which it is mounted.

The output of the carbon mike can then be directed into a filter which enhances a useful response range, 300 to 2800 Hz. The name of this game, however, is to match the mike to the filter in a manner which prevents or reduces the variation of impedance caused by the change in microphone resistance.

Let's look at the circuit in use at W1SNN. The carbon mike output is directed into an audio transformer. The excitation voltage applied to the microphone is reduced from 12 volts, usually supplied from a car battery.

A hash filter is incorporated with a voltage divider, which serves to keep the alternator whine from my Maverick out of the audio system and to reduce the battery voltage to 3½ volts. It is important to try to maintain the exciting voltage in the 3 to 3½ volt region, since increasing it above the high limit will allow the characteristic "frying" sound produced by the carbon granules to become objectionable. When transformer coupling is used, a current limiting resistor is required to insure that the current flow will not bias the transformer core too badly and destroy its frequency response. The 220 Ohm resistor in series with the divider/hash filter will keep both of these effects to a tolerable level.

The secondary of the microphone transformer is terminated in a fixed resistor, allowing the two section high pass filter to "see" a constant termination regardless of impedance reflections given by the microphone. The high pass filter output feeds into an impedance matching transformer, which is followed by a three section low pass filter.

The overall response of the combined filters depends upon the fact that load impedances must be constant, so the output of the last filter is terminated in a resistor. A potentiometer ac coupled to the output acts as an audio volume control. This control may be eliminated if one exists in the transmitter. However, remember the output of this microphone filter combination is in excess of .250 mV and is far more than required for most microphone input circuits. At W1SNN this microphone is used to generate direct FM by feeding it into a processed audio system incorporated in a frequency synthesizer. Very little audio is required and hence the pot. The response of the microphone and filter combination is such that it cuts out the low frequency rumbling produced by mechanical sounds of my vehicle in motion and the higher pitched undesirable traffic noise.

Since the audio level is kept quite low, the mike must be held close to the operator's mouth. The reduction of speech slurring from breath sounds and the overall improvement in the sound of the rig make the addition of all this circuitry worthwhile. ■

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All band operation (160-10 meters) with most any random length wire. 200 Watt power capability. Ideal for portable or home operation. A must for Field Day. Size: 2 x 4-1/4 x 2-3/8. Built-in neon tune-up indicator. Guaranteed for 90 days. Compact — easy to use. Only $29.95.

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T-UG8-D104, transistorized	$48.60
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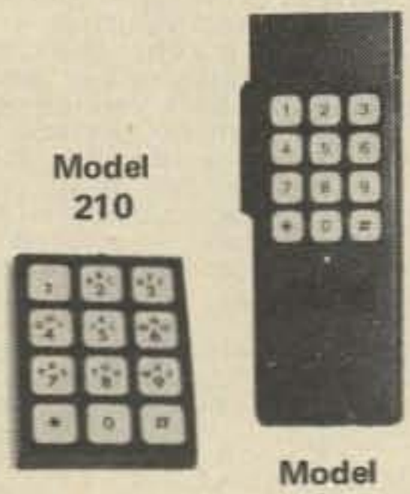

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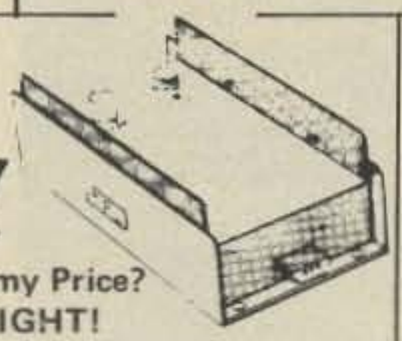

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7028	1-4W	60-80W	1 in/70 out	143-149 MHz	$169.00

Now get TPL COMMUNICATIONS quality and reliability at an economy price. The new Econo-Line gives you everything that you've come to expect from TPL at a real cost reduction. The latest mechanical and electronic construction techniques combine to make the Econo-Line your best amplifier value. Unique broad-band circuitry requires no tuning throughout the entire 2-meter band and adjacent MARS channels. See these great new additions to the TPL COMMUNICATIONS product line at your favorite amateur radio dealer.

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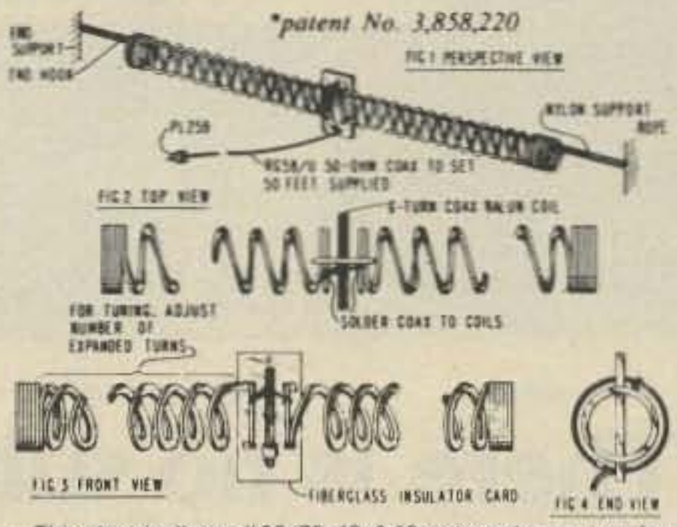
New Slinky® dipole* with helical loading radiates a good signal at 1/10 wavelength long!



• This electrically small 80/75, 40, & 20 meter antenna operates at any length from 24 to 70 feet • no extra balun or transmatch needed • portable—erects & stores in minutes • small enough to fit in attic or apartment • full legal power • low SWR over complete 80/75, 40, & 20 meter bands • much lower atmospheric noise pickup than a vertical and needs no radials • kit includes a pair of **specially-made 4-inch dia. by 4-inch long coils,** containing 335 feet of radiating conductor, balun, 50 ft. RG58/U coax, PL259 connector, nylon rope & instruction manual • now in use by US Dept. of State, US Army, radio schools, plus thousands of hams the world over

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FT-101EE 160-10M	XCVR W/O Processor	649
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FV-101B	External VFO	109
SP-101B	Speaker	22
SP-101PB	Speaker/Patch	59
YO-100	Monitor Scope	199
YD-844	Dynamic Base Mike	29
FA-9	Cooling Fan	15
MMB-1	Mobile Mount	19
RFP-102	RF Speech Processor	79
XF-30C	600 Hz CW Filter	40
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SOLID STATE	160-2M/SW RCVR	599

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FC-2	2M Converter	25
FM-1	FM Detector	20
	Aux/SW Crystals	5
XF-30B	AM-Wide Filter	40
XF-30C	600 Hz CW Filter	40
XF-30D	FM Filter	49
SP-101B	Speaker	22
FL-101 SOLID STATE TRANSMITTER	160-10M	525
Accessories:		
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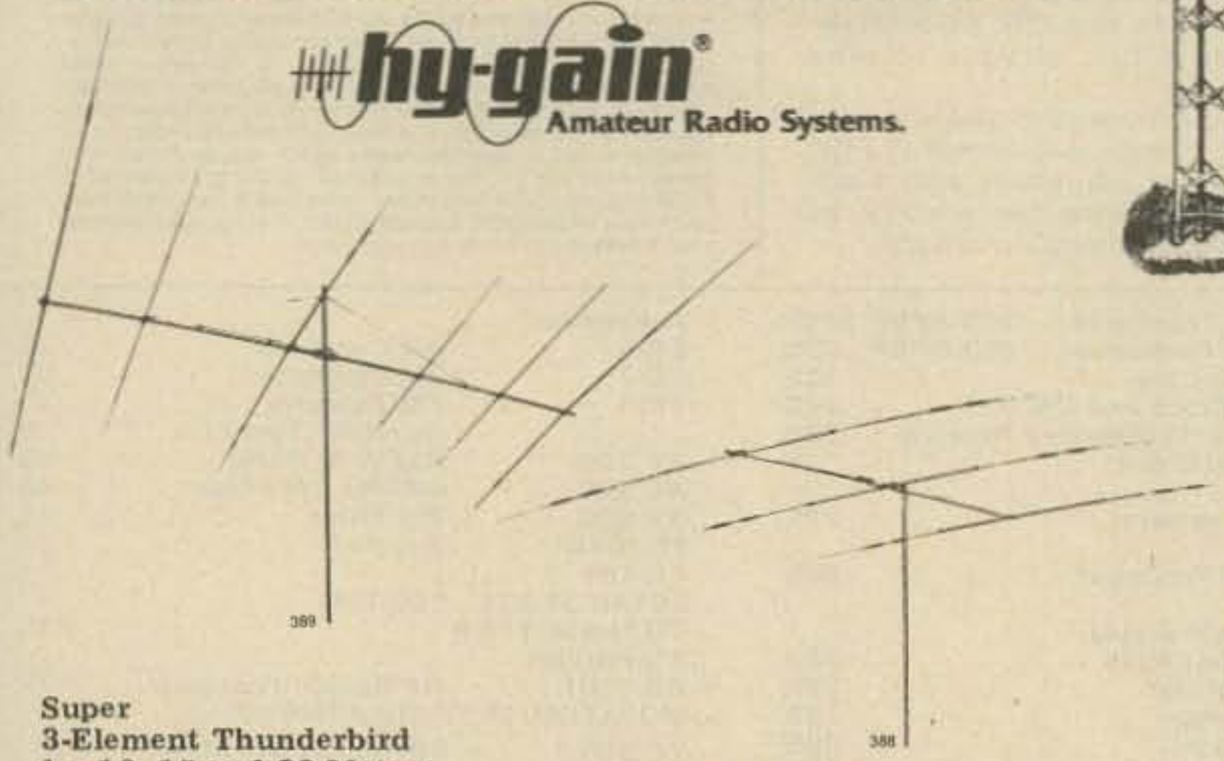


Super 3-Element Thunderbird for 10, 15 and 20 Meters Model TH3Mk3 — $199.95

Hy-Gain's Super 3-element Thunderbird delivers outstanding performance on 10, 15 and 20 meters. The TH3Mk3 features separate and matched Hy-Q traps for each band, and feeds with 52 ohm coax. Hy-Gain Beta Match presents tapered impedance for most efficient 3 band matching, and provides DC ground to eliminate precipitation static. The TH3Mk3 delivers maximum F/B ratio, and SWR less than 1.5:1 at resonance on all bands. Its mechanically superior construction features taper swaged slotted tubing for easy adjustment and larger diameter. Comes equipped with heavy tiltable boom-to-mast clamp. Hy-Gain ferrite balun BN-86 is recommended for use with the TH3Mk3.

	TH6DXX	TH3Mk3
Electrical		
Gain—average	8.7dB	8dB
Front-to-back ratio	25dB	25dB
SWR (at resonance)	Less than 1.5:1	Less than 1.5:1
Impedance	50 ohms	50 ohms
Power rating	Max legal	Max legal
Mechanical		
Longest element	31.1'	27'
Boom length	24'	14'
Turning radius	20'	15.7'
Wind load at 80 MPH	156 lbs.	103.2 lbs.
Maximum wind survival	100 MPH	100 MPH
Net weight	57 lbs.	36 lbs.
Mast diameter accepted	1¼" to 2½"	1¼" to 2½"
Surface area	6.1 sq. ft.	4.03 sq. ft.

6-Element Super Thunderbird DX for 10, 15 and 20 Meters Model TH6DXX

$239.95 Separate Hy-Q traps, featuring large diameter coils that develop an exceptionally favorable L/C ratio and very high Q, provide peak performance on each band whether working phone or CW. Exclusive Hy-Gain beta match, factory pretuned, insures maximum gain and F/B ratio without compromise. The TH6DXX feeds with 52 ohm coaxial cable and delivers less than 1.5:1 SWR on all bands. Mechanically superior construction features taper swaged, slotted tubing for easy adjustment and readjustment, and for larger diameter and less wind loading. Full circumference compression clamps replace self-tapping sheet metal screws. Includes large diameter, heavy gauge aluminum boom, heavy cast aluminum boom-to-mast clamp, and heavy gauge machine formed element-to-boom brackets. Hy-Gain's ferrite balun BN-86 is recommended for use with the TH6DXX.

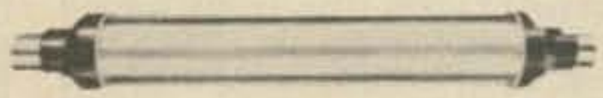
HY-GAIN'S INCOMPARABLE HY-TOWER FOR 80 THRU 10 METERS

Model 18HT
- Outstanding Omni-Directional Performance
- Automatic Band Switching
- Installs on 4 sq. ft. of real estate
- Completely Self-Supporting

By any standard of measurement, the Hy-Tower is unquestionably the finest multi-band vertical antenna system on the market today. Virtually indestructible, the Model 18HT features automatic band selection on 80 thru 10 meters through the use of a unique stub decoupling system which effectively isolates various sections of the antenna so that an electrical ¼ wavelength (or odd multiple of a ¼ wavelength) exists on all bands. Fed with 52 ohm coax, it takes maximum legal power . . . delivers outstanding performance on all bands. With the addition of a base loading coil, it also delivers outstanding performance on 160 meters. Structurally, the Model 18HT is built to last a lifetime. Rugged hot-dipped galvanized 24 ft. tower requires no guyed supports. Top mast, which extends to a height of 50 Ft., is 6061ST6 tapers aluminum. All hardware is iridite treated to MIL specs. If you're looking for the epitome in vertical antenna systems, you'll want Hy-Tower. Shpg. Wt., 96.7 lbs. Order No. 182
Price: $259.95
NEW Special hinged base assembly on Model 18HT allows complete assembly of antenna at ground level . . . permits easy raising and lowering of the antenna.

BROAD BAND DOUBLET BALUN
for 10 thru 80 meters
Model BN-86
$15.95

The model BN-86 balun provides optimum balance of power to both sides of any doublet and vastly improves the transfer of energy from feedline to antenna. Power capacity is 1 KW DC. Features weatherproof construction and built-in mounting brackets. $15.95 Shpg. Wt. 1 lb. Order No. 242



MULTI-BAND HY-Q TRAP DOUBLETS
Hy-Q Traps

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- Super-Strength Aluminum Clad Wire
- Weatherproof Center and End Insulators

Installed horizontally or as an inverted V, Hy-Gain doublets with Hy-Q traps deliver true half wavelength performance on every design frequency. Matched traps, individually pretuned for each band feature large diameter coils that develop an exceptionally favorable L/C ratio and very high Q performance. Mechanically superior solid aluminum trap housings provide maximum protection and support to the loading coil. Fed with 52 ohm coax, Hy-Gain doublets employ super-strength aluminum clad single strand steel wire elements that defy deterioration from salt water and smoke . . . will not stretch . . . withstand hurricane-like winds. SWR less than 1.5:1 on all bands. Strong, lightweight, weatherproof center insulators are molded from high impact cyolac. Hardware is iridate treated to MIL specs. Heavily serrated 7-inch end insulators molded from high impact cycolac increase leakage path to approximately 12 inches.

MODEL 2BDQ for 40 and 80 meters. 100' 10½" overall. Takes maximum legal power. Shpg. Wt., 7.5 lbs $49.95
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MODEL 5BDQ for 10, 15, 20, 40 and 80 meters. 94' overall. Takes maximum power. Shpg. Wt., 12.2 lbs. $79.95
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Strong lightweight, weatherproof Model CI is molded from high impact cycolac. Hardware is iridite treated to MIL specs. Accepts ¼" or ¾" coaxial. Shpg. Wt., 0.6 lbs. $5.95 Order No. 155

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A dipole antenna for the individuals who prefer the "do-it-yourself" flexibility of custom-designing an antenna for your specific needs. (Work the frequencies you wish in the 10 through 80 meters bands).
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Rugged 7-inch end insulators are molded from high impact cycolac that is heavily serrated to increase leakage path to approximately 12 inches. Available in pairs only. Shpg. Wt., 0.4 lbs. $3.95 Order No. 156

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to fit Any Mobile Unit

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Magnetic Mount or Gutter Clamp 5/8 wave — $38.50
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3/8" single hole mount
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model 372 CLIPREAMP

Model 372 — $27.50

Get maximum legal modulation without danger of splatter. Solid-state speech preamplifier and clipper for transmitters, public-address systems, and tape recorders needs no external power.

specifications

Input Impedance	100,000 ohms
Input Levels	5 millivolts to 20 millivolts
Voltage Gain	10 dB
Output Level	60 millivolts
Ouput Impedance	50,000 ohms
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	2-3/4" x 3" x 4-1/2"
Shipping Weight	7 oz.
Connectors	Terminal strip

UNIVERSAL HYBRID COUPLER II PHONE PATCH

model 3002W and model 3001W

Model 300 2W with *Compreamp* — $125.00

Model 300 1W without *Compreamp* — $85.00

Connect your station to the telephone lines. Five switch-selectable modes give complete flexibility for patching the station to the line and for tape recording and playback to or from the line or the station. The hybrid circuit provides for effortless VOX operation of the phone patch. A built-in *Compreamp* speech preamplifier/limiter (in Model 3002W) increases the level of weak phone signals and also prevents overmodulation when the local telephone is used as the station microphone. (The *Compreamp* also functions as a preamplifier/limiter with the station microphone, if desired.)

specifications

Inputs from:	
Line	600 ohms
Receiver	4 ohms
Microphone	High impedance (50,000 ohms) crystal or dynamic
Tape Recorder	4 ohms
Outputs to:	
Transmitter	50,000 ohms
Receiver Speaker	4 ohms
Tape Recorder	0.5 megohm
Size	6-1/2" x 7-1/2" x 3"
Shipping Weight	3-1/2 lbs.
Power	9-volt battery, Burgess 2U6 or equivalent
Connectors	Phono

COAXIAL ANTENNA CHANGEOVER RELAY

model 377

Model 377 — $17.95

Economical and reliable. Can be operated from VOX circuit for completely automatic operation or from PTT or manual T/R switch. Receiver input is automatically grounded when the relay is in the Transmit position. Wide AC operating voltage range and low operating current.

specifications

Power Rating	1000 watts CW (2000 watts SSB)
VSWR	Less than 1.15:1, DC to 150 MHz
Power Requirements	0.015 Ampere, 48 to 130 volts AC
Connectors	UHF Type SO-239
Dimensions	3-1/2" x 1-1/2"
Shipping Weight	1 lb.

BARKER & WILLIAMSON, INC.

Model 359 — $37.50

Increase your transmitter's effective speech power up to four times. Or use it with your tape recorder or public address system for improved performance. This two-stage, transistorized Audio Preamplifier/Limiter can be used with all types of transmitters. Powered by a long-lasting dry-cell battery—no external power needed. Installs without any wiring changes in your transmitter. Just connect the *Compreamp* between your microphone (50,000-ohm dynamic or high-impedance ceramic) and your transmitter's microphone input connector. Front-panel rocker switch lets you bypass the *Compreamp* when you want to. Compression level is adjustable, too.

specifications

Input Impedance	100,000 ohms
Input Level	5 millivolts to 20 millivolts
Voltage Gain	10 dB
Output Level	60 millivolts
Output Impedance	50,000 ohms
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	2-3/4" x 3" x 4-1/2"
Shipping Weight	6-1/2 oz.
Connectors	Terminal strip

COAXIAL SWITCHES AND ACCESSORIES

for antenna selection and RF switching

These high-quality switches have set the standard for the industry for years. Ceramic switches with silver-alloy contacts and silver-plated conductors give unmatched performance and reliability from audio frequencies to 150 MHz.

B&W coaxial switches are designed for use with 52- to 75-ohm non-reactive loads, and are power rated at 1000 watts AM, 2000 watts SSB. Connectors are UHF type. Insertion loss is negligible, and VSWR is less than 1.2:1 up to 150 MHz.

Crosstalk (measured at 30 MHz) is -45 dB between adjacent outlets and -60 dB between alternate outlets.

Models are available for desk, wall, or panel mounting, and with or without protective grounding of inactive outputs. Radial (side-mounted) connector models can be either wall or panel mounted; axial (backplate-mounted) connector models are for panel mounting only, save panel space.

Use the selector chart below to choose the models you need.


Model 550A


Model 590


Model 590G


Model 551A


Model 592


Model 595

COAXIAL SWITCH SELECTOR CHART

Model	PRICE	Outputs	Connector Placement	Mounting: Panel	Mounting: Wall	Mounting: Desk	Automatic Grounding	Dial Plate	Remarks
375	18.95	6	Axial	x			x	Supplied	PROTAX switch. Grounds all except selected output circuit.
376	18.95	5	Radial	x	x		x	Supplied	PROTAX switch. Grounds all except selected output circuit. Sixth switch position grounds *all* outputs.
550A	14.00	5	Radial	x	x			DP-5	
550A-2	12.50	2	Radial	x	x			DP-2	
551A	17.50	2	Radial	x	x			DP-2	Special 2-pole, 2-position switch used to switch any RF device in or out of series connection in a coaxial line. See figure (over).
556	.95	—	—		x			—	Bracket only, for wall mounting of radial connector switches.
590	17.95	5	Axial	x				DP-5	
590G	17.95	5	Axial	x			x	Supplied	Grounds all except selected output circuit.
592	16.50	2	Axial	x				DP-2	
595	18.50	6	In-line		x	x	x		Grounds all except selected output circuit.


Model 375


Model 376


Model 550A-2

ARGONAUT #509

AMPLIFIER #405

TEN-TEC

ARGONAUT, MODEL 509

Covers all Amateur bands 10-80 meters. 9 MHz crystal filter. 2.5 kHz bandwidth. 1.7 shape factor @ 6/50 dB points. Power required 12-15 VDC @ 150 mA receive, 800 mA transmit at rated output. Construction: aluminum chassis, top and front panel, molded plastic end panels. Cream front panel, walnut vinyl top and end trim. Size: HWD 4½" x 13" x 7". Weight 6 lbs.

LINEAR AMPLIFIER, MODEL 405

Covers all Amateur bands 10-80 meters. 50 watts output power, continuous sine wave. RF wattmeter. SWR meter. Power required 12-15 VDC @ 8 A, max. Construction: aluminum chassis, top and front panel, molded plastic side panels. Cream front panel, walnut vinyl top and end trim. Size: HWD 4½" x 7" x 8". Weight 2½ lbs.

Argonaut, Model 509	**$329.00**
Linear Amplifier, Model 405	**159.00**
Power Supply, Model 251 (Will power both units)	**79.00**
Power Supply, Model 210 (Will power Argonaut only)	**27.50**

The new ultra-modern fully solid-state TRITON makes operating easier and a lot more fun, without the limitations of vacuum tubes.

For one thing, you can change bands with the flick of a switch and no danger of off-resonance damage. And no deterioration of performance with age.

But that's not all. A superlative 8-pole i-f filter and less than 2% audio distortion, transmitting and receiving, makes it the smoothest and cleanest signal on the air.

The TRITON IV specifications are impeccable. For selectivity, stability and receiver sensitivity. And it has features such as *full* CW break-in, pre-selectable ALC, off-set tuning, separate AC power supply, 12 VDC operation, perfectly shaped CW wave form, built-in SWR bridge and on and on.

For new standards of SSB and CW communication, write for full details or talk it over with your TEN-TEC dealer. We'd like to tell you why "They Don't Make 'Em Like They Used To" makes Ham Radio even more fun.

TRITON IV $699.00

ACCESSORIES:

Model 240 One-Sixty Converter	$ 97.00
Model 244 Digital Readout	197.00
Model 245 CW Filter	$ 25.00
Model 249 Noise Blanker	29.00
Model 252G Power Supply	99.00
Model 262G Power Supply/VOX	129.00

TEN-TEC

KR20-A ELECTRONIC KEYER

A fine instrument for all-around high performance electronic keying. Paddle actuation force is factory adjusted for rythmic smooth keying. Contact adjustments on front. Weighting factor factory set for optimum smoothness and articulation. Over-ride "straight key" conveniently located for emphasis, QRS sending or tune-up. Reed relay output. Side-tone generator with adjustable level. Self-completing characters. Plug-in circuit board. For 117 VAC, 50-60 Hz or 6-14 VDC. Finished in cream and walnut vinyl. Price $67.50

KR5-A ELECTRONIC KEYER

Similar to KR20-A but without side-tone oscillator or AC power supply. Ideal for portable, mobile or fixed station. A great value that will give years of troublefree service. Housed in an attractive case with cream front, walnut vinyl top. For 6-14 VDC operation. Price $38.50

KR1-A DELUXE DUAL PADDLE

Paddle assembly is that used in the KR50, housed in an attractive formed aluminum case. Price $35.00

KR2-A SINGLE LEVER PADDLE

For keying conventional "TO" or discrete character keyers, as used in the KR20-A. Price $15.00

KR50 ELECTRONIC KEYER

A completely automatic electronic keyer fully adjustable to your operating style and preference, speed, touch and weithting, the ratio of the length of dits and dahs to the space between them. Self-controlled keyer to transmit your thoughts clearly, articulately and almost effortless. The jambie (squeeze) feature allows the insertion of dits and dahs with perfect timing.

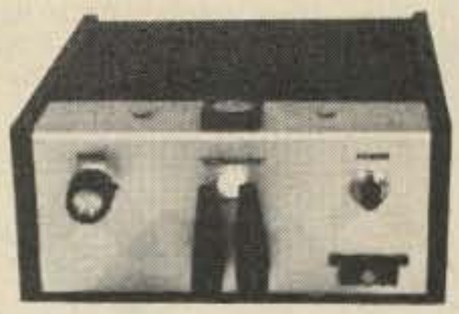
An automatic weighting system provides increased character to space ratio at slower speeds, decreasing as the speed is increased, keeping the balance between smoothness at low speeds and easy to copy higher speed. High intelligibility and rythmic transmission is maintained at all speeds, automatically.

Memories provided for both dits and dahs but either may be defeated by switches on the rear panel. Thus, the KR50 may be operated as a full iambic (squeeze) keyer, with a single memory or as a conventional type keyer. All characters are self-completing. Price $110.00

SPECIFICATIONS

Speed Range: 6-50 w.p.m.
Weighting Ratio Range: 50% to 150% of classical dit length.
Memories: Dit and dah. Individual defeat switches.
Paddle Actuation Force: 5-50 gms.
Power Source: 117VAC, 50-60 Hz, 6-14 VDC.
Finish: Cream front, walnut vinyl top and side panel trim.
Output: Reed relay. Contact rating 15 VA, 400 V. max.
Paddles: Torque drive with ball bearing pivot.
Side-tone: 500 Hz tone.
Adjustable output to 1 volt.
Size HWD: 2½" x 5½" x 8¼"
Weight: 1¾ lbs.

TEN-TEC



KR50

NORTH SHORE RF TECHNOLOGY

DUPLEXER & CAVITY KITS...

NOW AVAILABLE FOR YOU FULLY ASSEMBLED & TUNED!

- UPGRADE YOUR REPEATER WITH AN RF TECHNOLOGY DUPLEXER.
- ALL DUPLEXERS AND CAVITIES ARE TEMPERATURE COMPENSATED WITH INVAR® AND MEET ALL COMMERCIAL STANDARDS
- ONLY TOP QUALITY MATERIALS GO INTO OUR PRODUCTS.
- BOTH KITS & ASSEMBLED DUPLEXERS AND CAVITIES ARE AVAILABLE TO YOU AT A SAVINGS TO YOU.

Mod. 62-3 . . . 6 cav., 2 mtr., insertion loss 0.6 db with isolation 100 db typical; pwr. 350 w. Kit $399 ea. — Assembled $499.

Mod. 4220-3 . . . 4 cav. 220 MHz insertion loss 0.6 db with 80 db isolation typical; pwr. 350 w. Kit $279 ea. — Assembled $349.

Mod. 4440-3 . . . 4 cav. 440 MHz, insertion loss 0.6 db with 80 db isolation loss 0.6 db with 80 db isolation typical; pwr. 350 w. Kits $249 ea. — Assembled $329.

Mod. 30 Cavity Kits: 2 mtr. $75 ea., 220 MHz $65 ea., 440 MHz $65 ea.; 6 mtr. $115 ea. Add $15 for Assembled Kit.

Also available: 6 mtr., 4 cav. Kit $399 — Assembled $499, 2 mtr. 4 cav. Kit $299 — Assembled $399, 440 MHz TV Repeater Duplexer.

Now You Can Receive The Weak Signals With The ALL NEW AMECO PREAMPLIFIER

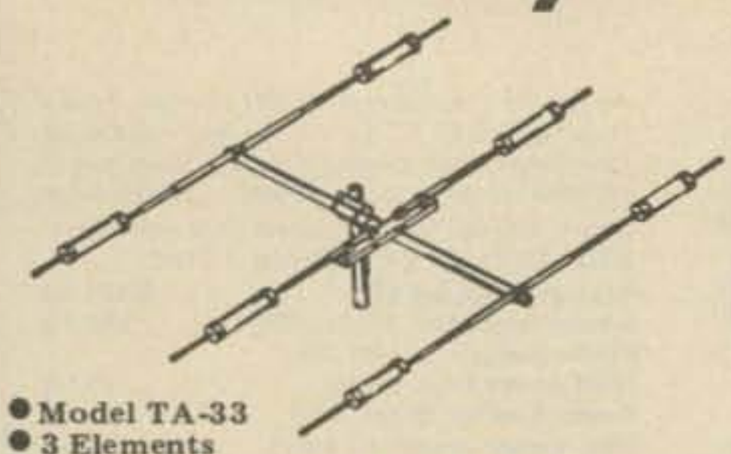
Model PT-2 is a continuous tuning 6-160 meter Pre-Amp specifically designed for use with a transceiver. The PT-2 combines the features of the well-known PT with new sophisticated control circuitry that permits it to be added to virtually any transceiver with No modification. No serious ham can be without one.

- Improves sensitivity and signal-to-noise ratio.
- Boosts signals up to 26 db.
- For AM or SSB.
- Bypasses itself automatically when the transceiver is transmitting.
- FET amplifier gives superior cross modulation protection.
- Advanced solid-state circuitry.
- Simple to install.
- Improves immunity to transceiver front-end overload by use of its built-in attenuator.
- Provides master power control for station equipment.

MODEL PT-2

$69.95

Mosley



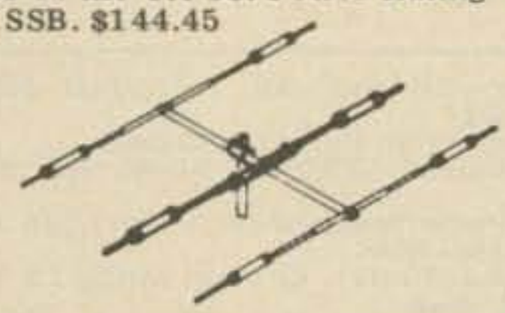
- Model TA-33
- 3 Elements
- 10.1 db Forward Gain (over isotropic source)
- 20 db Front-to-Back Ratio

The Mosley TA-33, 3-element beam provides outstanding 10, 15 and 20 meter performance. Exceptionally broadband — gives excellent results over full Ham bandwidth. Incorporating Mosley Famous Trap-Master traps. Power Rating — 2KW P.E.P. SSB. The TA-33 may also be used on 40 meters with TA-40KR conversion. Complete with hardware. $198.15

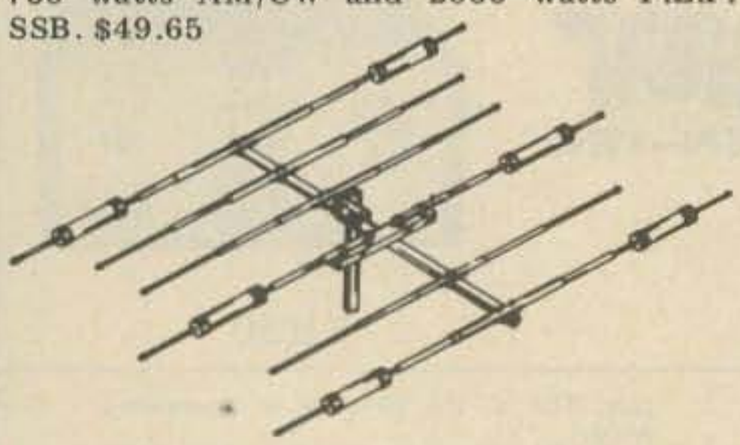
MULTI-BAND BEAMS
TRAP MASTER 33 . . . 10, 15 & 20 Meters

- Model TA-33Jr.
- 3 Elements
- 10.1 db Forward Gain (over isotropic source)
- 20 db Front-to-Back Ratio

The TA-33Jr . . . incorporates Mosley Trap-Master Junior traps. This is the low power brother of the TA-33. Power Rating — 1 KW P.E.P. SSB. $144.45



TA-33JR. POWER CONVERSION KIT MODEL MPK-3
Owners of the Mosley Trap-Master TA-33Jr. may obtain higher power without buying an entirely new antenna. The addition of the MPK-3 (power conversion kit) converts the TA-33Jr. into essentially a new antenna with 750 watts AM/CW and 2000 watts P.E.P. SSB. $49.65



TRAP MASTER 36 . . . 10, 15 & 20 Meters

- Model TA-36
- 6 Elements
- Forward Gain (over isotropic source) - 10.1 db on 15 & 20 meters, 11.1 db on 10 meters.

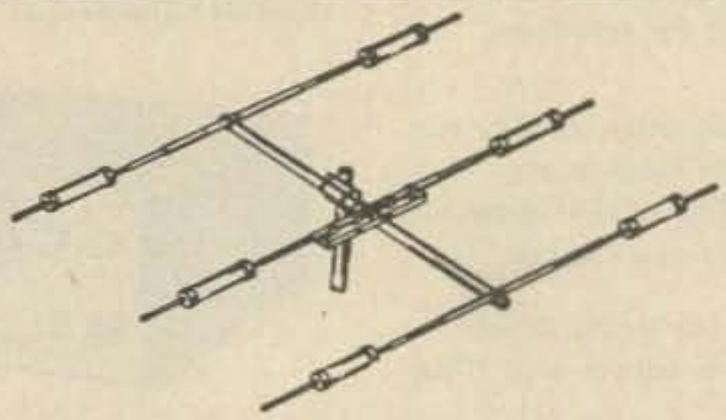
Front-to-Back Ratio on all bands. 20 db.
This wide-spaced, six element configuration employs 4 operating elements on 10 meters, 3 operating elements on 15 meters, and 3 operating elements on 20 meters. Automatic bandswitching is accomplished through Mosley exclusively designed high impedance parallel resonant "Trap Circuit." The TA-36 is designed for 1000 watts AM/CW or 2000 watts P.E.P. SSB. Traps are weather and dirt proof, offering frequency stability under all weather conditions. $328.35

MOSLEY AK-60 MAST PLATE ADAPTER
Mast Plate Adapter for adapting your Mosley 1½" mounted beam to fit 2" OD mast. Complete with angle and hardware. $9.85

NATIONAL RADIO COMPANY, INC.
NRCI

NCL-2000
Linear Amplifier. A full 10 Db gain. 20 watts in 2000 watts out. Can be driven with one watt. Continuous duty design utilizes two 8122 ceramic tetrode output tubes, designed for both AM and SSB operation. The industry standard for 12 years. Thousands in use all over the world. Price: $1,200

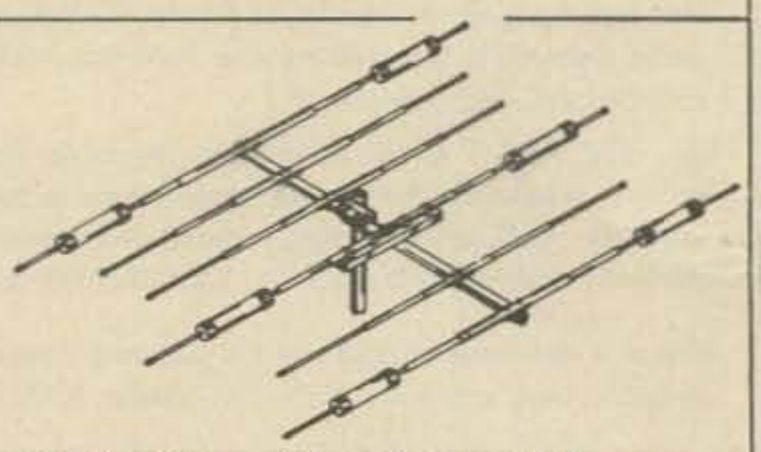
NCX-1000
The only 1000 watt, "single package" transceiver. Heavy duty design . . . results of 50 years of design leadership in amateur equipment. State of the art speech processing. linear amplifier, power supply, all in one package. Nothing extra to buy. Covers all amateur bands in HF spectrum . . . AM, SSB, CW. Price: $1,600



CLASSIC-33 . . . 10, 15 & 20 Meters
Model CL-33

- 3 Elements
- 10.1 db Forward Gain (over isotropic source) on all bands.
- 20 db Front-to-Back Ratio on 15 & 20 meters, 15 db on 10 meters.

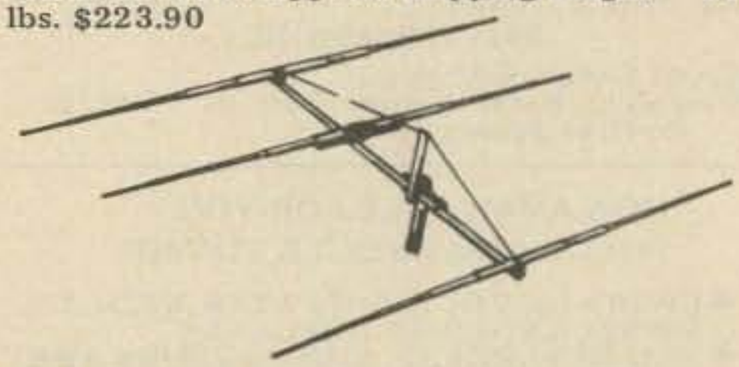
BRIDGING THE GAP . . . The Classic 33, combines the best of two Mosley systems. Incorporating Mosley Classic Feed System for a "Balanced Capacitive Matching" system with a feed point impedance of 52 ohms at resonance, and the Famous Mosley Trap-Master Traps for "weather-proof" traps with resonant frequency stability. This extra sturdy multi-band beam, Model CL-33, for operation on 10, 15 & 20 meters features improved boom to element clamping, stainless steel hardware, balanced radiation and a longer boom for even wider element spacing. Power Rating — 2 KW P.E.P. SSB. Recommended mast size — 2" OD. Wind Load — 120 lbs. at 80 MPH. Approx. shipping weight — 45 lbs. $223.90



CLASSIC-36 . . . 10, 15 & 20 Meters
Model CL-36

- 6 Elements
- 10.1 db Forward Gain (over isotropic source) on 15 & 20 meters, 11.1 db on 10 meters.
- 20 db Front-to-Back Ratio on all bands.

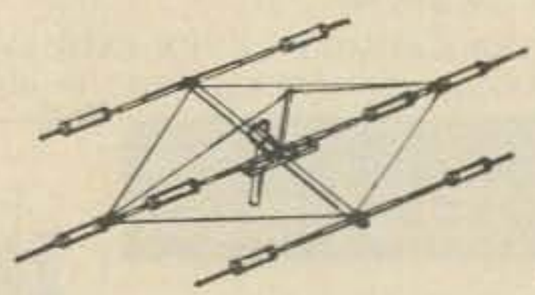
The Classic 36, like the smaller Classic 33, incorporates both the Mosley World-Famous Trap-Master Traps and the Mosley Classic Feed-System. Designed to operate on 10, 15 & 20 meters, this multi-band beam Model CL-36, employs the high standards of quality construction found in all Mosley products. The boom-to-mast clamping assures stability with a time-tested arrangement of mast plate, cast aluminum clamping blocks and stainless steel U-bolts. The exclusive "Balanced Capacitive Matching" system has a feed point impedance of 52 ohms at resonance. Wind Load — 210.1 lbs. at 80 MPH. Power Rating — 2 KW P.E.P. SSB. Recommended mast size — 2" OD. Approx. shipping weight — 71 lbs. via truck. $298.50



CLASSIC-203 . . . 20 Meters
Model CL-203
3 Elements

- 10.1 db Forward Gain (over isotropic source)
- 20 db Front-to-Back Ratio

Incorporating the Mosley patented Classic Feed System, this full size 20 meter single-band beam has 1½" to 3/8" dia. "swaged" elements wide spaced on a 2" dia. 24' boom. Maximum element length-37' 8½". The high standards in quality construction established by Mosley in over a quarter-century of manufacturing is reflected in this mono-band . . . Model CL-203. Boom-to-mast clamping assures stability with a time-tested arrangement of mast plate, cast aluminum clamping blocks and stainless steel U-bolts. The exclusive "Balanced Capacitive Matching" System has a nominal feed point impedance of 52 Ohms at 2 KW P.E.P. SSB. Recommended mast size-2" O.D. Approx. shipping wt: 42 lbs. via truck. $227.65

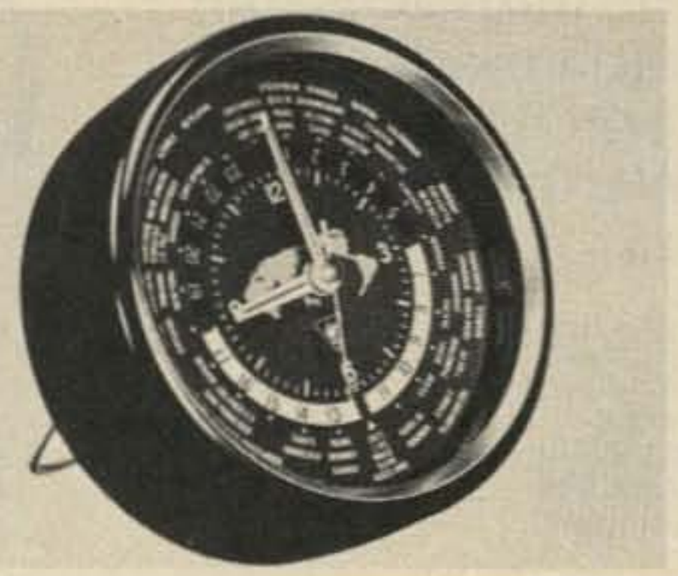


40 METER CONVERSION KIT MODEL TA-40KR
Work 40 meters in addition to 10, 15 & 20 meters by using a TA-40KR conversion kit on the radiator element of the TA-33 and TA-36. (Beams with broad band capacitive matching may not be converted!) Convert the TA-33Jr. with the MPK-3 (power conversion kit) before adding the TA-40KR kit. $88.45

SIGNAL-MASTER ANTENNA
Beam Antenna . . . Model S-402 for 40 meters
For a top signal needed to push through forty meter QRM, the Mosley Signal Master S-402 will do the trick! This 100% rust-proof 2-element beauty constructed of rugged heavy-wall aluminum is designed and engineered to provide the performance you need for both DX hunting and relaxing in a QRM free rag-chewing session. Beam is fed through link coupling, resulting in an excellent match over the entire bandwidth. $257.50

A new precision clock which tells time anywhere in the world at a glance, has been announced by **Yaesu Electronics Corporation**. The time in any principal city or time zone can be simultaneously coordinated with local time on a 24 hour basis. After the initial setting, as the clock runs, a Time Zone Hour Disc advances automatically, showing correct time all over the world without further adjustment. The clock is especially designed to withstand shock and may be hung on a wall or placed on its desk mount. The clock will run an entire year on a single 1.5 volt flashlight battery and the mechanism starts as soon as the battery is inserted. It measures six inches in diameter by two and one half inches deep. An excellent item for the business office, ham radio operator, short wave listener, boat owner, and others who want an accurate dependable clock.

Priced at $30, it is available at all authorized Yaesu dealers in the United States.



Now...more than ever--- the TEMPO line means solid value

Tempo VHF/ONE

the "ONE" you've been waiting for

No need to wait any longer – this is it! Whether you are already on 2-meter and want someting better or you're just thinking of getting into it, the VHF/ONE is the way to go.

• Full 2-meter band coverage (144 to 148 MHz for transmit and receive. • Full phase lock synthesized (PLL) so no channel crystals are required. • Compact and lightweight – 9.5" long x 7" wide x 2.25" high. Weight – About 4.5 lbs. • Provisions for an accessory SSB adaptor. • 5-digit LED receive frequency display. • 5 KHz frequency selection for FM operation. • Automatic repeater split – selectable up or down for normal or reverse operation. • Microphone, power cord and mounting bracket included. • Two built-in programmable channels. • All solid state. • 10 watts output. • Super selectivity with a crystal filter at the first IF and E type ceramic filter at the second IF. • 800 Selectable receive frequencies. • Accessory 8-pin socket. • $495.00

TEMPO SSB/ONE
SSB adapter for the Tempo VHF/One
* Selectable upper or lower sideband. * Plugs directly into the VHF/One with no modification. * Noise blanker built-in. * RIT and VXO for full frequency coverage. * $225.00

ATLAS 350-XL

- ALL SOLID STATE
- SSB TRANSCEIVER
- 350 WATTS P.E.P. OR CW INPUT
- 10 THROUGH 160 METER COVERAGE

Illustrated with optional AC supply, Auxiliary VFO, and Digital Dial.

The all new Atlas 350-XL has all the exciting new features you want, plus superior performance and selectivity control never before possible.

● 10-160 METERS
Full coverage of all six amateur bands in 500 kHz segments. Primary frequency control provides highly stable operation. Also included is provision for adding up to 10 additional 500 kHz segments between 2 to 22 MHz by plugging in auxiliary crystals.

● 350 WATTS
P.E.P. and CW input. Enough power to work the world barefoot!

IDEAL FOR DESKTOP OR MOBILE OPERATION
Measuring just 5 in. high x 12 in. wide x 12½ in. deep, and weighing only 13 pounds, the Atlas 350-XL offers more features, performance and value than any other transceiver, regardless of size, on the market today!

● SELECTIVITY CONTROL
This amazing new breakthrough in filter design is truly the filter of the future. Selectivity control on the front panel provides control of bandwidth as well as selection of upper or lower sideband, or double sideband. Continuously variable from 300 to 2700 Hz bandwidth. Shape factor is better than 1.7, with ultimate rejection better than 130 dB. Selectivity for SSB can be set for maximum voice fidelity at 2700 Hz bandwidth, providing transmission and reception of audio from 300 to 3000 Hz, or it can be narrowed down to 2400, 2100 or even 1500 Hz if necessary to reduce adjacent channel QRM. Selectivity can be narrowed gradually to as little as 300 Hz for CW reception.

This amazing new breakthrough in filter design is by Bob Crawford and Eckert Argo of Consulting Engineers. Atlas Radio is privileged to be first to offer this "programmable filter" in the radio communication field and for sometime to come will be the only one.

- **RECEIVER INCREMENTAL TUNING**
- **AUDIO FREQUENCY NOTCH FILTER**
- **PUSH TO TALK**
- **VOX OPERATION**
- **FULL BREAK-IN CW OPERATION**

MODEL 350-XL $995

● DIGITAL DIAL READOUT
The Atlas 350-XL has space provided for quick installation of this plug-in accessory. Provides precise frequency readout within 50 Hz. All L.E.D. Dot Matrix 6 digit display.
DD6-XL DIGITAL DIAL $195

● PLUG-IN AUXILIARY VFO or CRYSTAL OSCILLATOR
Auxiliary VFO is plugged into the space provided on the front panel of the 350-XL. You have a second tuneable VFO with same tuning ranges as primary VFO for tuning to a separate transmit or receive frequency. LEDs indicate which VFO, primary or secondary, will be used for receive and transmit.

Or instead of the auxiliary VFO a Crystal Oscillator may be plugged into the front panel. Eleven crystal sockets are available with a vernier control for exact frequency setting.
MODEL 305 AUXILIARY VFO $155
MODEL 311 AUXILIARY CRYSTAL OSCILLATOR $135

● 350-PS MATCHING AC SUPPLY
Includes front facing speaker and phone jack. Provides 14 volts filtered and regulated D.C. for both low current and high current circuits of the 250-XL. Internal space provided for future installation of accessories such as CW Keyer, Speech Processor, Phone Patch, etc. Operates on 100-130 or 200-260 volts, 50-60 Hz . . $195

● SAME PLUG-IN-AND-GO MOBILE FEATURE AS OUR FAMOUS 210x/215x
The 350-XL has its own optional Mobile Mounting Bracket for quick, easy plug-in or removal from your car. All connections are made automatically $65

● ATLAS 210x/215x SSB TRANSCEIVERS
Our famous little compact SSB Transceivers remain a very important part of our product line $679
With noise blanker installed $719

No. 114-320-003 – $9.90
No. 114-322-003 – Brass – $10.30

No. 114-320-001 – $8.30
No. 114-322-001 – Brass – $8.65

No. 114-310-003 – $8.25
No. 114-312-003 – Brass – $8.65

NYE VIKING SPEED-X KEYS
NYE VIKING Standard Speed-X keys feature smooth, adjustable bearings, heavy-duty silver contacts, and are mounted on a heavy oval die cast base with black wrinkle finish. Available with standard, or Navy knob, with, or without switch, and with nickel or brass plated key arm and hardware.

Pamper yourself with a Gold-Plated NYE VIKING KEY!
Model No. 114-31C-004GP has all the smooth action features of NYE Speed-X keys in a special "presentation" model. All hardware is heavily gold plated and it is mounted on onyx-like jet black plastic sub-base. List price is $50.00.

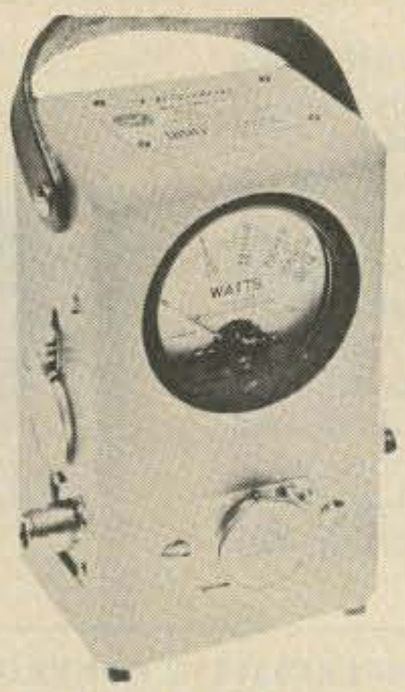
No. SSK-1 $23.95
No. SSK-1CP-Chrome – $29.95

NYE VIKING SQUEEZE KEY
Extra-long, finger-fitting molded paddles with adjustable spring tension, adjustable contact spacing. Knife-edge bearings and extra large, gold plated silver contacts! Nickel plated brass hardware and heavy, die cast base with non-skid feet. Base and dust cover black crackle finished. SSK-1 — $23.45.
SSK-1CP has heavily chrome-plated base and dust cover. List price, $29.95.

CODE PRACTICE SET
You get a sure, smooth, Speed-X model 310-001 transmitting key, linear circuit oscillator and amplifier, with a built-in 2" speaker, all mounted on a heavy duty aluminum base with non-skid feet. Operates on standard 9V transistor type battery (not included). List price, $18.50.
PHONE PATCH Model No. **250-46-1** measures 6-1/2" wide, 2-1/4" high and 2-7/8" deep. List price, $36.50. **Model 250-46-3**, designed for use with transceivers having a built-in speaker, has its own built-in 2" x 6" 2 watt speaker. Measures 6-1/2" wide, 2-1/4" high and 2-7/8" deep. List price, $44.50.

The indispensable BIRD model 43 THRULINE® Wattmeter

MODEL		PRICE
43		$110
Elements (Table 1) 2-30 MHz		40
Elements (Table 1) 25-1000 MHz		35
Elements (Table 2)		50
80F, 80M	5W	27
8080 QC-N (M)	25W	47
8085 QC-N (M)	50W	75
Minimonitor®		149



Read RF Watts Directly.

0.45-2300 MHz, 1-10,000 watts ±5%, Low Insertion VSWR—1.05.

Unequalled economy and flexibility: Buy only the element(s) covering your present frequency and power needs, add extra ranges later if your requirements expand.

BIRD

Table 1 STANDARD ELEMENTS (CATALOG NUMBERS)

Power Range	Frequency Bands (MHz) 2-30	25-60	50-125	100-250	200-500	400-1000
5 watts	—	5A	5B	5C	5D	5E
10 watts	—	10A	10B	10C	10D	10E
25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H					
5000 watts	5000H					

Table 2 LOW-POWER ELEMENTS

1 watt	Cat. No.	2.5 watts	Cat. No.
60-80 MHz	060-1	60-80 MHz	060-2
80-95 MHz	080-1	80-95 MHz	080-2
95-125 MHz	095-1	95-150 MHz	095-2
110-160 MHz	110-1	150-250 MHz	150-2
150-250 MHz	150-1	200-300 MHz	200-2
200-300 MHz	200-1	250-450 MHz	400-2
275-450 MHz	275-1	400-850 MHz	800-2
425-850 MHz	425-1	800-950 MHz	800-2
800-950 MHz	800-1		

BOMAR Crystal Company

Novice Crystals (Specify Band Only)

TWO METERS

CRYSTALS IN STOCK

Motorola HT 220 Crystals In Stock!

Standard ● Icom ● Heathkit ● Ken ● Clegg ● Regency ● Wilson ● VHF Eng ● Drake ● And Others!

$4.50 @ Lifetime Guarantee

Make/Model	Xmit Freq.	Rec. Freq.

THE BIG SIGNAL "W2AU" BALUN $12.95

THE APPROVED LEADING HAM AND COMMERCIAL BALUN IN THE WORLD TODAY.

THE PROVEN BALUN

IT'S WHAT'S INSIDE THAT COUNTS!

1. **HANDLES FULL 2 KW PEP AND THEN SOME.** Broad-Banded 3 to 40 Mc.
2. **HELPS TVI PROBLEMS** By Reducing Coax Line Radiation
3. **NOW ALL STAINLESS STEEL HARDWARE.** SO239 Double Silver Plated
4. **IMPROVES F/B RATIO** By Reducing Coax Line Pick-Up
5. **REPLACES CENTER INSULATOR.** Withstands Antenna Pull of Over 600 Lbs.
6. **BUILT-IN LIGHTNING ARRESTER.** Helps Protect Balun — Could Also Save Your Valuable Gear
7. **BUILT-IN HANG-UP HOOK.** Ideal For Inverted Vees, Multi-Band Antennas, Dipoles, Beam and Quads

NOW BEING USED BY ALL BRANCHES OF THE U.S. ARMED FORCES, FAA, RCA, CIA, CANADIAN DEFENSE DEPT. PLUS THOUSANDS OF HAMS THE WORLD OVER

THEY'RE BUILT TO LAST...

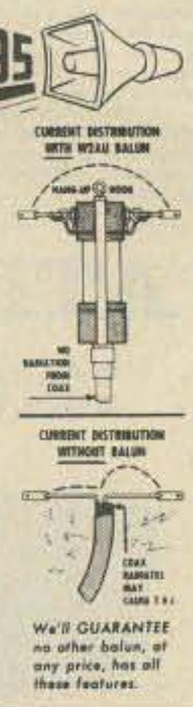
BIG SIGNALS DON'T JUST HAPPEN— GIVE YOUR ANTENNA A BREAK

Comes in 2 models. 1:1 matches 50 or 75 ohm unbalanced (coax line) to 50 or 75 ohm balanced load. 4:1 model matches 50 or 75 ohm unbalanced (coax line) to 200 or 300 ohm balanced load.

AVAILABLE AT ALL LEADING DEALERS. IF NOT, ORDER DIRECT

The big signal W2AU Balun reflects the type of quality that has kept our product out front and number 1 in Baluns the world over for the past 10 years.

The originator of the Balun with a built-in lightning arrester and hang up hook.



We'll GUARANTEE no other balun, at any price, has all these features.

SERIES 31 — BNC CONNECTORS

Amphenol's BNC connectors are small, lightweight, weatherproof connectors with bayonet action for quick disconnect applifications.

Shells, coupling rings and male contacts are accurately machined from brass. Springs are made of beryllium copper. All parts in turn are ASTROplated® to give you connectors that can take constant handling, high temperatures and resist abrasion.

BNC BULKHEAD RECEPTACLE 31-221-385 UG-1094 Mates with any BNC plug. Receptacle can be mounted into panels up to 104" thick. $1.25

BNC (M) TO UHF (F) ADAPTER 309-2900-385 UG-225 Adapts any BNC jack to any UHF plug. $3.63

DOUBLE MATE ADAPTER 83-877-385 Both coupling rings are free turning. Connects 2 female components. $2.72

JACK ADPATER $1.95

575-102-385 Adapts 83-1SP-385 to Motorola type auto antenna jack or pin jack.

PANEL RECEPTACLE 83-1R-385 SO239 Mounts with 4 fasteners in 21/32" diameter hole. $1.17

PANEL RECEPTACLE 83-878-385 SO239SH Mounts in single 21/32" diameter hole. Knurled lock nuts prevent turning. $1.59

BNC ANGLE ADAPTER 31-009-385 UG-306 Adapts any BNC plug for right angle use. $4.23

BNC TEE ADAPTER 31-008-385 UG-274 Adapts 2 BNC plugs to 31-003-385 or other female BNC type receptable. $4.56

BNC(F) TO UHF (M) ADAPTER 31-028-385 UG-273 Adapts any BNC plug to any UHF jack. $2.39

PUSH-ON 83-1SP-385 83-5SP-385 Features an unthreaded, springy shell to push fit on female connectors. $2.27

LIGHTNING ARRESTOR 575-105-385 Eliminates static build-up from antenna. Protects your valuable equipment against lightning damage. $4.80

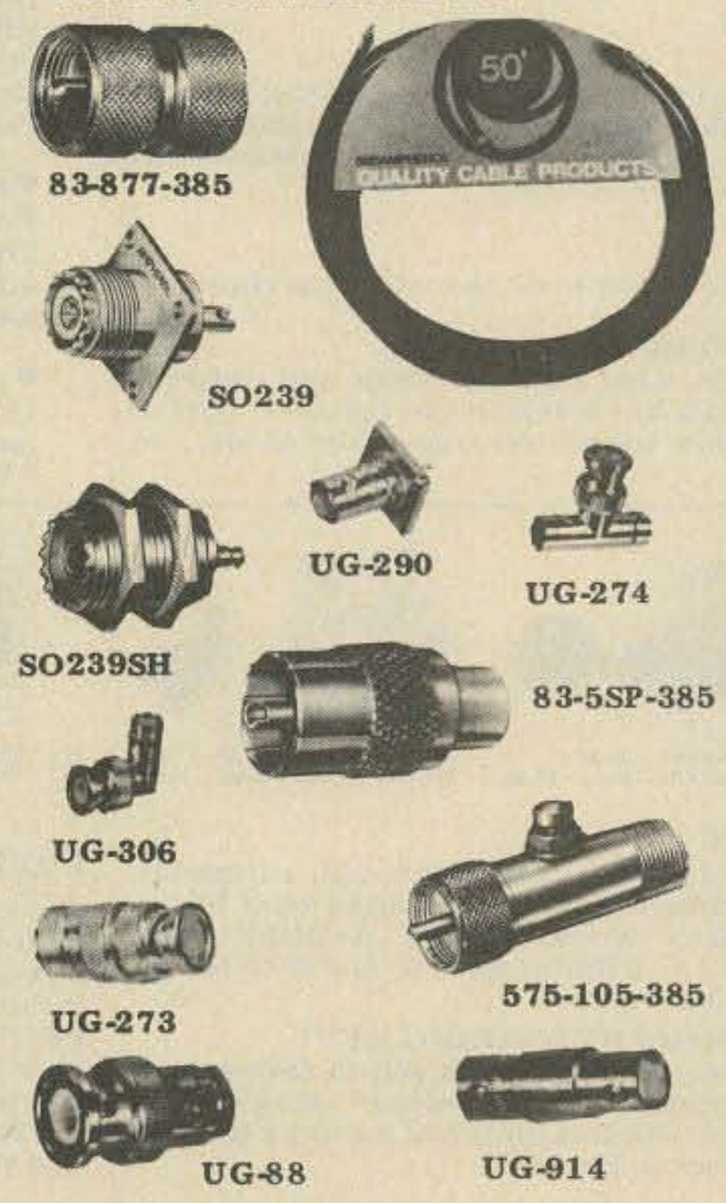
BNC PLUG 31-002-385 UG-88 Commonly used for communications antenna lead cables. For RG 55/U & RG 58/U cables. $1.59

BNC STRAIGHT ADAPTER 31-219-385 UG-914 1 9/32" long, allows length of cables to be joined. Mates with BNC plugs. $2.12

BNC PANEL RECEPTACLE 31-003-385 UG-290 Mounts with 4 fasteners in 29/64" diameter hole. $1.74

SERIES 581 — PACKAGED CABLE ASSEMBLIES

All popular lengths are now available in your choice of RG 8/U or RG 58/U type low loss polyfoam dielectric cable. Installed PL-259 connectors are ASTROplated — Amphenol's new non-tarnishing finish — which has all the advantages of precious metal plus more heat, corrosion and abrasion resistors that silver ever had! These cable assemblies are ideal for CB, ham radio and other communications antenna installations and they are ready for immediate use.



RG 8/U TYPE POLYFOAM COAXIAL CABLE ASSEMBLIES 581-803 3-ft. with ASTROplated PL-259's on both ends. $5.60

581-820 20-fit with ASTROplated PL-259's on both ends. $11.80

581-850 50-fit with ASTROplated PL-259's on both ends. $23.10

581-875 75-fit with ASTROplated PL-259's on both ends. $30.30

581-8100 100-ft. with ASTROplated PL-259's on both ends. $38.50

RG 58/U TYPE POLYFOAM COAXIAL CABLE ASSEMBLIES 581-5812 12-ft. with ASTROplated PL-259's on both ends. $6.34

581-5820 20-ft with ASTROplated PL-259's on one end and SPADE LUGS ON OTHER END. $6.30

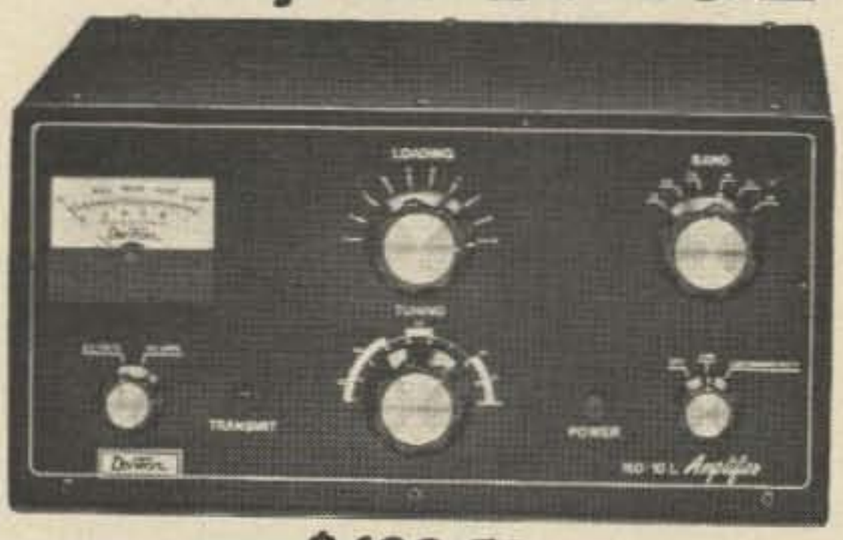
518-5820-2 20-ft. with ASTROplated PL-259's on both ends. $7.36

581-5850 50-ft. with ASTROplated PL-259's on both ends. $11.20

581-5875 75-ft. with ASTROplated PL-259's on both ends. $14.00

581-58100 100-ft. with ASTROplated PL-259's on both ends. $16.10

SUPER AMP
from DenTron



$499.50

If the amplifier you're thinking of buying doesn't deliver at least 1000 to 1200 watts output, to the antenna, you're buying the wrong amplifier.

Our New Super Amp is sweeping the country because hams have realized that the DenTron Amplifier will deliver to the antenna, (output power), what other manufacturers rate as input power.

The Super Amp runs a full 2000 watts P.E.P. input on SSB, and 1000 watts DC on CW, RTTY or SSTV 160-10 meters, the maximum legal power.

The Super Amp is compact, low profile, has a solid one-piece cabinet assuring maximum TVI sheilding.

The heart of our amplifier, the power supply, is a continuous duty, self-contained supply built for contest performance.

We mounted the 4 - 811 A's, industrial workhorse tubes, in a cooling chamber featuring the on-demand variable cooling system.

The hams at DenTron pride themselves on quality work, and we fight to keep prices down. That's why the dynamic DenTron Linear Amplifier beats them all at $499.50.

NOW AVAILABLE WITH 572 B^3 FOR **$574.50**

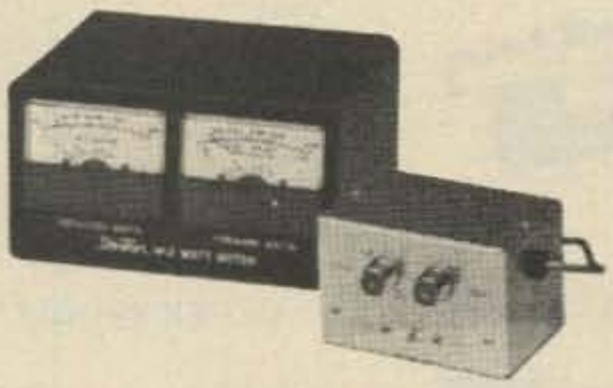
The 80-10 Skymatcher

Here's an antenna tuner for 80 through 10 meters, handles 500 w P.E.P. and matches your 52 ohm transceiver to a random wire antenna.

- Continuous tuning 3.2 - 30 mc
- "L" network
- Ceramic 12 position rotary switch
- SO–239 receptional to transmitter
- Random wire tuner
- 3000 volt capacitor spacing
- Tapped inductor
- Ceramic antenna feed thru
- 7" W, 5" H, 8" D., Weight: 5 lbs.

$59.50

Read forward and reflected watts at the same time



Tired of constant switching and guesswork?

Every serious ham knows he must read both forward and reverse wattage simultaneously for that perfect match. So upgrade with the DenTron W-2 Dual in line Wattmeter.

$99.50

Match everything from 160 to 10 with the new 160-10 MAT

NEW: The Monitor Tuner was designed because of overwhelming demand. Hams told us they wanted a 3 kilowatt tuner with a built-in wattmeter, a front panel antenna selector for coax, balanced line and random wire. So we engineered the 160-10m Monitor Tuner. It's a lifetime investment at $299.50.

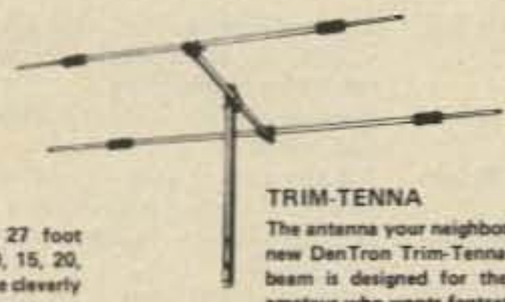
$299.50

Meet the SuperTuner

The DenTron Super Tuner tunes everything from 160-10 meters. Whether you have balanced line, coax cable, random or long wire, the Super Tuner will match the antenna impedance to your transmitter. All DenTron tuners give you maximum power transfer from your transmitter to your antenna, and isn't that where it really counts?

1 KW MODEL **$129.50** 3 KW MODEL **$229.50**

The Sky Openers



SKYMASTER

A fully developed and tested 27 foot vertical antenna covers entire 10, 15, 20, and 40 meter bands using only one cleverly applied wave trap. A full 1/4 wave antenna on 20 meters. Constructed of heavy seamless aluminum with a factory tuned and sealed HQ Trap, SKYMASTER is weatherproof and withstands winds up to 80 mph. Handles 2 KW power level and is for ground, roof or tower mounting. Radials included in our low price of

$84.50

Also 80 m resonator for top mounting on SKYMASTER.

$29.50

SKYCLAW

A tunable monoband high performance vertical antenna, designed for 40, 80, 160 meter operation. SKYCLAW gives you the following spectrum coverage:

BAND (Meters)	BANDWIDTH (kHz)
160	50
80	200
40	entire band

Tuning is easy and reliable. Rugged construction assures that this self-supporting unit is weatherproof and survives nicely in 100 mph winds.. Handles full legal power limit.

$79.50

EX-1

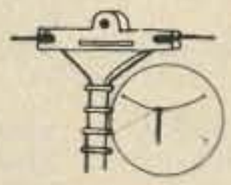
The DenTron EX-1 Vertical Antenna is designed for the performance minded antenna experimenter. The EX-1 is a full 40 meter, ¼ wave, 33', self-supporting vertical. The EX-1 is the ideal vertical for phasing.

$59.50

TRIM-TENNA

The antenna your neighbors will love. The new DenTron Trim-Tenna with 20 meter beam is designed for the discriminating amateur who wants fantsatic performance in an environmentally appealing beam. It's really loaded! Up front there's a 13 foot 6 inch director with precision Hy-Q coils. And, 7 feet behind is a 16 foot driven element fed directly with 52 ohm coax. The Trim-Tenna mounts easily and what a difference in on-the-air performance between the Trim-Tenna and that dipole, long wire or inverted Vee you've been using. 4 & 6 Forward Gain Over Dipole.

$129.50



ALL BAND DOUBLET

This All Band Doublet or inverted Type Antenna covers 160 thru 10 meters. Has total length of 130 feet (14 ga. stranded copper) although it may be made shorter if necessary. This tuned Doublet is center fed through 100 feet of 450 ohm PVC covered balanced transmission line. The assembly is complete. Add rope to the ends and pull up into position. Tune with the DenTron Super Tuner and you're on 10 through 160 meters with one antenna! Now just for the DenTron All Band Doublet.

$24.50

DenTron

DRAKE TVI FILTERS High Pass Filters for TV Sets provide more than 40 dB attenuation at 52 MHz and lower. Protect the TV set from amateur transmitters 6-160 meters.

Drake TV-300-HP
Model No. 1603
For 300 ohm twin lead
Price: $10.60

DRAKE TV-5200-LP
200 watts to 52 MHz. Ideal for six meters. For operation below six meters, use TV-3300-LP or TV-42-LP.
Model No. 1609 Price: $26.60

Drake TV-75-HP
Model No. 1610
For 75 ohm TV coaxial cable; TV type connectors installed
Price: $13.25

DRAKE TV-3300-LP
100 watts max. below 30 MHz. Attenuation better than 80 dB above 41 MHz. Helps TV i-f interference, as well as TV front-end problems. Price: $26.60 Model No. 1608

LOW PASS FILTERS FOR TRANSMITTERS
have four pi sections for sharp cut off below channel 2, and to attenuate transmitter harmonics falling in any TV channel and fm band. 52 ohm. SO-239 connectors built in.

DRAKE TV-42-LP Model No. 1605
is a four section filter designed with 43.2 MHz cut-off and extremely high attenuation in all TV channels for transmitters operating at 30 MHz and lower. Rated 100 watts input. Price: $14.60

TUFTS RADIO CATALOG

WORK ALL REPEATERS WITH OUR NEW SYNTHESIZER II

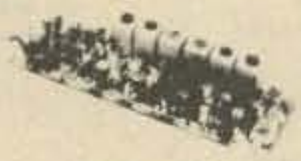
The Synthesizer II is a two meter frequency synthesizer. Frequency is adjustable in 5 kHz steps from 140.00 MHz to 149.995 MHz with its digital readout thumb wheel switching. Transmit offsets are digitally programmed on a diode matrix, and can range from 10 kHz to 10 MHz. No additional components are necessary!
Kit . . . . . $169.95 Wired and tested $239.95

RX28C	28-35 MHz FM receiver with 2 pole 10.7 MHz crystal filter	59.95
RX50C Kit	30-60 MHz rcvr w/2 pole 10.7 MHz crystal filter	59.95
RX144C Kit	140-170 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX144C W/T.	same as above – factory wired and tested	114.95
RX220C Kit	210-240 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX220C W/T	same as above – factory wired and tested	114.95
RX432C Kit	432 MHz rcvr w/2 pole 10.7 MHz crystal filter	79.95
RXCF	accessory filter for above receiver kits gives 70 dB adjacent channel rejection	8.50
TX144B Kit	transmitter exciter – 1 watt – 2 meters	29.95
TX144B W/T.	same as above factory wired and tested	49.95
TX220B Kit	transmitter exciter – 1 watt – 220 MHz	29.95
TX220B W/T.	same as above – factory wired and tested	49.95
PA2501H Kit	2 meter power amp – kit 1 w in – 25w out with solid state switching, case, connectors	59.95
PA2501H W/T	same as above – factory wired and tested	74.95
PA4010H Kit	2 meter power amp – 10w in – 40w out – relay switching	59.95
PA4010H W/T	same as above – factory wired and tested	74.95
PA144/15 Kit	2 meter power amp – 1w in – 15w out – less case, connectors and switching	39.95
PS15C Kit	15 amp – 12 volt regulated power supply w/case, w/fold-back current limiting and overvoltage protection	79.95
PS15C W/T	same as above – factory wired and tested	94.95
PS25C Kit	25 amp – 12 volt regulated power supply w/case, w/fold-back current limiting and overvoltage protection	129.95
PS25C W/T	same as above – factory wired and tested	149.95
RPT28 Kit	repeater – 10 meter	TBA
RPT28	repeater – 10 meter, wired & tested	TBA
RPT50 Kit	repeater – 6 meter	TBA
RPT50	repeater – 6 meter, wired & tested	TBA
RPT144 Kit	repeater – 2 meter – 15w – complete (less crystals)	465.95
RPT220 Kit	repeater – 220 MHz – 15w – complete (less crystals)	465.95
RPT432 Kit	repeater – 10 watt – 432 MHz (less crystals)	515.95
TRX 144 Kit	case and all components to build 15 watt 10 channel scanning 2 meter transceiver (less mike and crystals)	219.95
TRX 220 Kit	same as above except for 220 MHz	219.95
TRX 432 Kit	same as above except 10 watt and 432MHz	254.95
SYN II Kit	2 meter synthesizer, transmit offsets programmable from 100 KHz - 10 MHz, (Mars offsets with optional adapters)	169.95
SYN II	same as above, wired and tested	239.95
HT 144B Kit.	2 meter, 2w, 4 channel, hand held receiver with crystals for 146.52 simplex	129.95
NICAD	battery pack, 12 VDC, ½ amp	29.95
NICAD	battery charger	5.95
Rubber Duck	2 meter, with male BNC connector	8.95

RECEIVERS

RF28 Kit	10 meter RF front end 10.7 MHz output	12.50
RF50 Kit	6 meter RF front end 10.7 MHz output	12.50
RF144D Kit	2 meter RF front end 10.7 MHz output	17.50
RF220D Kit	220 MHz RF front end 10.7 MHz output	17.50
RF432 Kit	432 MHz RF front end 10.7 MHz output	27.50
IF 10.7F Kit	10.7 MHz IF module includes 2 pole crystal filter	27.50
FM455 Kit	455 KHz IF stage plus FM detector	17.50
AS2 Kit	audio and squelch board	15.00

TRANSMITTERS

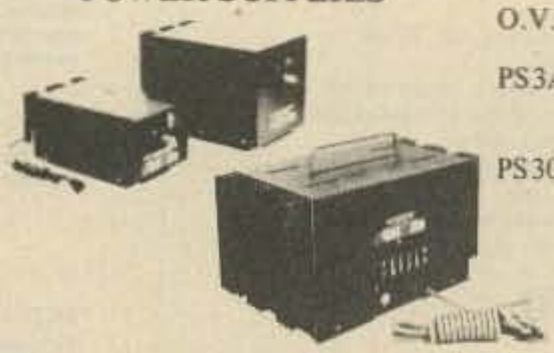


TX432B Kit.	transmitter exciter 432 MHz	39.95
TX432B W/T	same as above - factory wired and tested	59.95
TX150 Kit	300 milliwatt, complete 2 meter transmitter, less crystal and mike	19.95

POWER AMPLIFIERS

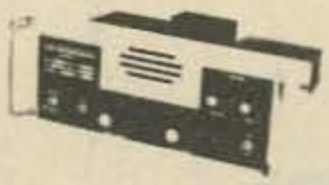
PA144/25 Kit	similar to PA144/15 kit except 25w out	49.95
PA220/15 Kit	similar to PA144/15 for 220 MHz	39.95
PA432/10 Kit	power amp – similar to PA144/15 except 10w and 432 MHz	49.95
PA140/10	10w in – 140w out – 2 meter amp – factory wired and tested	179.95
PA140/30	30w in – 140w out – 2 meter amp – factory wired and tested	159.95

POWER SUPPLIES



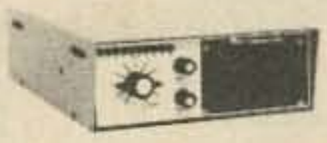
O.V.P.	adds over voltage protection to your power supplies, 15 VDC max	9.95
PS3A Kit	12 volt – power supply regulator card with fold back current limiting	8.95
PS3012	new commercial duty 30 amp 12 VDC regulated power supply w/case, w/foldback current limiting and over voltage protection wired and tested	239.95

REPEATERS



RPT144	repeater – 15 watt – 2 meter – factory wired and tested	695.95
RPT220	repeater – 15 watt – 220 MHz – factory wired and tested	695.95
RPT432	repeater – 10 watt – 432 MHz – factory wired and tested	749.95
DPLX144	2 meter, 600 KHz spaced duplexer, wired and tuned to frequency	399.95
DPLX220	220 MHz duplexer, wired and tuned to frequency	399.95

TRANSCEIVERS



OTHER PRODUCTS BY VHF ENGINEERING

CD1 Kit	10 channel receive xtal deck w/ diode switching	6.95
CD2 Kit	10 channel xmit deck w/switch and trimmers	14.95
CD-3 Kit	UHF version of CD-1 deck, needed for 432 multi-channel operations	12.95
COR2 Kit	complete COR with 3 second and 3 minute timers	19.95
SC3 Kit	10 channel auto-scan adapter for RX with priority.	19.95
Crystals	we stock most repeater and simplex pairs from 146.0-147.0 (each)	5.00
CWID Kit	159 bit, field programmable, code identifier with built-in squelch tail and ID timers	39.95
CWID	wired and tested, not programmed	54.95
CWID	wired and tested, programmed	59.95
Microphone	2,000 ohm dynamic mike with P.T.T. and coil cord	9.95

SYNTHESIZERS

WALKIE TALKIES

vhf engineering

THE WORLD'S MOST COMPLETE LINE OF VHF-FM KITS AND EQUIPMENT

Now It's Crystal Clear

Yes, now ICOM helps you steer clear of all the hassles of channel crystals. The new IC-22S is the same surprising radio you've come to know and love as the IC-22A, except that it is totally crystal independent. Zero crystals. Solid state engineering enables you to program 23 channels of your choice without waiting. Now the ICOM performance you've demanded comes with the convenience you've wanted, with your new IC-22S. *Price: $289.00*

Hold it!

Take hold of SSB with these two low cost twins. ICOM'S new portable **IC-202** and **IC-502** put it within your reach wherever you are. You can take it with you to the hill top, the highways, or the beach. Three portable watts PEP on two meters or six!

Hello, DX! The ICOM quality and excellent receiver characteristics of this pair make bulky converters and low band rigs unnecessary for getting started in SSB-VHF. You just add your linear amp, if you wish, connect to the antenna, and DX! With the **202** you may talk through OSCAR VI and VII! Even transceive with an "up" receiving converter! The **IC-502,** similarly, makes use of six meters in ways that you would have always liked but could never have before. In fact, there are so many things to try, it's like opening a new band.

Take hold of Single Side Band. Take hold of some excitement. Take two.

IC-202
2 Meter SSB • 3 Watts PEP • True IF Noise Blanker
Switched Dial Lights • Internal Batteries • 200KHz
VXO Tuning • 144.0, 144.2 + 2 More! • RIT!
Price: $259.00

IC-502
6 Meter SSB • 3 Watts PEP • True IF Noise Blanker
Switched Dial Lights • Internal Batteries • 800KHz
VFO • RIT!
Price: $249.00

IC-245 Transceiver
The VFO Revolution goes mobile with the unique, ICOM developed LSI synthesizer with 4 digit LED readout. The IC-245 offers the most for mobile on the market. The easy to use tuning knob moves accurately over 50 detent steps and assures excellent control as easily as steering the vehicle. With its optional adapter, the IC-245 puts you into all mode operation on 12V DC power with a compact dash-mounted transceiver. In FM, the synthesizer command frequency is displayed in 5 kHz steps from 146 to 148 MHz, and with the side band adapter the step rate drops to 100 Hz from 144 to 146 MHz. For maximum repeater flexibility, the transmit and receive frequencies are independently programmable on any separation. The IC-245 even comes equipped with a multiple pin Molex connector for remote control. The IC-245 is a product of the revolution in VFO design, from its new style front panel, to its excellent mechanical rigidity and Large Scale Integrated Circuitry. Your IC-245 will give you the most for mobile. $499.00

THE NEW ICOM 4 MEG, MULTI-MODE, 2 METER RADIO — IC 211
ICOM introduces the first of a great new wave of amateur radios, with new styling, new versatility, new integration of functions. You've never before laid eyes on a radio like the IC-211, but you'll recognize what you've got when you first turn the single-knob frequency control on this compact new model. The IC-211 is fully synthesized in 100 Hz or 5 kHz steps, with dual tracking, optically coupled VFOs displayed by seven-segment LED readouts, providing any aplit. The IC-211 rolls through 4 megahertz as easily as a breaker through the surf. With its unique ICOM developed LSI synthesizer, the IC-211 is now the best "do everything" radio for 2 meters, with FM, USB, LSB and CW operation. $749.00

Now ICOM Introduces 15 Channels of FM to Go!

The New IC-215: the FM Grabber

This is ICOM's first FM portable, and it puts good times on the go. Change vehicles, walk through the park, climb a hill, and ICOM quality FM communications go right along with you. Long lasting internal batteries make portable FM really portable, while accessible features make conversion to external power and antenna fast and easy.

Grab for flexibility with the new **IC-215** FM portable.

- Front mounted controls and top mounted antenna
- Narrow filter (15KHz — compatible spacing)
- 15 channels (12 on dial / 3 priority)
- Fully collapsible antenna
- Compatible mount feature for flexible antenna
- Dual power (3 watts high / 400 mw low, nominal)
- External power and antenna easily accessible
- Lighted dial and meter

Price: $229.00

Your new **IC-215** comes supplied with: 5 popular channels; handheld mic, with protective case; shoulder strap; connectors for external power and speaker; 9 long-life C batteries.

ICOM

RADIO CATALOG

HAM RADIO / MOBILE COMMUNICATIONS

THOMSON-CSF

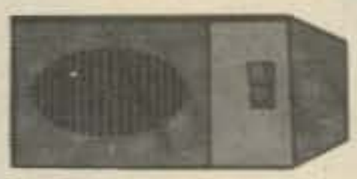
NPC

ELECTRONICS

MODEL	NET PRICE		
12V4	$19.95	103R	$39.95
600	$20.50	*13 HM 4	$41.95
102	$24.95	104R	$49.95
612	$27.95	12/115	$69.95
107	$28.95	108R	$79.95
12 HM 4	$29.95	108RM	$99.95
		109R	$149.95

MODEL 12HM4

NPC 2.5 Amp Regulated Power Supply. Solid State. Short Circuit Protected.



ALSO! Available as 13 HM 4 with built-in loudspeaker.

Low cost regulated power supply quietly converts 115 volts AC to 13.5 volts DC ±200 millivolts. 1.5 amps continuous, 2.5 amps reg. Ideally suited for operating mobile CB transceivers in your home or office base station.

	TYPICAL	MAXIMUM
Output Voltage	13.5 ±.5VDC	14VDC
Continuous Current	1.5 Amp	
Regulation	2.5 Amp	
Ripple/Noise	5 mV RMS	10 mV RMS

Case: 3" (H) x 4" (W) x 5¼" (D). Shipping Weight: 3 lbs.

MODEL 107

NPC 4 Amp Power Supply, 6 Amp Max. Solid State. Overload Protected

Functions silently in converting **115 volts AC to 12 volts DC. 4 amps** continuous, 6 amps max. Enables anyone to enjoy CB radio, car 8-track cartridge, cassette player or car radio in a home or office.

Continuous Current (Full Load)	4 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	10,000 uF
Ripple (Full Load)	.5 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4¾" (W) x 5¾" (D). Shipping Weight: 5 lbs.

MODEL 103R

NPC 4 Amp Regulated Power Supply, Solid State. Dual Overload Protection.

Converts 115 volts AC to 13.6 volts DC ±200 millivolts. Handles 2.5 amps continuous and 4 amps max. Ideally suited for applications where no hum and DC stability are important such as CB transmission, small Ham radio transmitter, and high quality eight-track car stereos. Can also be used to trickle-charge 12 volt car batteries.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2 VDC	13.6 ±.3 VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	2.5 Amp	
Current Limit	4 Amp	
Current Foldback	1 Amp	

Case: 3" (H) x 4¾" (W) x 5¾" (D). Shipping Weight: 4 lbs.

MODEL 109R

NPC 25 Amp Regulated Power Supply. 4-Way Protected. Output Voltage and Current Meters.

Extra heavy-duty unit quietly converts 115 volts AC to 13.6 volts DC ±200 millivolts. 10 amps continuous, 25 amps max. All solid state. Features dual current overload, overvoltage and thermal protection. Ideally suited for operating mobile Ham radio and linear amplifier in your home or office. Excellent bench power supply for testing and servicing of mobile communications equipment.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±2VDC	13.6 ±3VDC
Line/Load Regulation	50 mV	100 mV
Ripple Noise	5 mV RMS	10 mV RMS
Transient Response	20 uSec	
Current Continuous	10 Amp	
Current Limit	26 Amp	
Overvoltage Protection	14.5 V	15 V
Thermal Overload	180°F	

Case: 4¾" (H) x 9" (W) x 8½" (D). Shipping Weight: 15 lbs.

MODEL 12V4

NPC 1.75 Amp Power Supply. 3 Amp Max.

Functions silently in converting 115 volts AC to 12 volts DC. Ideally suited for most applications including 8-track stereo, burglar alarm, car radio and cassette tape player within power rating.

Continuous Current (Full Load)	1.75 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	5,000 uF
Ripple (Full Load)	.4 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4" (W) x 5¼" (D). Shipping Weight: 3 lbs.

MODEL 108RM

NPC 12 Amp Regulated Power Supply. Solid State. 3-Way Protected. Current Meter.

This heavy duty unit quietly converts 115 volts AC to 13.6 volts DC ±200 millivolts. 8 amps continuous, 12 amps max. All solid state. Features dual current overload and overvoltage protection. Ideally suited for operating mobile Ham radio 2 meter AM-FM-SSB transceivers in your home or office. Can also be used to trickle-charge 12 volt car batteries.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±2VDC	13.6 ±3VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	8 Amp	
Current Limit	12 Amp	
Current Foldback	2.5 Amp	
Overvoltage Protection	14.5 V	15 V

Case: 4¼" (H) x 7½" (W) x 5½" (D). Shipping Weight: 9.5 lbs.

ALSO AVAILABLE AS MODEL 108RA WITHOUT METER AND OVERVOLTAGE PROTECTION.

MODEL 104R

NPC 6 Amp Power Supply Regulated. Solid State. Dual Overload Protection.

Converts 115 volts AC to 13.6 volts DC ±200 millivolts. Handles 4 amps continuous and 6 amps max. Ideally suited for applications where excellent DC stability is important, such as CB transmission, small Ham radio transmitter, and high quality eight-track car stereos. Can be used to trickle-charge 12 volt car batteries.

	MAXIMUM	TYPICAL
Output Voltage	13.6 ±2 VDC	13.6 ±3 VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	4 Amp	
Current Limit	6 Amp	
Current Foldback	2 Amp	

Case: 3½" (H) x 5[illegible]" (W) x 6[illegible]" (D). Shipping Weight: 6 lbs.

MODEL 102

NPC 2.5 Amp Power Supply. 4 Amp Max. Solid State. Overload Protected.

Functions silently in converting 115 volts AC to 12 volts DC. 2.5 amps continuous, 4 amps max. Enables anyone to enjoy CB radio, car 8-track cartridge, cassette tape player or car radio in a home or office.

Continuous Current (Full Load)	2.5 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	5,000 uF
Ripple (Full Load)	.6 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4¼" (W) x 5¾" (D). Shipping Weight: 4 lbs.

	12 VDC 1N	14 VDC 1N
Output Voltage (No Load)	115 V RMS	130 V RMS
Output Voltage (Full Load)	100 V RMS	115 V RMS
Frequency (No Load)	58 Hz	66 Hz
Frequency (Full Load)	54 Hz	62 Hz
Power Continuous	200W	
Power Peak	240W	
Parallel Connection	350W	

All Values Are Typical

MARINE & RV

MODEL 12-115

NPC 12-115 Solid State Inverter. 200 W. Parallel Connection for Higher Power up to 350 W.

Converts 12 volts DC to 115 volts AC @ 60 Hz output. 200 watts continuous operation with peak power up to 240 watts. All silicon semiconductors assure high reliabiltiy at excessive ambient temperatures. The output voltage is a square wave. The inverter is not recommended where high transients are not tolerable.

The 12-115 allows you to have AC house current in your boat, car, truck, camper, house trailer, or houseboat. Will operate small household appliances, T.V., hand tools, electric shaver, AC radios, and lights within power rating. Built-in overload protection.

Case: 4½" (H) x 7½" (W) x 5½" (D). Shipping Weight: 7 lbs.

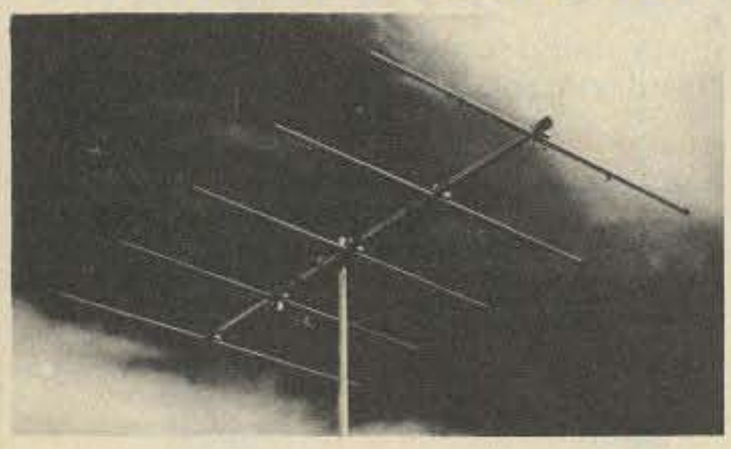
MODEL 612

Model 612 Power Converter

NPC 612 converts 6 volt negative ground or 12 volt positive ground electrical systems to 12 volt negative ground operation. Provides full 3 amp continuous power. The inexpensive solution for installing car radios, stereo and cassette tape players, in vehicles with 6 volt negative ground or 12 volt positive ground systems.

Case: 2¾" (H) x 3" (W) x 5" (D). Shipping Weight: 1 lb.

6 METER BEAMS



3 - 5 - 6 - 10 ELEMENTS

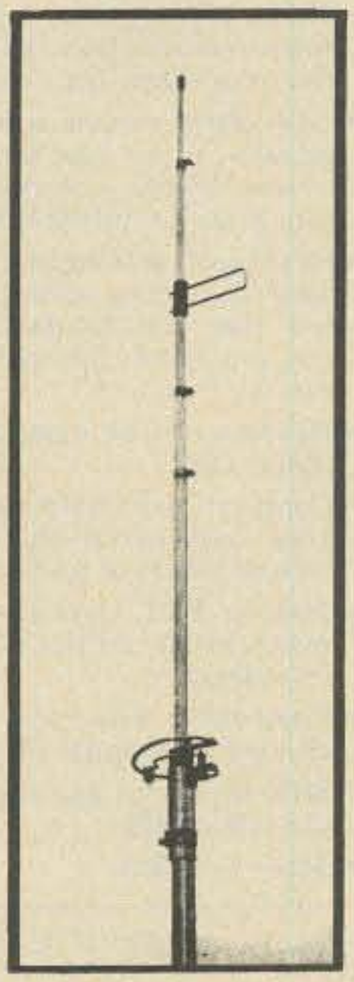
Proven performance from rugged, full size, 6 meter beams. Element spacings and lengths have been carefully engineered to give best pattern, high forward gain, good front to back ratio and broad frequency response.

Booms are .058 wall and elements are 3/4" - 5/8" .049 wall seamless chrome finish aluminum tubing. The 3 and 5 element beams have 1 3/8" - 1 1/4" booms. The 6 and 10 element beams have 1 5/8" - 1 1/2" booms. All brackets are heavy gauge formed aluminum. Bright finish cad plated ubolts are adjustable for up to 1 5/8" mast on 3 and 5 element and 2" on 6 and 10 element beams. All models may be mounted for horizontal or vertical polarization.

New features include adjustable length elements, kilowatt Reddi Match and built-in coax fitting for direct 52 ohm feed. These beams are factory marked and supplied with instructions for quick assembly.

Description	3 element	5 element	6 element	10 element
Model No.	A50-3	A50-5	A50-6	A50-10
Boom Lngth	6'	12'	20'	24'
Longest El.	117"	117"	117"	117"
Turn Radius	6'	7' 6"	11'	13'
Fwd. Gain	7.5 dB	9.5 dB	11.5 dB	13 dB
F/B Ratio	20 dB	24 dB	26 dB	28 dB
Weight	7 lbs.	11 lbs.	18 lbs.	25 lbs.

new **RINGO RANGER for FM**



4.5 dB* — 6 dB Omnidirectional GAIN BASE STATION ANTENNAS**

FOR MAXIMUM PERFORMANCE AND VALUE

Cush Craft has created another first by making the world's most popular 2 meter antenna twice as good. The new Ringo Ranger is developed from the basic AR-2 with three half waves in phase and a one eighth wave matching stub. Ringo Ranger gives an extremely low angle of radiation for better signal coverage. It is tunable over a broad frequency range and perfectly matched to 52 ohm coax.

ARX-2, 137-160 MHz, 4 lbs., 112"
ARX-220, 220-225 MHz, 3 lbs., 75"
ARX-450, 435-450 MHz, 3 lbs., 39"

* Reference ½ wave dipole.
** Reference ¼ wave whip used as gain standard by many manufacturers.

Work full quieting into more repeaters and extend the radius of your direct contacts with the new Ringo Ranger.

You can up date your present AR-2 Ringo with the simple addition of this extende. kit. The kit includes the phasing network and necessary element extensions. The only modifications required are easy to make saw slits in the top section of your antenna.

ARX-2K CONVERSION KIT

2 METER ANTENNAS FM

A-FM RINGO 3.75 dB Gain (reference ¼ wave whip). Half wave length antennas with direct dc ground, 52 ohm feed takes PL-259, low angle of radiation with 1-1 SWR. Factory preassembled and ready to install, 6 meter partly preassembled, all but 450 MHz take 1¼" mast. There are more Ringos in use than all other FM antennas combined.

Model Number	AR-2	AR-25	AR-6	AR-220	AR-450
Frequency MHz	135-175	135-175	50-54	220-225	440-460
Power—Hdlg. Watts	100	500	100	100	250
Wind area sq. ft.	.21'	.21'	.37'	.20'	.10'

B-4 POLE Up to 9 dB Gain over a ½ wave dipole. Overall antenna length 147 MHz — 23' 220 MHz — 15', 435 MHz — 8', pattern 360° — 6 dB gain, 180° — 9 dB gain, 52 ohm feed takes PL 259 connector. Package includes 4 complete dipole assemblies on mounting booms, harness and all hardware. Vertical support mast not supplied.

AFM-4D 144 - 150 MHz, 1000 watts, wind area 2.58 sq. ft.
AFM-24D 220 - 225 MHz, 1000 watts, wind area 1.85 sq. ft.
AFM-44D 435 - 450 MHz, 1000 watts, wind area 1.13 sq. ft.

D-POWER PACK The big signal (22 element array) for 2 meter FM, uses two A147-11 yagis with a horizontal mounting boom, coaxial harness and all hardware. Forward gain 16 dB, F/B ratio 24 dB, ½ power beamwidth 42°, dimensions 144" x 80" x 40", turn radius 60", weight 15 lbs., 52 ohm feed takes PL-259 fitting.

A147-22 146 - 148 MHz, 1000 Watts, wind area 2.42 sq. ft.

D-YAGI STACKING KITS VPK includes horizontal mounting boom, harness, hardware and instructions for two vertically polarized yagis gives 3 dB gain over the single antenna.

A14-VPK,	complete 4 element stacking kit
A14-SK,	4 element coax harness only
A147-VPK,	complete 11 element stacking kit
A147-SK,	11 element coax harness only
A449-SK,	6 + 11 element coax harness only

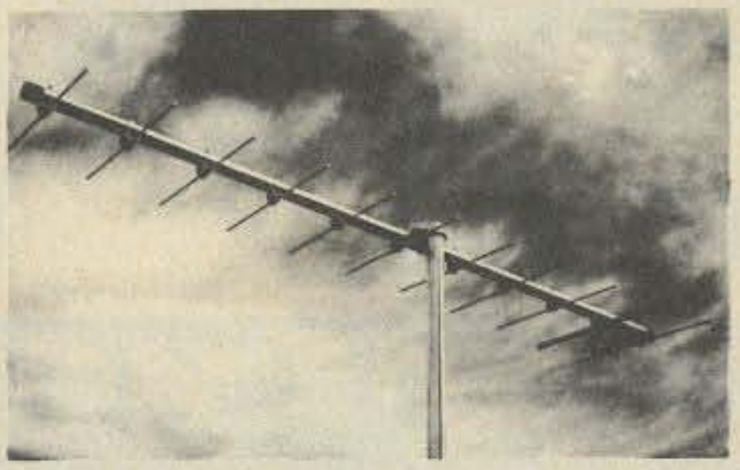
E-4-6-11 ELEMENT YAGIS The standard of comparison in VHF-UHF communications, now cut for FM and vertical polarization. The four and six element models can be tower side mounted. All are rated at 1000 watts with direct 52 ohm feed and PL-259 connectors.

Model Number	A147-11	A-147-4	A449-11	A449-6	A220-11
Boom/Longest ele.	144"/40"	44"/40"	60"/13"	35"/26"	102"/26"
Wght./Turn radius	6 lbs., 72"	3 lbs., 44"	4 lbs., 60"	3 lbs., 18"	5 lbs., 51"
Gain/F/B ratio dB	13.2/28	9/20	13.2/28	11/25	13.2/28
½ Power beam	48°	66°	48°	60°	48°
Wind area sq. ft.	1.21	.43	.39	.30	.50
Frequency MHz	146-148	146-148	440-450	440-450	220-225

F-FM TWIST 12.4 dB Gain: Ten elements horizontal polarization for low end coverage and ten elements vertical polarization for FM coverage. Forward gain 12.4 dB, F/B ratio 22 dB, boom length 130", weight 10 lbs., longest element 40", 52 ohm Reddi Match driven elements take PL-259 connectors, uses two separate Feed lines.

A147-20T 145 - 147 MHz, 1000 watts, wind area 1.42 sq. ft.

HIGH PERFORMANCE VHF YAGIS



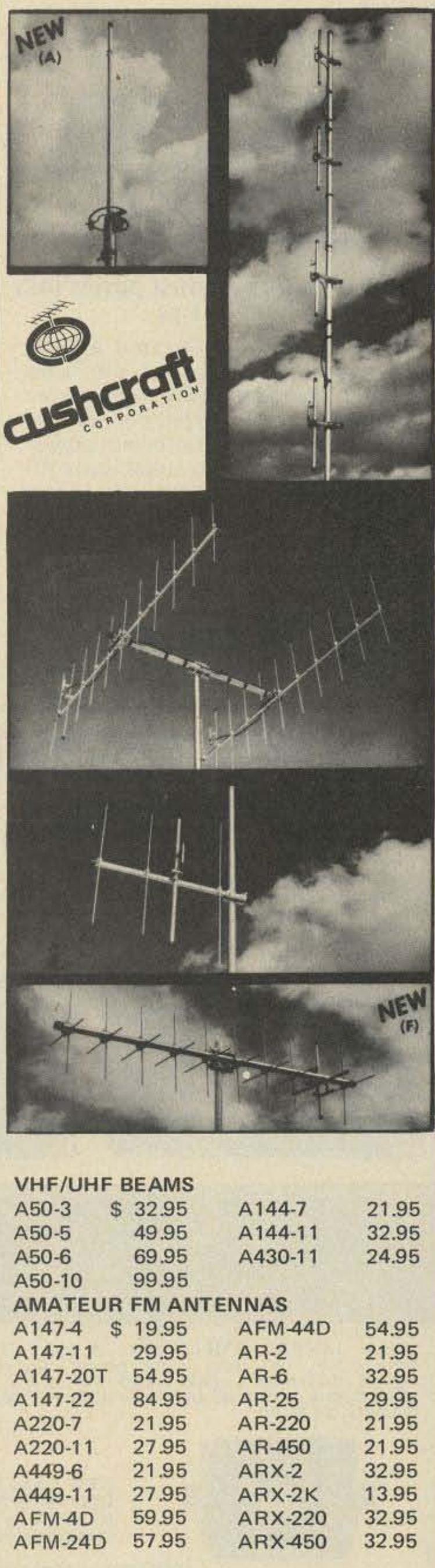
3/4 , 1-1/4, 2 METER BEAMS

The standard of comparison in amateur VHF/UHF communications Cush Craft yagis combine all out performance and reliability with optimum size for ease of assembly and mounting at your site.

Lightweight yet rugged, the antennas have 3/16" O. D. solid aluminum elements with 5/16' center sections mounted on heavy duty formed brackets. Booms are 1" and 7/8" O.D. aluminum tubing. Mast mounts of 1/8" formed aluminum have adjustable u-bolts for up to 1-1/2" O.D. masts. They can be mounted for horizontal or vertical polarization. Complete instructions include data on 2 meter FM repeater operation.

New features include a kilowatt Reddi Match for direct 52 ohm coaxial feed with a standard PL-259 fitting. All elements are spaced at .2 wavelength and tapered for improved bandwidth.

Model No.	A144-7	A144-11	A220-11	A430-11
Description	2m	2m	1¼m	¾m
Elements	7	11	11	11
Boom Lngth.	98"	144"	102"	57"
Weight	4	6	4	3
Fwd. Gain	11 dB	13 dB	13 dB	13 dB
F/B Ratio	26 dB	28 dB	28 dB	28 dB
Fwd. Lobe @ ½ pwr. pt.	46	42	42	42
SWR @ Freq.	1 to 1	1 to 1	1 to 1	1 to 1



VHF/UHF BEAMS

A50-3	$ 32.95	A144-7	21.95
A50-5	49.95	A144-11	32.95
A50-6	69.95	A430-11	24.95
A50-10	99.95		

AMATEUR FM ANTENNAS

A147-4	$ 19.95	AFM-44D	54.95
A147-11	29.95	AR-2	21.95
A147-20T	54.95	AR-6	32.95
A147-22	84.95	AR-25	29.95
A220-7	21.95	AR-220	21.95
A220-11	27.95	AR-450	21.95
A449-6	21.95	ARX-2	32.95
A449-11	27.95	ARX-2K	13.95
AFM-4D	59.95	ARX-220	32.95
AFM-24D	57.95	ARX-450	32.95

Description:	144 MHz. Model:	Price:	220 MHz. Model:	Price:	432 MHz. Model:	Price:
20 Element DX-Array	DX-120	42.95	DX-220	37.95	DX-420	32.95
Frame & Harness (40 El.)	DXK-140	59.95	DXK-240	54.95	DXK-440	39.95
Frame & Harness (80 El.)	DXK-180	109.95	DXK-280	89.95	DXK-480	79.95
1-1 52-ohm balun	DX-1BN	12.95	DX-2BN	12.95	DX-4BN	12.95
Vert. Pol. Bracket (20 El.)	DX-VPB	9.95	DX-VPB	9.95	DX-VPB	9.95

CUSH CRAFT — RADIO CATALOG

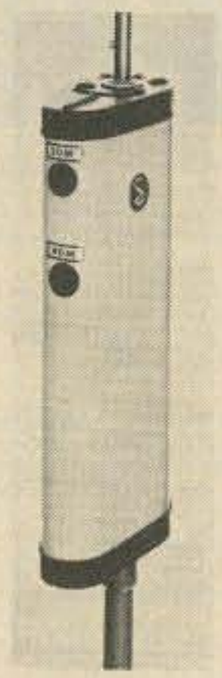
why waste watts?

SWR-1 guards against power loss for $21.95

If you're not pumping out all the power you're paying for, our little SWR-1 combination power meter and SWR bridge will tell you so. You read forward and reflected power simultaneously, up to 1000 watts RF and 1:1 to infinity VSWR at 3.5 to 150 MHz.

Got it all tuned up? Keep it that way with SWR-1. You can leave it right in your antenna circuit.

SWAN® ELECTRONICS
A subsidiary of Cubic Corporation



DELUXE
742 TRI-BAND
MOBILE
ANTENNA

- Automatically adjusts to proper resonance for 20, 40 and 75 meters.
- Power rated at 500 Watts P.E.P.
- Includes base section, automaticoil and whip top section. 742 Antenna $79.95

EXCLUSIVE
DELUXE
5-BAND MOBILE
45 ANTENNA

- All band manual switching antenna for 10, 15, 20, 40 and 75 meters.
- Power rated at 1000 Watts P.E.P.
- Includes base section with mobilecoil and six foot whip top section. 45 Antenna $114.95

SWAN METERS HELP YOU GET IT ALL TOGETHER

These wattmeters tell you what's going on.

With one of these in-line wattmeters you'll know if you're getting it all together all the time. Need high accuracy? High power handling? Peak power readings? For whatever purpose we've got the wattmeter for you. Use your Swan credit card. Applications at your dealer or write to us.

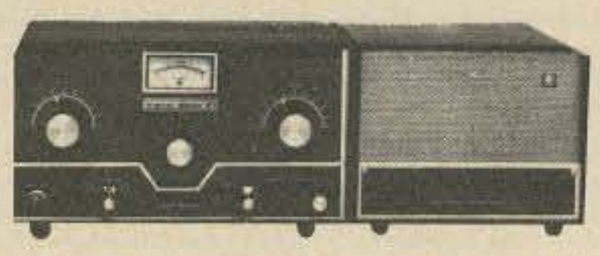
WM2000 In-Line Wattmeter With Muscle. Scales to 2000 watts. New flat response directional coupler for maximum accuracy. $59.95

WM3000 Peak-reading Wattmeter. Reads RMS power, then with the flick of a switch, true peak power of your single-sideband signal. That's what counts on SSB. $79.95

WM1500 High-Accuracy In-Line Wattmeter. 10% full scale accuracy on 5, 50, 500 and 1500 watt scales, 2 to 30 MHz. Forward and reflected power. Use it for trouble-shooting, too. $74.95

SWAN® ELECTRONICS
A subsidiary of Cubic Corporation

SWAN LINEAR AMPLIFIERS A Mark II 2000 watt P.E.P. full legal input power unit or the 1200X matching Cygnet 1200 watt P.E.P. input powerhouse with built-in power supply. The choice is yours. $849.95



NEW Swan MMBX Impedance Matcher

It keeps your transmitter and your antenna on speaking terms for a song. Price: $23.95

CYGNET 1200X PORTABLE LINEAR AMPLIFIER

To quadruple the output of the 300B Cygnet *de novo*, simply add this matching unit for more than a kilowatt of power. Complete with self-contained power supply and provision for external ALC, this Cygnet offers exceptionally high efficiency and linearity. $349.95

Additional Swan products include: fixed and mobile antennas, VFO's telephone patch, VOX, wattmeter, microphones and mounting kits. As another extra service, only Swan Electronics offers factory-backed financing to the amateur radio community. Visit an authorized Swan Electronics dealer for complete details

SWAN® ELECTRONICS

JMR MOBIL-EAR™

Two-way-radio headset with superior fidelity Electret-Capacitor boom microphone and palm-held talk switch.

$69.95

FOR BROADCAST-QUALITY TRANSMISSION AND RECEPTION FOR BOTH MOBILE UNITS AND BASE STATIONS.

- Boom-mounted electret-capacitor microphone delivers studio-quality, undistorted voice reproduction. Variable gain control lets you adjust for optimum modulation.
- Cushioned earcup lets you monitor in privacy -- no speaker blare to disturb others. Blocks out environmental noises, too. Made of unbreakable ABS plastic.
- Headband self-adjusts for comfortable wear over long hours. Spring-flex hinge lets you slip headset on and off with just one hand. Reversible for right or left ear.
- Headset can be hung on standard microphone clip.
- Compact palm-held talk switch lets you keep *both* hands on the wheel for safer driving. Made of unbreakable ABS plastic.
- Built-in FET transistor amplifier adapts microphone output to any transceiver impedance.
- Compatible with most two-way radios including 40-channel CB units.
- Built-in Velcro pad for easy mounting of the talk switch.
- Made in U.S.A.

SPECIFICATIONS

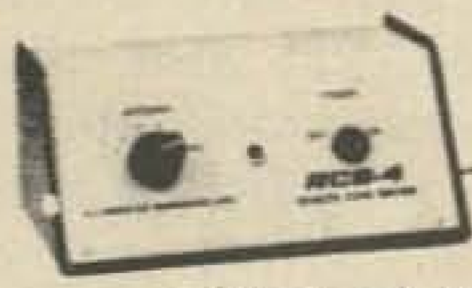
Earphone impedance and type:	8 ohms, dynamic
Microphone type:	Electret capacitor
Microphone frequency response:	200–6000 Hz
Amplifier type:	FET transistor, variable gain
Amplifier battery power:	7-volt Mallory TR-175
Switching:	Relay or electronic

IDEAL FOR EVERY TWO-WAY RADIO COMMUNICATIONS NEED . . .

CB operators • Amateur radio operators • Police and fire vehicles • Ambulances and emergency vehicles • Taxis and truckers • Marine pleasure and work boats • Construction and demolition crews • Industrial communications • Security patrols • Airport tower and ground crews • Remote broadcast and TV-camera crews • Foresters and fire-watch units •

- *Remote*
- *Motor Controlled*

RCS-4



COAX ANTENNA SWITCH

- Control unit works on 110/220 VAC, 50/60 Hz, and supplies necessary DC to motor.
- Excellent for single coax feed to multiband quads or arrays of monobanders. The five positions allow a single coax feed to three beams and two dipoles, or other similar combinations.
- Control cable (not supplied) same as for HAM-M rotator.
- Selects antennas remotely, grounds all unused antennas. GND position grounds all antennas when leaving station. "Rain-Hat" construction shields motor and switches.
- Motor: 24 VAC, 2 amp. Lubrication good to $-40°F$.
- Switch RF Capability: Maximum legal limit. Price: $120.00

MATCHING NETWORKS

MN-4
200 watts
Price: $110.00

MN-2000
2000 watts PEP
Price: $220.00

General: • **Integral Wattmeter** reads forward power in watts and VSWR directly; can be calibrated to read reflected power • **Matches 50 ohm transmitter output** to coax antenna feedline with VSWR of at least 5:1 • Covers ham bands 80 thru 10 meters • **Switches in or out** with front panel switch • **Size:** 5½"H, 10¾"W, 8"D (14.0 x 27.3 x 20.3 cm), MN-2000, 14⅜"D (36.5 cm).
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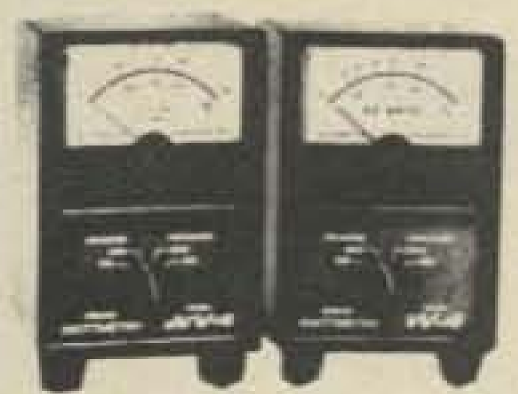

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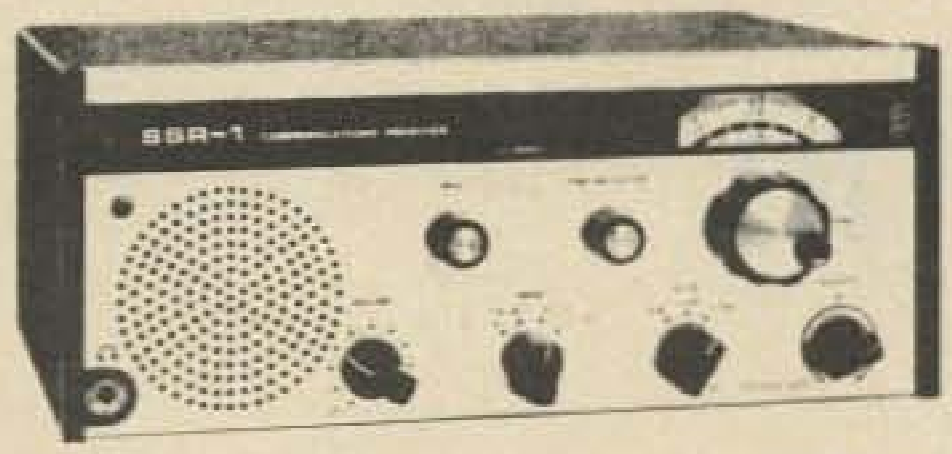
	2000 watts	±(5% of reading + 20 watts)
WV-4	100 watts	±(5% of reading + 1 watt)
	1000 watts	±(5% of reading + 10 watts)

DRAKE



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- **Low Cost • All Solid State • Built-in AC Power Supply • Selectable Sidebands**
- **Excellent Performance**

PRELIMINARY SPECIFICATIONS: • **Coverage:** 500 kHz to 30 MHz • **Frequency** can be read accurately to better than 5 kHz • **Sensitivity** typically .5 microvolts for 10 dB S+N/N SSB and better than 2 microvolts for 10 dB S+N/N AM • **Selectable sidebands** • **Built-in power supply:** 117/234 VAC ± 20% • **If the AC power source fails** the unit switches automatically to an internal battery pack which uses eight D-cells (not supplied) • **For reduced current drain** on DC operation the dials do not light up unless a red pushbutton on the front panel is depressed.
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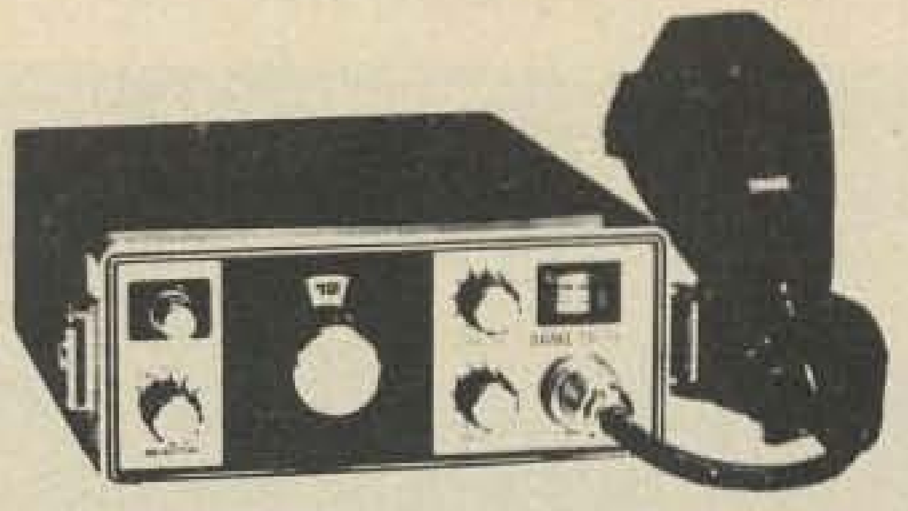

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Background

The Minicom MK IV is a miniaturized solid state communications receiver, and it should be apparent from the title that there have been 3 predecessors. I guess the earliest version was one I included for illustrative purposes in my article on the LM-373.[1] The real MK I, however, did not appear until 1974 when it was published as a construction project.[2] The MK II was devised during the time the MK I was awaiting publication and, since it was very similar, no

The MK IV makes an attractive package.

attempt to publish details was undertaken. Instead, all readers who inquired about the MK I were advised of the later version. The MK III appeared in print together with a collection of circuit ideas for receivers.[3] It was different from the others in that a triple varactor was used to replace the 3-gang tuning capacitor in the rf section. As with all previous Minicoms, single band operation on 80 meters was standard.

At various times I attempted to design a converter that could be mated with the Minicom assembly to produce a multiband receiver of diminutive proportions. The converter usually ended up being larger than the receiver and success eluded me for a very long time. By using 3 separate PC boards and constructing the converter around and between the wafers of a surplus rotary switch, a suitable converter was finally evolved which led to several copies of multiband Minicoms in the same size cabinet as the single band MK I. Construction of this converter, however, was far too tricky and the rotary switch too hard to come by to make publication of details practical.

The MK IV

Over a period of many months, I investigated the offerings of several switch manufacturers to see if a converter design could be developed that would be suitable for publication. The Stackpole Series 80 subminiature rotary switch offered the most promise, so I ordered some samples fabricated to my specs. The switch has printed circuit pins so that the 2 boards used for the converter mount right to the switch. Pins from various sections are brought out on opposite sides so that the 2 boards form a sandwich with the switch in the middle.

The converter together with 2 other PC assemblies make up the bulk of the receiver circuitry. A third board constituting an ac power supply completes the lineup. Everything is housed in a Radio Shack #270-254 cabinet whose dimensions are 6 ¼" x 2 ¾" x 7 ¼".

The main PC assembly contains the tunable i-f which covers 3.5 to 4.0 MHz, a noise blanker with threshold control, and 2 amplifier stages. Selectivity is provided by 2 transformers and 2 dual ceramic filters at 455 kHz. The companion board houses the detector, AGC circuits, S-meter amplifier, BFO, tunable CW filter, and audio power amplifier. Both of these boards are 2.4" x 5.5".

Power required is a positive 12 volt source capable of supplying 120 to 150 mA during audio peaks. No-signal drain is about 80 mA for SSB/CW operation. The internal regulated supply meets these requirements and is automatically switched off when the receiver is switched to an external dc source.

There are 8 operating controls and 3 switches on the front panel as well as an S-meter and phone jack. The controls are main tuning, rf peaking, AGC time constant, rf gain, af gain, blanker threshold, CW filter tuning, and BFO tuning. Switch controls consist of the bandswitch, AM-SSB/CW selector, and CW filter mode switch. The ac/dc power selector switch, antenna connector, ac power cord connector, and

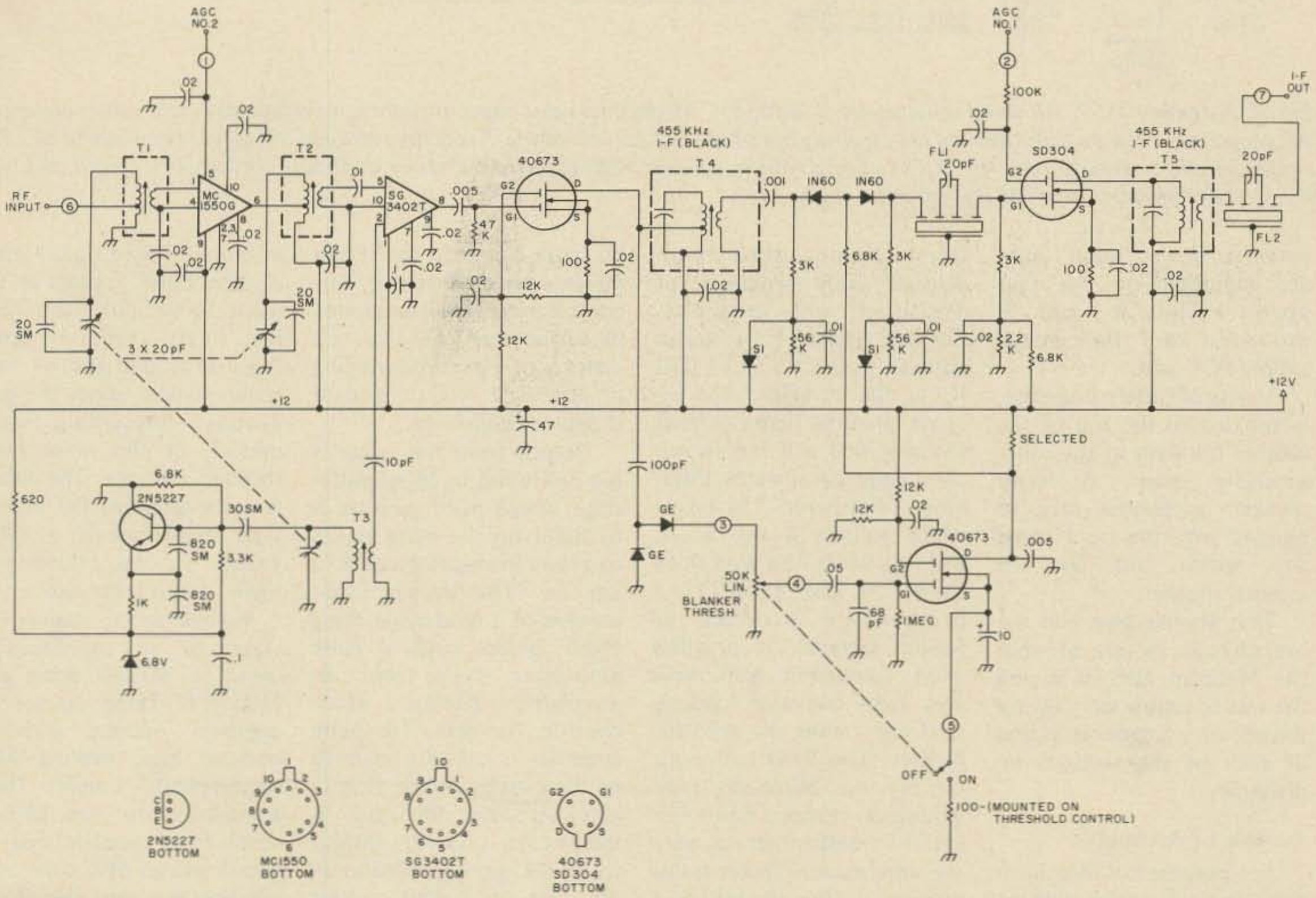

Fig. 1. Assembly PC-1. All fixed resistors are ¼ Watt, 5%. All decimal value capacitors are low voltage discs. All capacitors are in uF except as noted on schematic. Capacitors with polarity marked are electrolytics of at least 15 volt rating. All SM (silver mica) capacitors are in pF. The circled numbers denote pads on the PC board which connect to external points or controls. The artwork layout in Fig. 5 shows the physical location of each of these points.

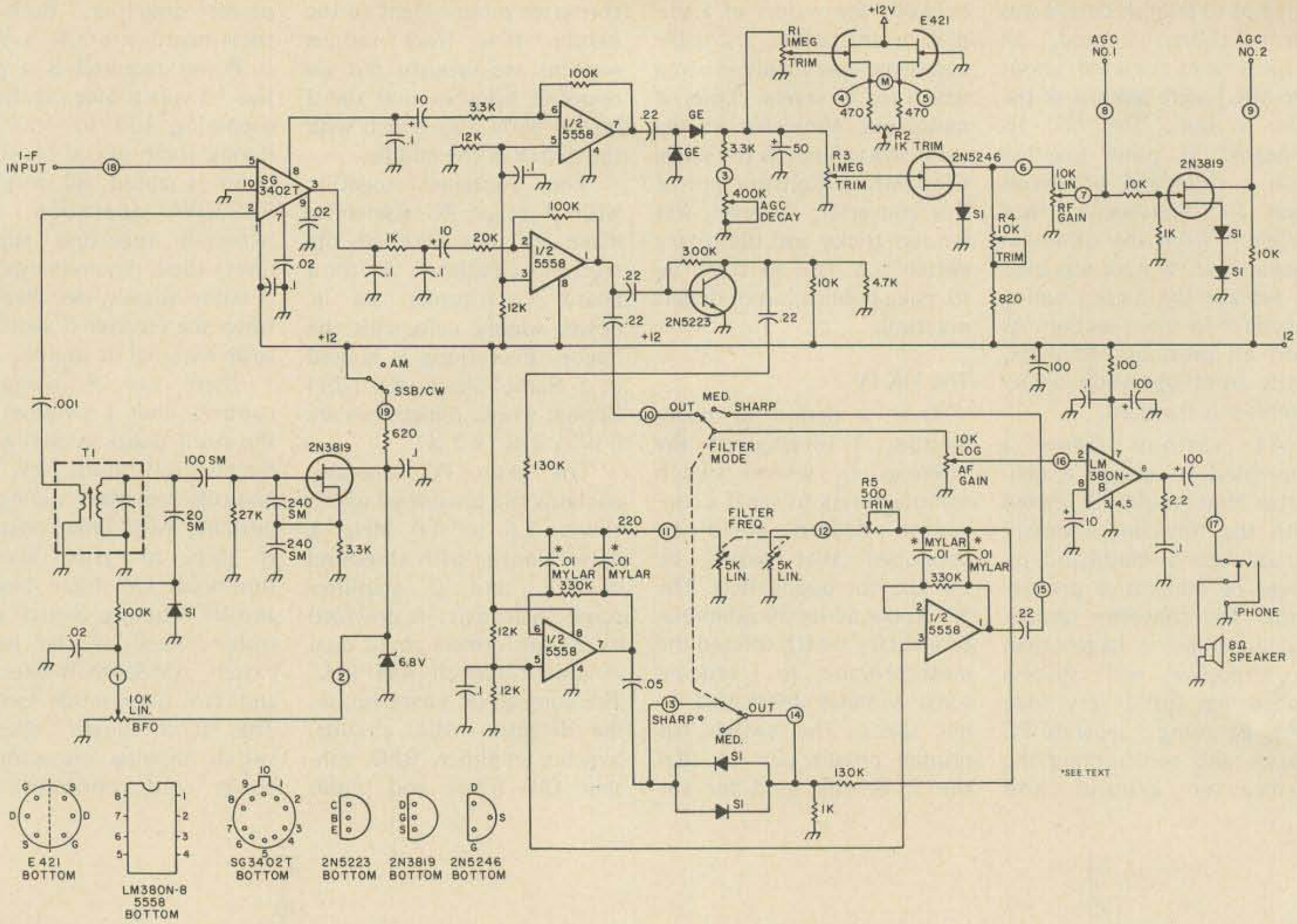

Fig. 2. Assembly PC-2. All fixed resistors are ¼ Watt, 5%. All decimal value capacitors are low voltage discs and values are in uF. All capacitors with polarity marked are electrolytics of at least 15 volt rating. Capacitors marked SM (silver mica) are in pF. The circled numbers denote pads on the PC board which connect with external points or controls. The artwork layout in Fig. 6 shows the physical location of each of these pads.

external power input jacks are mounted on the rear apron. The ac fuse is mounted on the power supply PC board.

The small internal speaker is epoxied to the top of the cabinet for want of any other available space. A larger speaker or phones may be plugged into the front panel jack which cuts out the internal speaker.

That should give you the overall basic picture of what the Minicom MK IV is and the rest to follow will take up the circuitry and construction of each of the sections individually.

Tunable I-f Assembly

For purposes of identification this assembly will be called out as PC-1. Fig. 1 is the schematic for this board.

Recent receivers in this series used MOSFET rf amplifiers which often were plagued with problems of oscillation and instability. For this version, I decided to go back to the old MC1550G IC in the rf stage. The receiver pictured here has been working fine and not shown any tendency towards instability whatsoever. The mixer which follows is also an IC and one which I've used since the MK II. The SG3402T is a proprietary product of Silicon General. It provides good conversion gain with very light oscillator loading, thus eliminating the need for buffers. The VFO tank coils on previous Minicoms were wound on stripped down 455 kHz i-f transformers, as were the antenna and mixer transformers in the rf section. I later found that in some cases this tank coil caused excessive drift in the VFO and the scheme was abandoned. Since no harm comes to the rf and mixer circuits, however, this construction is still employed here. The new VFO tank coil consists of a pie-type winding of litz wire on a standard slug-tuned coil form.

Output from the mixer is fed unfiltered to an amplifier stage whose main purpose is to build up the noise spikes to a level the blanker can do a job on. The blanker itself consists of a diode gate using 1N60 diodes and a pulse amplifier fed from an envelope detector which controls the gate. The pulse amplifier is capacity coupled to the output of the first i-f amplifier and the gate is transformer coupled. Output from the gate terminates in the first of 2 dual ceramic filters used for selectivity in the i-f strip. The 1N60 diodes are normally forward biased and do not impede transmission of the i-f signal. When a noise pulse appears at the input to the pulse amplifier, its drain voltage drops towards ground and momentarily reverse biases the gate diodes, preventing transmission of the noise pulse through the gate. The circuit is quite effective for impulse type noise but is of little value against fluorescent lights, power leaks, etc.

Following the blanker is a stage of i-f amplification using a SD304 dual gate MOSFET. These devices by Signetics operate with all positive bias, making AGC requirements simple. These transistors are run with a small fixed positive bias on gate 1 and an AGC controlled positive bias on gate 2. As gate 2 bias approaches zero, gain drops rapidly and can affect changes as great as 40 dB. Output from this stage is

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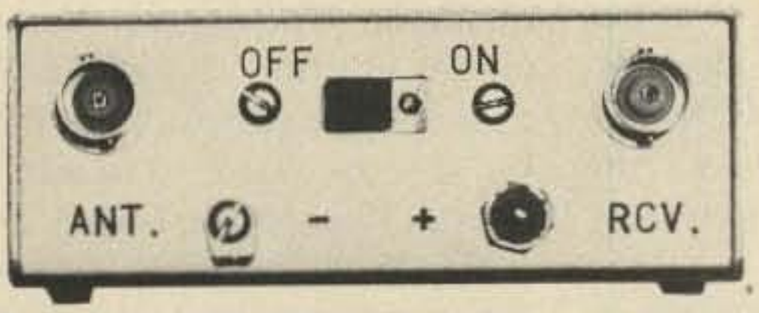

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R2

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20m	2.2 uH	18 MHz
15m	1.5 uH	25 MHz
10m	(same tank circuit as 15m)	

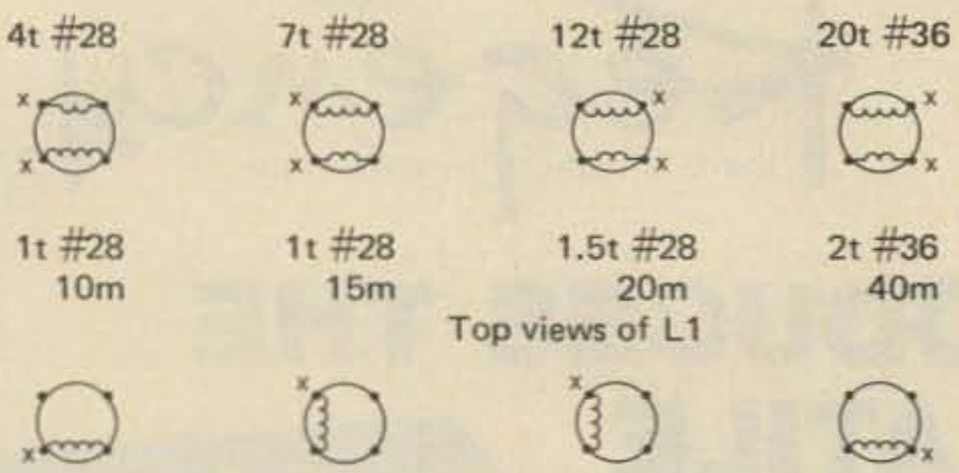


Table 1. All coils wound on Gowanda Series 7 coil forms. Forms are .209" diameter x .625" long with Carbonyl E cores. "X" indicates cold or ground end of winding.

transformer coupled to the second ceramic filter, which completes the circuitry assigned to this board.

Detector and Audio Section

This assembly is PC-2 and the schematic for it is Fig. 2.

A second SG3402T IC is used as detector for both AM and SSB/CW, it being necessary only to disable the BFO for AM reception. The SG3402T has 2 outputs via pins 3 and 8. In this case, pin 3 is used as the main audio source and is fed to the preamp which uses half of a dual op amp. Output from the preamp connects to either the audio gain control or is left open if the CW filter is in use. In order to maintain a fairly constant input to the CW filter, audio from the preamp is fed to a saturating amplifier circuit and from there to the filter. The filter itself consists of 2 identical active bandpass filters joined by a threshold detector.[4] Both sections are tuned simultaneously by a dual 5k pot. A 3 position switch allows the filter to be cut out of the circuit, operated with the threshold detector shorted out for medium selectivity, or with the threshold detector intact for sharp response. It will not always be practical to use the Sharp position, since weak signals or QSB may cause the signal level to fall below the barrier potential of the diodes and cut out altogether. In such cases, the Medium position will still provide a good deal of selectivity. The frequency range covered by the filter is approximately 400 to 1600 Hz.

An LM380N-8 is used in the audio power amplifier stage. This IC is rated at 600 mW output and requires few external components.

The BFO is diode tuned and uses a standard 455 kHz transistor i-f transformer for the tank circuit. Before installing the transformer, the secondary is modified to 4 turns so as to supply proper injection level to the detector. Operating voltage for the oscillator and bias for the tuning diode are zener regulated.

Audio output from the detector is used as the source for generating AGC voltage and is taken from pin 8. The second half of the dual op amp is used to amplify the audio about 30 times before rectification. The resulting positive voltage is stored in an electrolytic capacitor and bled off at a rate determined by the setting of the T/C control. The latter is a front panel control giving the operator a choice of AGC decay time over a continuous range of milliseconds to seconds.

The FET which follows amplifies and inverts the dc voltage appearing across the electrolytic capacitor so that as signal increases, the level at the top of the rf gain control decreases. This is the proper action for control of the SD304, and when I used this transistor in all gain-controlled stages, no further circuitry was needed. Now, however, a reverse effect is required for the MC1550G used in the tuner rf stage. The SD304 operates at full gain when the AGC level is 5 to 6 V. The MC1550G doesn't start to lose again until the AGC starts to rise above this level, making a second inversion necessary. This is accomplished with an additional FET. The rf gain control does the same thing as the AGC when manual control is desired.

It may be worth noting that an early version of the MK IV used separate sources for AGC control. As might be expected, output from the i-f amplifier was used during AM reception in place of the audio source. Since AM is seldom used, this extra circuitry and additional switching were eliminated to save space. Though perhaps not ideal for AM, the audio AGC works well enough to make AM reception practical whenever it is needed.

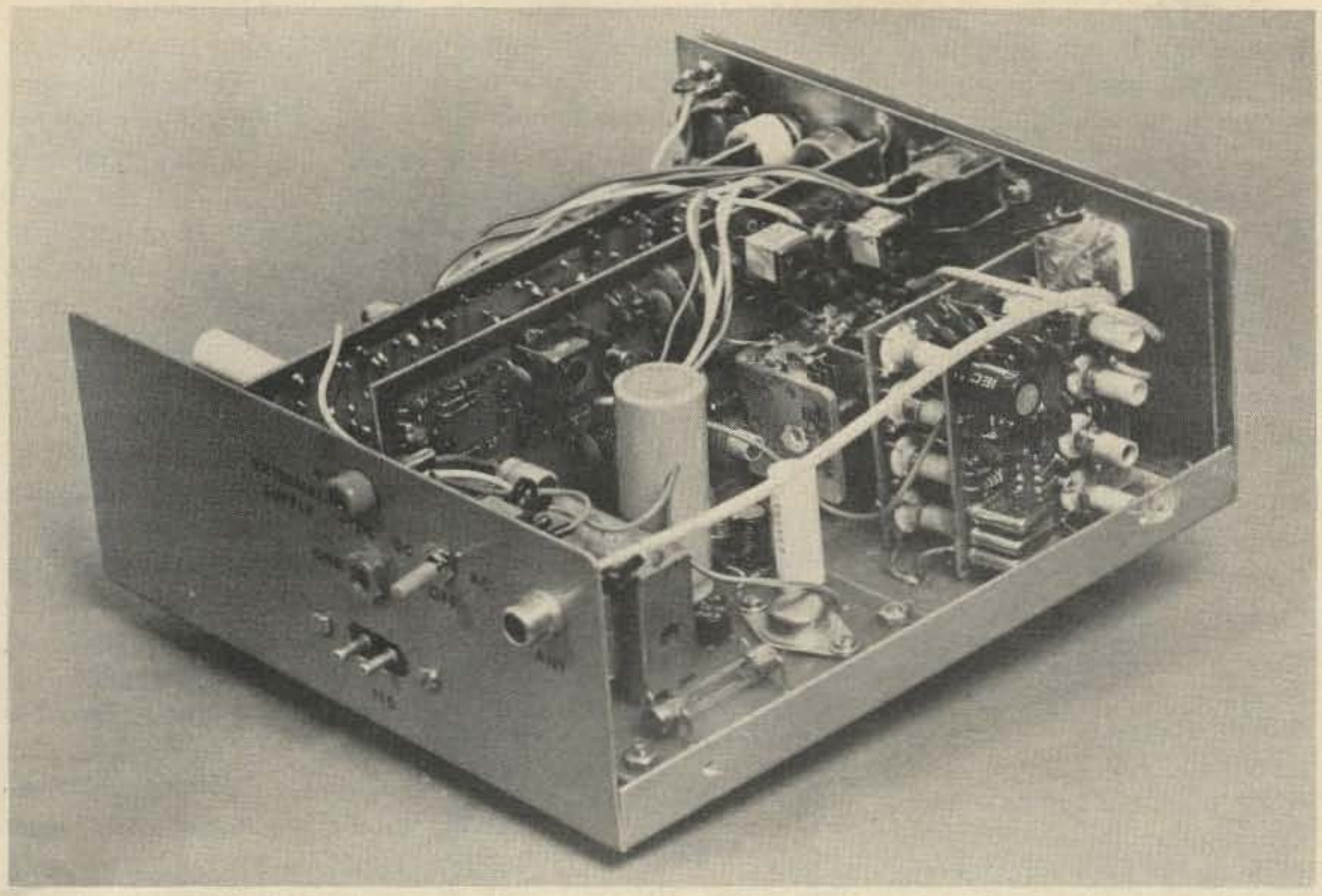
The S-meter amplifier is the final item included in this assembly. Control voltage for this stage is taken directly from the storage capacitor. Trimmer R1 controls meter sensitivity by setting the amount of AGC voltage applied to the meter amplifier. R2 is used to balance the circuit for zero deflection under no-signal conditions.

There are 3 other trimmers on this board intended for various purposes. R3 is the AGC threshold adjustment and sets the point at which AGC starts to affect gain relative to signal strength. R4 is used to set the static AGC level of 5 to 6 volts mentioned above. The last trimmer, R5, is a tracking adjustment for the 2 sections of the dual pot used to tune the audio filter.

The heart of the converter is the Stackpole Series 80 subminiature rotary switch. It is rectangular in shape and measures 13/16" x 9/16". Each section is a totally enclosed module and up to 10 of these decks may be combined in various configurations to make up the desired switching pattern. In the case of our converter, 5 sections of 1 pole, 5 positions are required. All the contacts emerge along one side of the module and are spaced on one-tenth inch centers along both axes. To conform with the design of the converter, 2 sections have their contacts brought out one side of the switch and 3 sections on the opposite side. The 2 PC boards are both 2" square and mount directly to the switch on opposite sides. One board had to be made 2-sided to accommodate all the circuitry, but a single-sided board was sufficient for the other. The double-sided board contains the rf amplifier with its 4 antenna coils and the 3 crystals for the oscillator. The second board houses the mixer with its 4 coils and the remainder of the local oscillator circuitry. Overall thickness is 1-5/8".

Fig. 3 is the schematic for the converter whose circuit consists of a cascode rf stage using a pair of JFETs followed by a dual gate mixer. A second JFET functions as crystal oscillator. The switching is arranged so that the antenna feeds right through on 80 meters.

A 25 MHz crystal is used for coverage of both 15 meters and the low end (28.5 to 29.0 MHz) of 10 meters, thus economizing on both cost and precious space. If coverage of some 500 kHz segment other than those used here is desired, suitable crystals and tank coils may be substituted. Also note that with this design 40, 20, and 15 meters tune backwards.



Internal layout showing vertical mounting of all assemblies except power supply in center foreground.

The 10 meter band will tune normally from low to high with CW rotation of the tuning capacitor since the crystal is on the low side. As built, the converter covers 7.0 to 7.5 MHz, 21.0 to 21.5 MHz, 14.0 to 14.5 MHz, and 28.5 to 29.0 MHz. The tunable i-f covers the 80 meter band from 3.5 to 4.0 MHz.

Power Supply

A simple basic regulator circuit is used in the power supply and requires no particular comment. It is entirely self-contained, including transformer, on a board 2.3" x 3.1". Output is 12 volts at 150 mA. A schematic for the power supply appears in Fig. 4.

That just about covers everything that's in the receiver, so now we can get on with the actual building. I hope you're a real honest-to-goodness do-it-yourselfer and will be making your own boards, too. That's half the fun and not nearly as difficult as so many readers seem to think, judging from the mail I get.

The only real problem area regarding fabrication of the printed circuits used in the MK IV is the double-sided board used in the converter. I generally cut out a cardboard frame for all my boards so that the board fits snugly in the cutout and can't move during handling. The film is cut slightly larger than the opening and once lined up is fastened with tape around the edge. To expose 2-sided boards, I line up the second film on the backside and fasten only one edge with tape. This film is then merely hinged and can be lifted to insert the 2-sided board. Each side is then exposed in turn and the board processed as usual.

Assembling PC-1

All the holes will have to be drilled before any components can be mounted, and it would be well to go ahead and drill all the boards at one time. I generally don't bother with anything smaller than a #65 drill, but you may if you wish a real snug fit on semiconductors or other components with fine leads. Most holes can be drilled with either a #60 or #65 drill. Use a #50 drill for the 2 mounting lugs on the 455 kHz i-f cans and a #30 drill for the 2 screws holding the 3-gang variable capacitor. The #30 drill can also be used for the 2 power transformer mounting lugs and the tuning slug access holes on the single-sided converter board. The power supply regulator transistor can be mounted with either #2 or #4 screws, so drill the 2 holes to suit. The 4 corner mounting holes on this board can be drilled for #4 screws. About the only other odd holes are those for the vertical trimmer resistors on PC-2 which require a #54 drill.

As with assembly of all the boards making up this project, a few basic rules to follow will make the job easier. In line with this, I generally mount the shallowest components first since the board is usually turned on its back during soldering and direct contact of the component with the top of the bench prevents it from falling out. This means all resistors and diodes go in first. The smallest discs, silver micas, semiconductors, and ICs would follow, with the larger discs, electrolytics and transformers going last. In most cases, you can tell what order to follow by laying out all the components in proper sequence by height. Try to keep heating of germanium diodes to a minimum since they are the most temperature sensitive parts you'll be installing. A small iron is essential, but not one with inadequate heating capacity. The rest of the DOs and DON'Ts I'll skip, since you've heard them all before and if you are tackling this project, you must be a big boy now.

The rf transformers and VFO tank coil will have to be wound before proceeding with the assembly operation. All the winding information is contained in Table 2. T1 and T2 are wound on stripped down 455 kHz transistor i-f transformers of the 3/8" square variety. Wire salvaged from the transformers is used to wind the new coils. If you read reference 2, you'll get a few tips on how to go about this operation.

Winding T3 is a little more of a problem if you don't have a coil winding machine. I use one of those that's been advertised in many of the mail order catalogs since the year 1 and sold under the name of MoReCo the last I looked. When I bought mine,

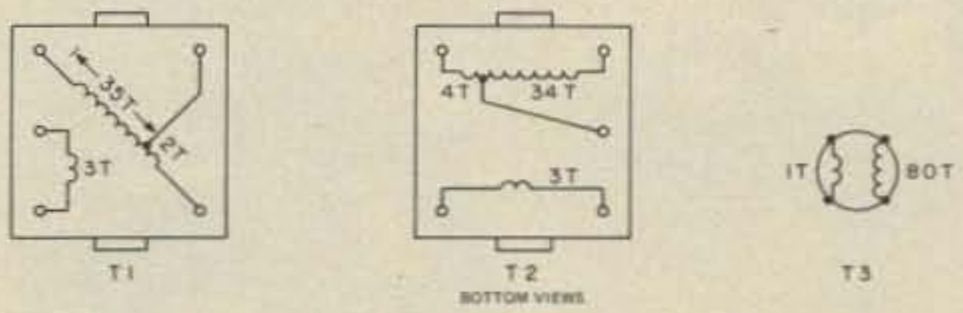


Table 2. T1 and T2 are wound on stripped 455 kHz transistor i-f transformers using salvaged wire. T3 is pie-wound with 7/44 litz wire on a Gowanda Series 7 coil form with Carbonyl E (red) core. The 1 turn link is wound over the top of the pie.

it was a Morris coil winder. A ¼" cam is used and the winding located as close to the bottom of the form as practical. Impregnate the winding with a generous dose of coil wax when done. Use standard 455 kHz i-f transformers for T4 and T5.

Don't forget that unlike other ICs in T0-5 cans, the MC1550G has pin 1 located adjacent to the tab and not pin 10. Also, before installing the SG3402T you'll have to cut off pin 6 since there is no hole for this lead in the board.

The 20 pF padding capacitors across the rf and mixer gangs of the tuning capacitor are mounted right on the capacitor before installation. One end of each padder is soldered to the frame and the other end to the stator connection on each of the first 2 gangs. Before mounting the variable capacitor, you should grind the shaft to desired length and also clip the 3 stator solder lugs to 1/8".

The drain resistor for the noise blanker pulse amplifier is selected during test and a 1k resistor should be temporarily installed. The 100 Ohm source resistor is mounted externally. See Fig. 9.

The SFD-455D filters have small circles molded into the top of the case at one end. Mount these parts with the circle towards the 20 pF coupling capacitor associated with each filter.

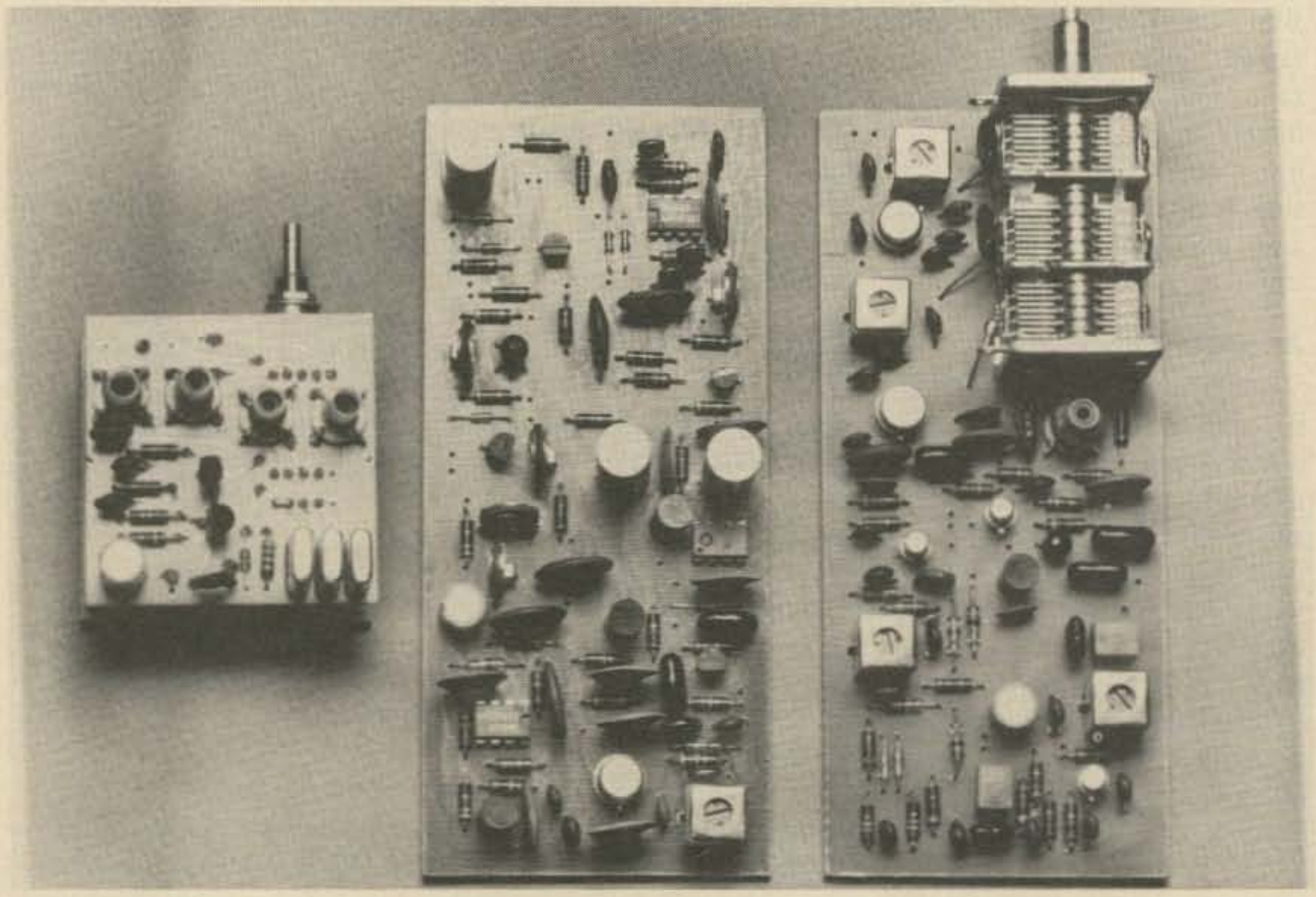
The 3-gang tuning capacitor will be the last item installed. Use #4-40 screws with internal tooth lock washers under the head and insert from the copper side of the board. Use 2 flat washers between the board and the frame of the variable capacitor at each screw in order to clear the rivets and prevent distortion of the board when the screws are tightened. Long pigtails cut from resistors during assembly can be used to connect each gang to its respective pad. These leads should be soldered to the capacitor stator lugs before mounting, since little room is left after mounting. The free end of each lead can be guided into the proper hole as the capacitor is mated with the board.

PC-1 and PC-2 both have several pads available for the +12 supply and are so marked right on the board. You will also find a number of empty holes around the copper border which are there for ground returns if needed. The remaining pads with empty holes amid the copper circuitry are for connections to external controls or to other boards and can be left alone for the present.

Assembling PC-2

Proceed with this board just as with PC-1. There are no coils to wind, but there is a modification to perform on the BFO transformer (T1) before it can be installed. Using a standard i-f transformer, remove the assembly from the can and break off the secondary leads right at the point where they enter the bobbin. A pair of fine tweezers is ideal for this operation. Unsolder the remaining wire from each of the pins and clean off any excess solder. Using a piece of salvaged wire from the rf transformers, wind a new secondary of 4 turns right over the existing windings and solder the ends to the secondary pins.

Clip pin 6 on the SG3402T as before and you are ready to start mounting parts. Assembly is quite straightforward and when the board is complete, set it aside with PC-1 until everything is ready for testing.



Top view of converter, PC-2 and PC-1 fully assembled.

Assembling the Converter

I've taken a lot of liberties with construction of the converter and you may not agree with some of the techniques employed, but it did allow me to squeeze 10 pounds into a 5 pound bag. If anyone comes up with any good ideas on improving this beast without increasing the size, I'd like to hear from you.

As I mentioned earlier, one of the 2 converter boards is 2-sided. One side contains all the circuitry while the other is a ground plane. All the components for this board are mounted on the wiring side, which becomes the top of the converter. This means that all leads will have to be soldered to their pads right at the point of entry except for those connecting to ground on the other side. You can tell which leads get grounded by whether or not the copper has been etched from around the hole on the backside.

There are 4 locations where it is impossible to solder the leads because the pads are covered by the component when it is inserted into the board. These 4 points include one end of each crystal and the positive terminal of the electrolytic filter capacitor. Since I don't have plating-through capability in my rather simple printed circuit facility, I solved this problem by inserting a tiny eyelet through the top of the board and soldering the head to the pad. The component lead is then soldered to the barrel of the eyelet on the other side.

The coils are wound as shown in Table 1. Make certain you get the right orientation when inserting the coil into the board. The crystals may be in either HC18/U or HC25/U holders to fit the layout. I personally prefer the latter since the pins seem to take solder better than the wire leads.

The bottom board is assembled in the normal manner, with components

mounted on the clear side. The ground plane for this board, as with all previous sections, is the copper border around the outside edge. Eventually all printed circuit grounds will be made common with each other and the metal cabinet.

When mounting the 3 subminiature trimmer capacitors used to tune the oscillator tank circuits, try and connect the rotor side to ground. If you look at the top of the trimmer, you'll see a tiny slit at one end where the lug comes up and connects to the stator plate. This end should go to the choke (tank coil) and the other end to ground. The chokes used for the tank coils are mounted vertically in hairpin fashion, with the bottom of each choke seated in the hole closest to the middle of the board. The top leads are bent a full 180° and inserted into the proper mating hole.

There are 5 jumpers and 1 component wired between the 2 boards when the sandwich is complete. The component is the 500 pF disc capacitor connected between the mixer drain and converter output. Cut one end to about ½" lead length and solder this end to its pad on the bottom (single-sided) board. Next you can mount the bandswitch to this board, being careful not to damage any of the pins. Once the 2 switch decks are fully seated, solder all the connections. Now mate the top board with the 3 remaining switch decks topside. Insert the free end of the 500 pF disc into its pad and clip off any excess lead after soldering. As soon as everything is seated properly and the 2 boards appear to be parallel, solder all switch connections.

The remaining jumpers are mostly straight through and here again you can use pigtail clippings. Use sleeving if you wish to insulate these leads, although it is not necessary. There are 2 jumpers joining the ground planes on each board, and you'll find these

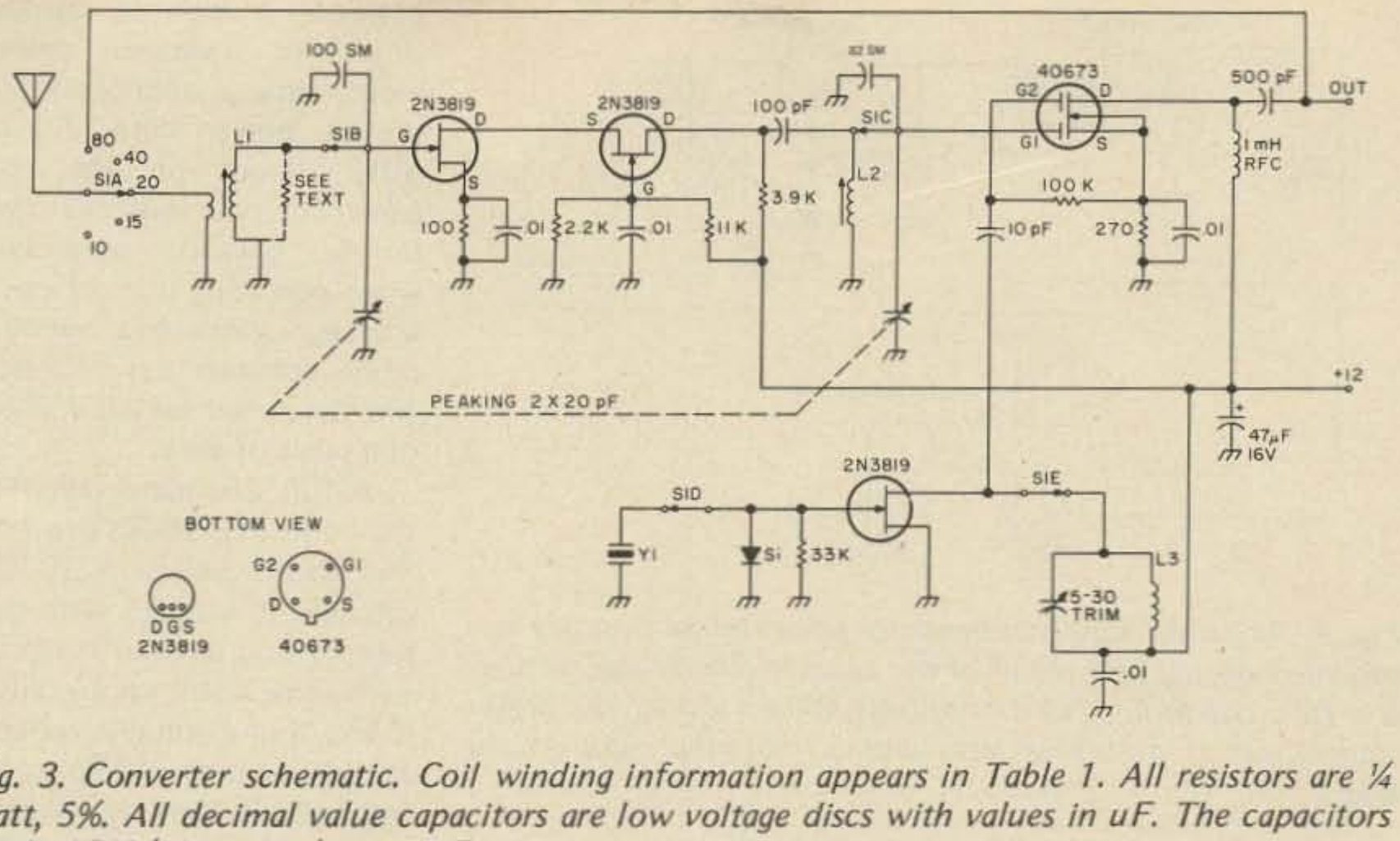


Fig. 3. Converter schematic. Coil winding information appears in Table 1. All resistors are ¼ Watt, 5%. All decimal value capacitors are low voltage discs with values in uF. The capacitors marked SM (silver mica) are in pF.

holes halfway up each side right at the edge of the board. The next 2 jumpers are at the rear of the assembly. One of these joins the 12 volt bus on each board. Use the innermost of the 2 12 volt pads on the top board and the pad between the 40 and 20 meter coils directly below. There is a slight offset to this pair of holes. The other pair joins the 100 pF coupling capacitor from the rf amplifier to the mixer gate. These 2 line up exactly and fall between the 20 and 15 meter coils below. The final jumper is up front and joins the gate of the crystal oscillator transistor with the switch deck that selects crystals. There is about ½" of offset between these 2 holes. On the top board, use the second hole from the right, and the hole directly in front of the oscillator transistor on the bottom board.

Putting it All Together

The receiver was assembled on a sub-base and sub-panel constructed of regular G10 printed circuit material. The panel and base were cut to fit snugly inside the cabinet and were joined by soldering to form an "L" shaped sub-chassis. The pots, switches, S-meter, and phone jack were all fastened directly to the sub-panel. All assemblies but the power supply were mounted vertically to the sub-base with PC-1 in the center. Short lengths of brass angle were soldered along the bottom edge of PC-1 and PC-2 and then drilled to take #4 screws which fastened the boards to the bottom of the cabinet. PC-1 was mounted with the tuning capacitor at the bottom and PC-2 with the BFO transformer up front and facing the outside. This puts these 2 assemblies back to back. From front to rear, PC-1 is positioned so that the end of the large outer shaft on the tuning capacitor is flush with the outside panel. PC-2 has to be positioned farther back in order to clear the front panel controls.

The converter is mounted by fastening the bandswitch to the sub-panel with the switch towards the bottom. A jumper is soldered from the ground plane on each board to the sub-base since there is no other means by which the converter gets grounded. A very small 2-gang variable capacitor from an FM transistor radio was found to fit between the converter boards and is used to peak the rf circuits.

The power supply was mounted parallel to the base behind the converter and is partly visible in the photo. Small standoffs are used in each corner to keep the printed wiring from shorting against the base.

The holes in the front panel were made just large enough for the 1/8" shafts to clear. Since very small knobs must be used to accommodate all the controls in the limited space, a large hole would be unsightly if the knob couldn't cover it. The knobs I used are only 5/16" in diameter and are not really knobs, but were made by someone unknown from unknown material whose origin is lost in antiquity. I had only 6 when I built the MK IV, so I had to keep the number of controls to that number. The remaining controls will take real knobs and you can select those that suit your fancy.

The 2 toggle switches in the bottom row were fastened to the sub-panel but allowed to extend all the way through the front panel where a second nut was used to hold everything together. The phone jack barrel was too short to take a nut so I epoxied a flat washer around the opening to dress it up.

The S-meter is one of those very common subminiature edgewise types with nothing but a 3-color scale and no calibration. Movement sensitivity is 500 uA. A small strip of tape and

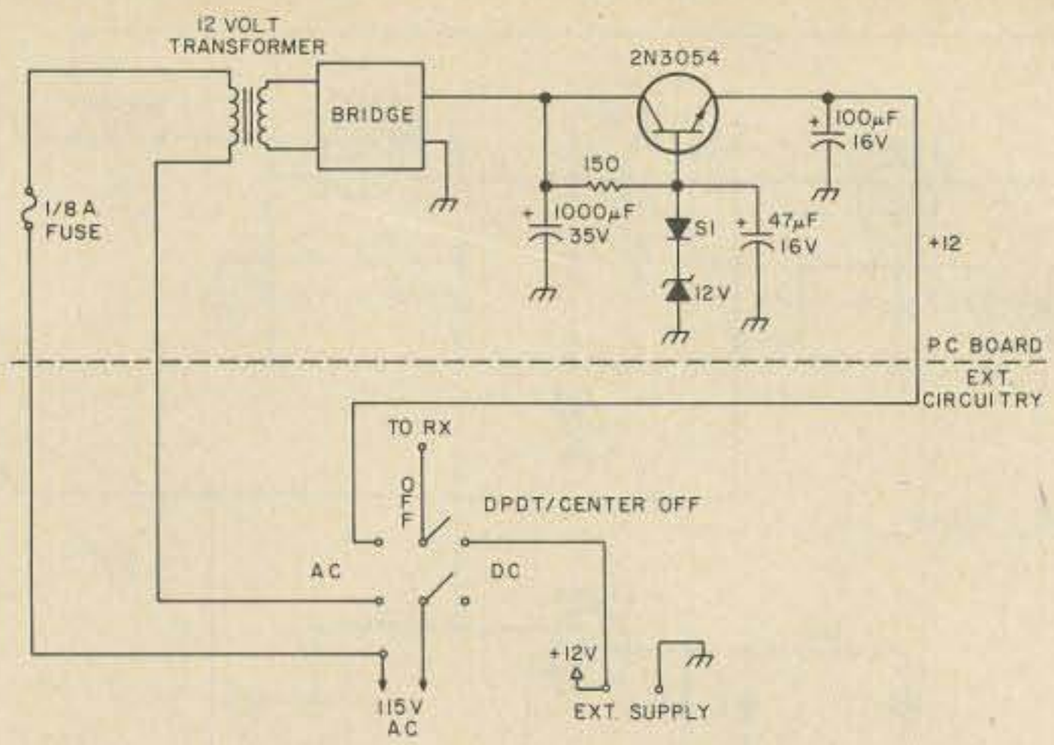


Fig. 4. Ac power supply schematic. The external circuitry was mounted on the rear panel of the cabinet. The bridge rectifier is a TO-5 size molded unit of at least 50 volt rating. The power transformer is a surplus item and is mounted right on the board.

some transfer lettering transformed it into a neat little S-meter. There was only enough room for 3, 5, 9, and a + sign to indicate signals over S9.

The remaining panel hardware consists of a phono jack for antenna input, a DPDT power switch with center-off position, a pair of banana jacks for external power input, and a connector for the ac power cord. All of these mount on the rear panel. If you wish to have reverse polarity protection when operating from external sources, connect a suitable diode between the +12 jack and the power switch in place of a piece of wire.

A full size panel layout is shown in Fig. 10 for use with the Radio Shack #270-254 cabinet. If you go with this setup you'll have to come up with some small knobs. Also, if you find a suitable variable capacitor for the peaking control, you'll have to make a shaft for it, as these little solid dielectric variables don't come with a shaft. This component is not vital, however, and can be left out. If it is, delete the title from the artwork.

The dial portion of the panel artwork has 2 blank scales. One of these can be calibrated to read from .5 to 1.0 in the clockwise direction and the other from 0 to .5 in the reverse direction. When using the 3.5 or 28.5 MHz bands, you will use the first scale, and when switched to 7.0, 14.0 or 21.0 MHz, you use the other scale. As you can see, I calibrated every 100 kHz, but some intermediate steps could be included. Only one set of calibration marks is needed since the scales are exact reciprocals.

Everything You Wanted To Know About Parts

At this point you may be thinking it's a nice project but not worth risking one's sanity trying to find all the parts. I must admit that you would have a lot of trouble obtaining some of the items, so I've been slowly amassing a shoe box full of spares to help out. If you write for a price list or anything else, please enclose an SASE or you won't get a reply.

Some parts can be substituted and the obvious ones we'll skip. The dual JFET S-meter amplifier is one possibility. I had an E421 on hand but some unmarked types in my junk box worked as well. I specified diodes as either germanium or silicon because I found no noticeable difference in performance with any particular type. Some very worthwhile bargains in first line diodes can be found in many ads in *73*, so take advantage of them. The 1N60 did work slightly better in the blanker gate so was the one diode I spelled out. The 1N60 is a germanium type if you wish to experiment. For the silicon units there are plenty of 1N914s and 1N4148s around at bargain prices.

There are only a couple of bipolar transistors in the entire receiver and these are not critical. Just don't try to use a PNP for an NPN. The

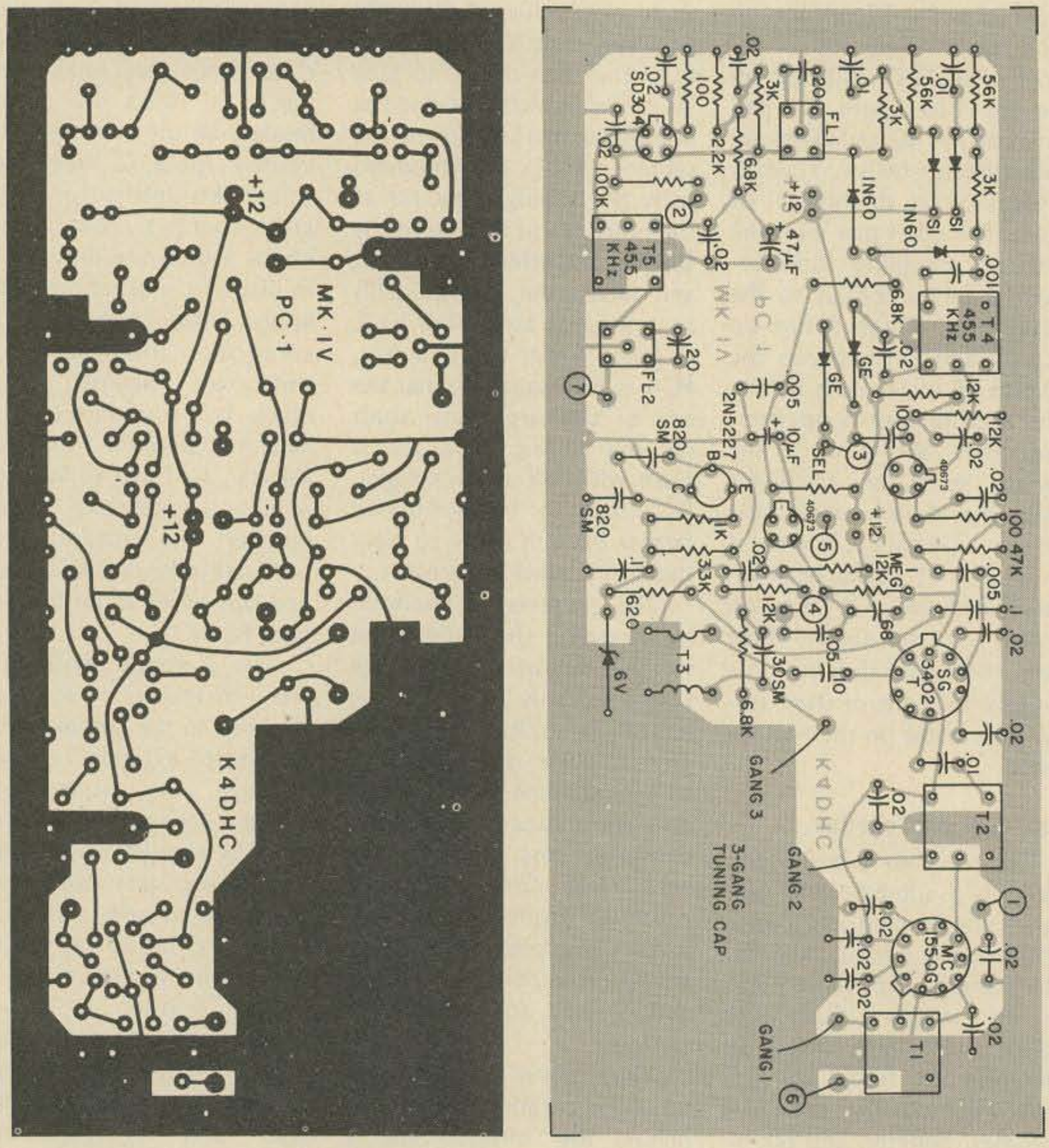
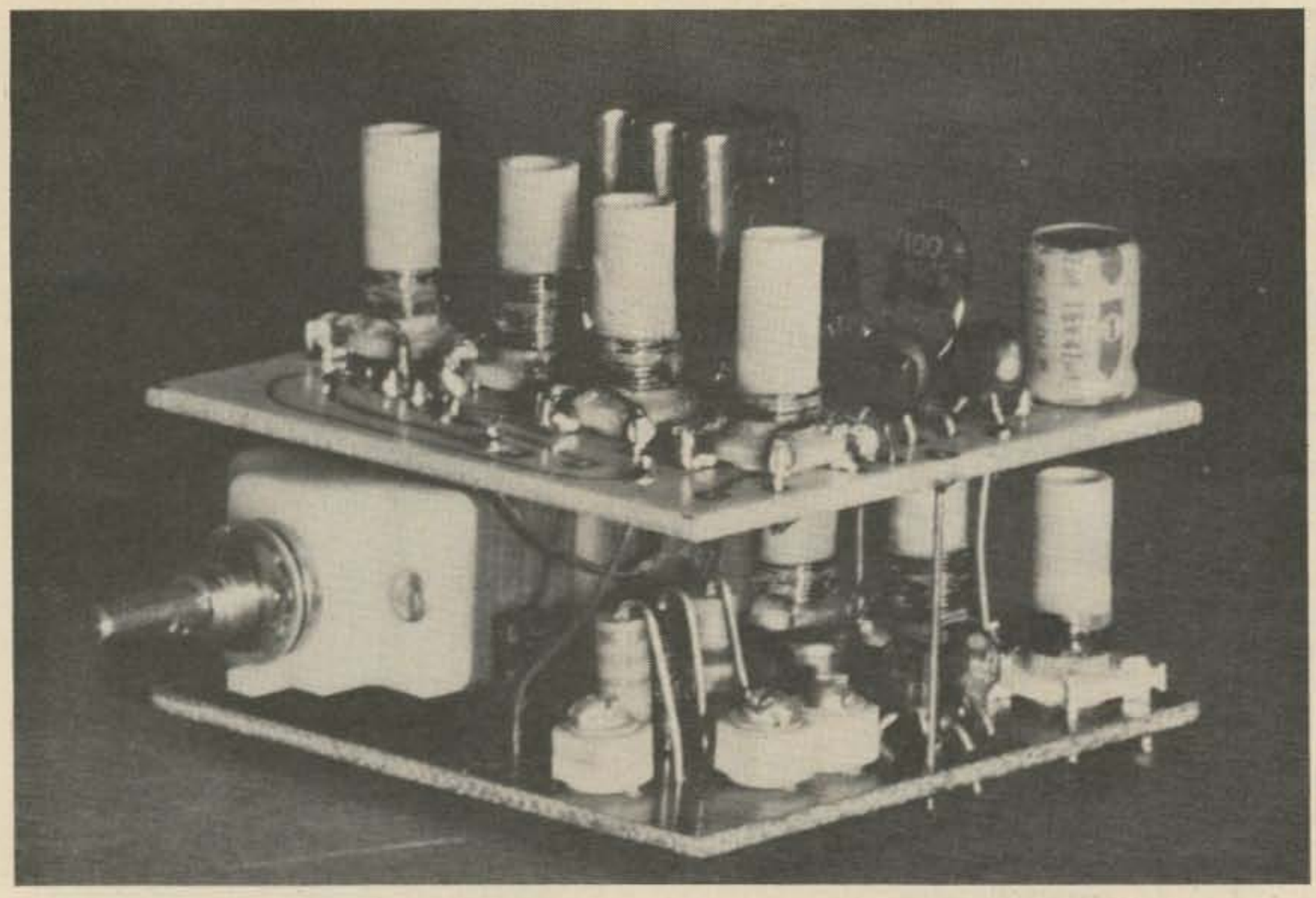


Fig. 5. Assembly PC-1 board and component layout.



This view of the converter shows additional details of the sandwich construction.

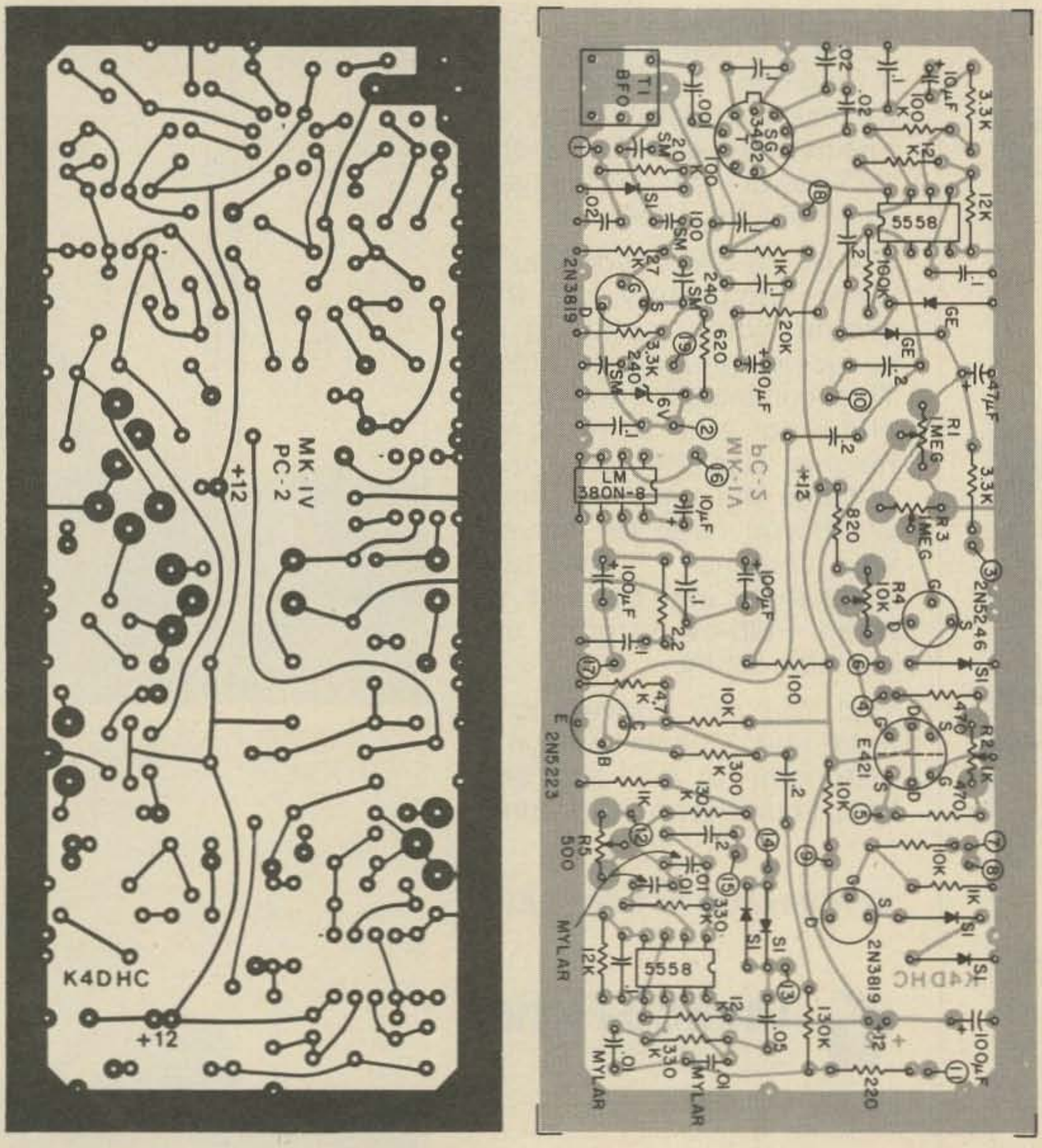


Fig. 6. Assembly PC-2 board and component layout.

40673 dual gate MOSFET has possibilities, such as the 40841, but don't try to substitute for the SD304 which is best left alone.

The tuning capacitor is the same one I've used for all the Minicom receivers except the MK III. It is equivalent to the old J. W. Miller #1460 but has a built-in 7:1 reduction. A pointer will have to be made for it from a piece of clear plastic. You can scratch a hairline in the plastic with a sharp instrument and fill it in with a red ballpoint pen. A nylon screw insulator with a ¼" hole makes a good hub for the pointer and will slip right over the outer shaft of the variable capacitor. If it's a little loose, a single layer of masking tape on the shaft will snug it up.

As I mentioned before, knobs are the big problem, and if any reader has a solution or the facilities to produce some 5/16" knobs for 1/8" shafts, please let me know.

The controls themselves will have to be the ½" or 5/8" diameter types to fit the space available. There are a lot of these around, so keep your eyes peeled when you read the ads. A dual 5k pot in this category is another story and it's not likely you'll find one. By the time this is published, I hope to have some of the little Clarostat ½" square Series 388 pots in a dual 5k version in my shoe box. There is one in the receiver pictured but it is not visible.

The 3 position toggle switch I used for the CW filter mode selector is an Alco MST 205PA. This switch makes some circuits in the center position, so don't try to use a regular DPDT with a center-off position.

Before concluding this section, I should point out that there is no reason why the receiver couldn't be made slightly larger and some of the problems thereby cured. The receiver as it stands is not the most convenient instrument to use from the human engineering standpoint. I cer-

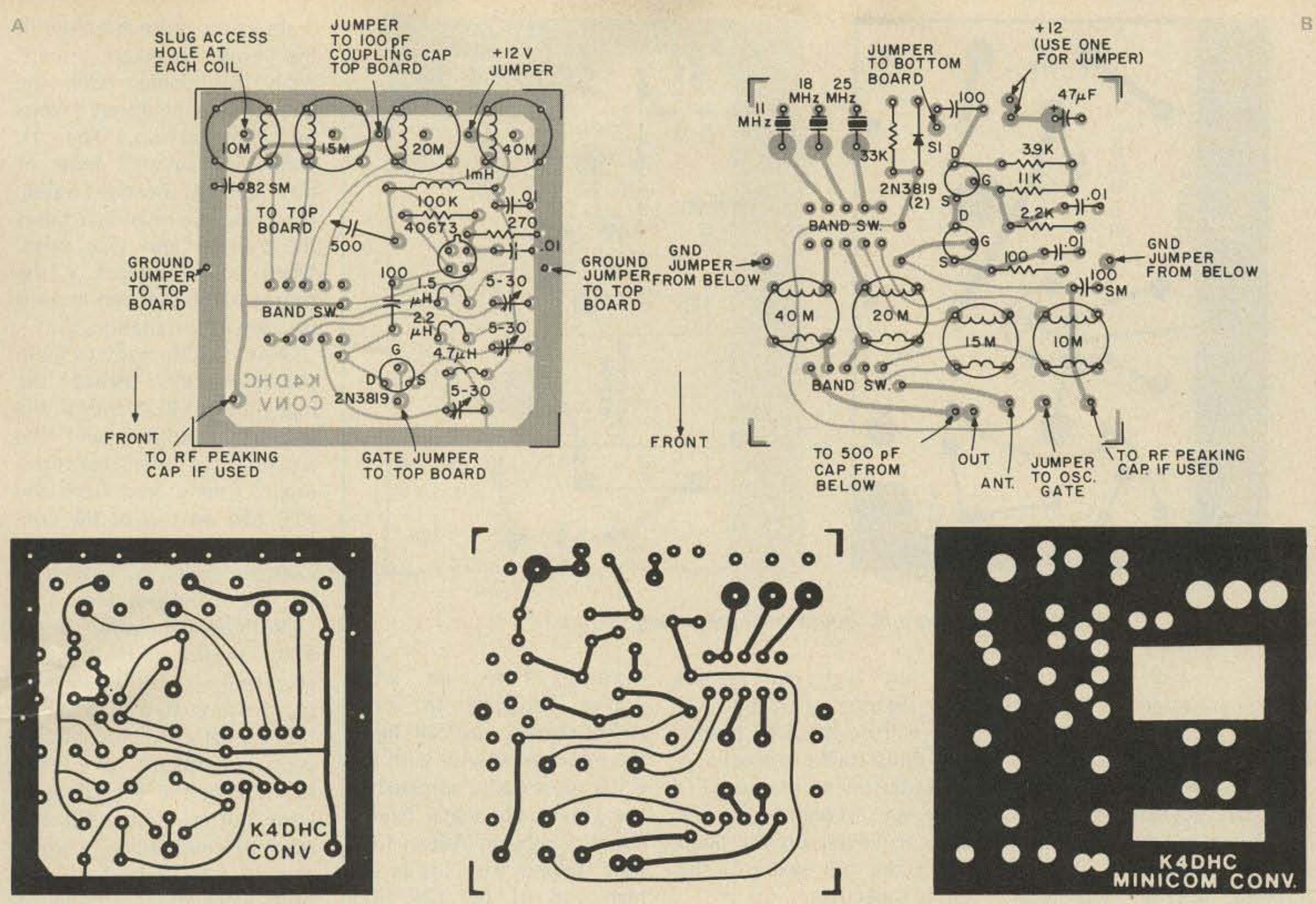


Fig. 7. Converter bottom board PC and component layout (a) and top board (b). Jumpers are explained in the text.

tainly wouldn't recommend it as a station receiver unless you had very small hands and very thin fingers. On a short term basis, however, such as business trips, vacations, or during an emergency, its many extra features would make it acceptable.

Getting It To Work

The best way to tackle initial alignment is to get the 80m section working first. This means that PC-1 and PC-2 will have to be wired up with their controls and interconnections. I've found that the easiest way is to just lay it out on the bench with nothing actually mounted. The leads going to the controls can be cut to about the right length for cabinet mounting and should require minimal trimming later. Besides the controls and switches, you'll need the following wiring:

1. A lead to pad #6 on PC-1 for the antenna or input.

2. A lead from pad #1 on PC-1 to pad #9 on PC-2.

3. A lead from pad #2 on PC-1 to pad #8 on PC-2.

4. A lead from pad #7 on PC-1 to pad #18 on PC-2.

5. A lead from +12 on PC-1 to +12 on PC-2.

6. A lead from +12 on PC-1 to the power supply.

7. A lead from pad #17 on PC-2 to the speaker. Later the lead will go to the phone jack.

Pad #4 on PC-2 is the positive connection for the S-meter if you wish to connect it up at this time. The initial settings prior to firing up are:

1. Set all trimmer resistors on PC-2 to mid position.
2. Set tuning capacitor to full mesh and turn the 2 compression trimmers up snug but not tight.
3. Switch blanker OFF, rf gain to maximum, CW filter OFF, detector to SSB/CW, BFO at mid position, and audio gain to suit.
4. Tie all grounds together with short clip leads.
5. Fire up.

If no smoke is seen, the first thing to do is get the BFO on frequency. If you slowly run the slug in the BFO transformer out towards the top, you should hear some noise when you hit 455 kHz. Adjust the slug for zero beat, which will be the dead zone between noise peaks as you pass through the i-f frequency. The BFO control should then vary the BFO frequency as indicated by noise buildup on either side of zero. The action won't be linear, but don't worry about it.

The next thing is to get the VFO running at about 3 MHz. I use a scope, but if you don't have one, use a counter, a general coverage receiver, or brute force. This latter means feeding a hefty signal in at 3.5 MHz and adjusting the slug in the VFO tank until a signal is heard. Once the VFO has been set by one of these means for the low end of the band, feed in a barely detectable signal at 3.5 MHz and peak T1 and T2 on PC-1. At this time you know the receiver is working and the AGC should be set.

Leave the rf gain at maximum and remove the signal generator. Turn R3 all the way towards ground. With a

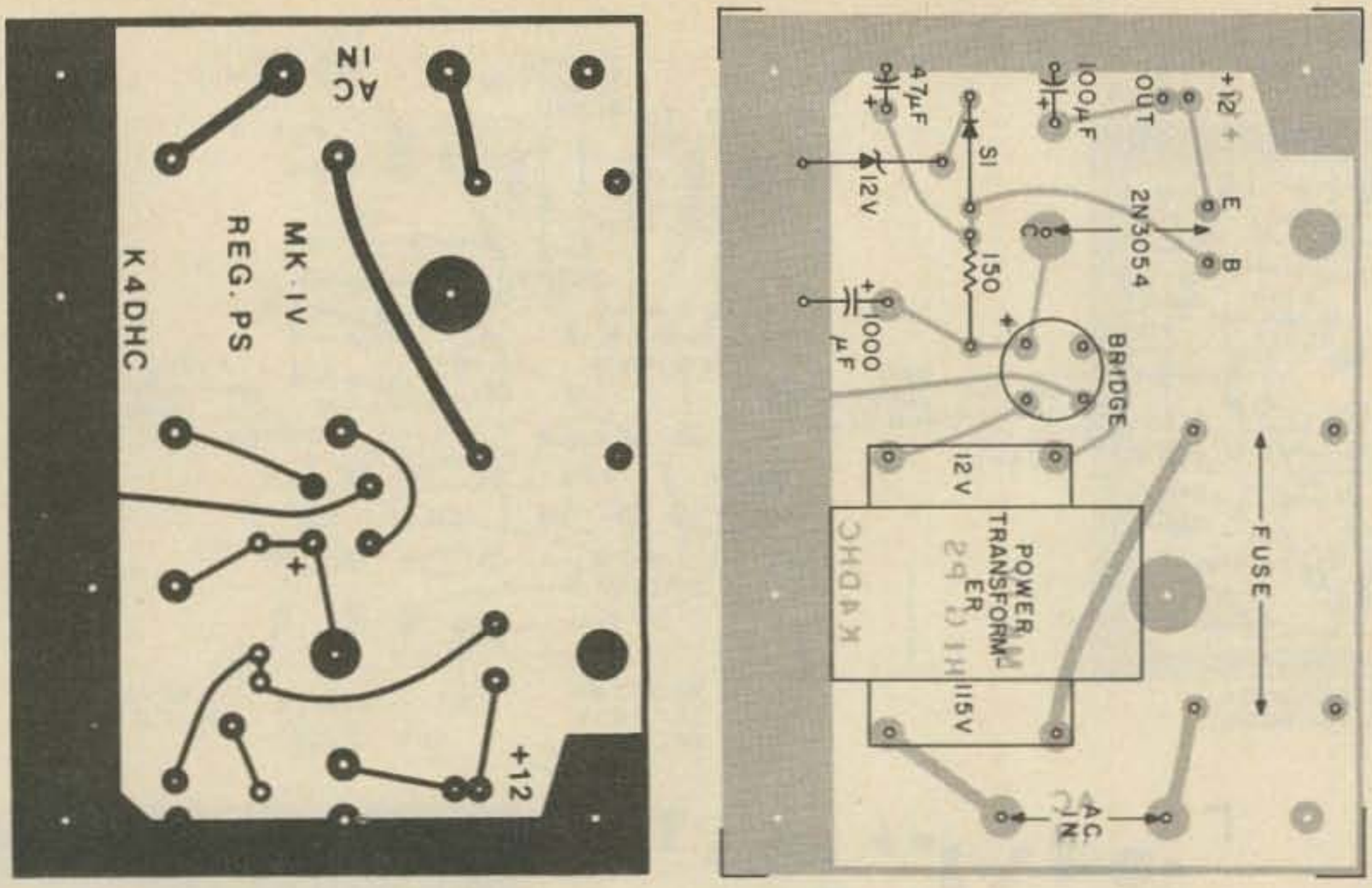


Fig. 8. Power supply PC board and component layout.

scope or high impedance meter connected to the top end of the rf gain control, adjust R4 till a reading of 5 volts dc or slightly less is indicated. Advance R3 about one third of its total travel and you should be in business. R3 sets the AGC threshold and can be advanced or retarded to suit your idea of how tight you'd like the action to be.

Now you can go back to aligning the front end. T1 and T2 should be peaked at the low end and the 2 compression trimmers used to peak the high end at 4.0 MHz. Several trips up and back will be required before everything tracks properly. A final adjustment of the VFO frequency should also be made to center up the band within the full swing of the tuning capacitor.

The 2 i-f transformers on PC-1 tune rather broadly, but you can run the cores through their travel once to get the best setting.

The remaining trimmers on PC-2 can be adjusted next. Turn the rf gain to minimum and set R2 for zero S-meter reading. Later on when you're listening to some strong signals, you can adjust the meter sensitivity with R1. R5 is most easily adjusted by using a steady signal from a signal generator. Adjust for a note falling just inside the high end of the CW filter tuning range and with the filter in circuit, peak the response with the dual tuning pot and then repeak with R5. Repeat a few times to make sure you're as close as possible.

The last thing to check out is the voltage level at the drain of the pulse amplifier in the noise blanker circuit. With the blanker ON, the level should be about 5 volts for best action. The 1k temporary resistor may or may not be the right value. Lowering the resistance raises the voltage and vice versa. When you've arrived at the proper value you can make a permanent installation.

Now you're ready to tie in the converter. Switch the input lead to PC-1 over to the converter output, and the antenna to the converter input. Run a lead from the +12 pad on top of the converter to a +12 pad on PC-1. Clip the converter ground to the rest of the grounds.

With the bandswitch in the 80m position, make sure everything is still working. If so, the next step is to get all the crystal oscillator circuits started. I usually use a scope to observe the crystal oscillator output, but a hit and miss technique will work, too. If a band is dead at a time when there should be signals present, turn the trimmer for that oscillator tank a bit at a time until you start hearing signals. For dead bands you'll have to rely on a signal generator. L1 and L2 for each band can be stagger-tuned for best overall response across a given band, or a small 2-gang variable can be used for continuous peaking. There is a pad on each converter board for connecting to the capacitor. Don't forget to ground the common rotor connection.

There is a possibility of oscillation occurring in the rf amplifier stage of the converter. The receiver shown in the photos had this problem on 40m and required the addition of a 12k resistor across the secondary of L1 on that band. The resistor was soldered directly to the pins on the base of the coil form. If similar problems come up in your receiver, apply the same remedy using the largest value of resistor that cures the trouble. Make no evaluation, however, until every-

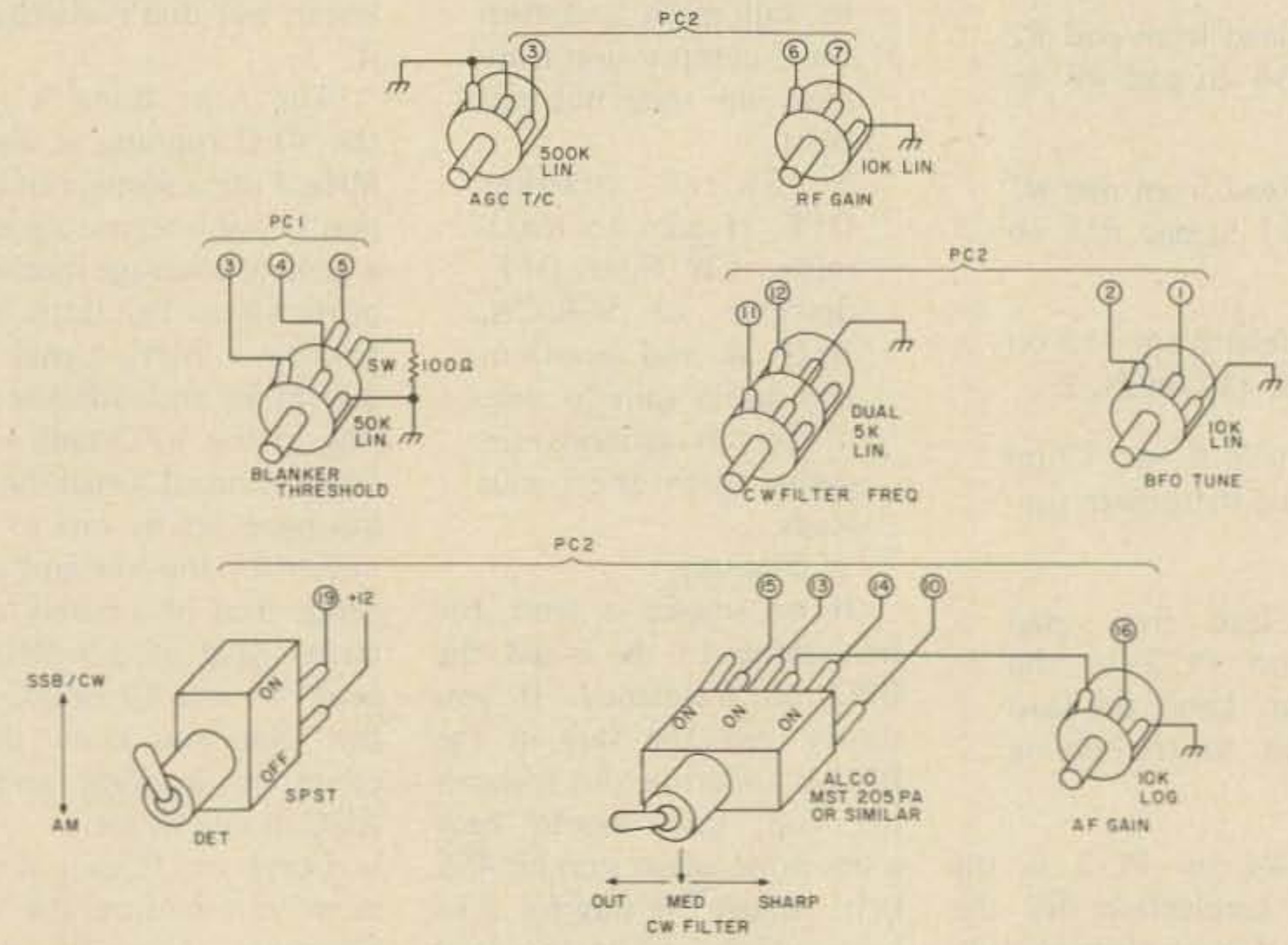


Fig. 9. Pictorial wiring diagram of front panel controls.

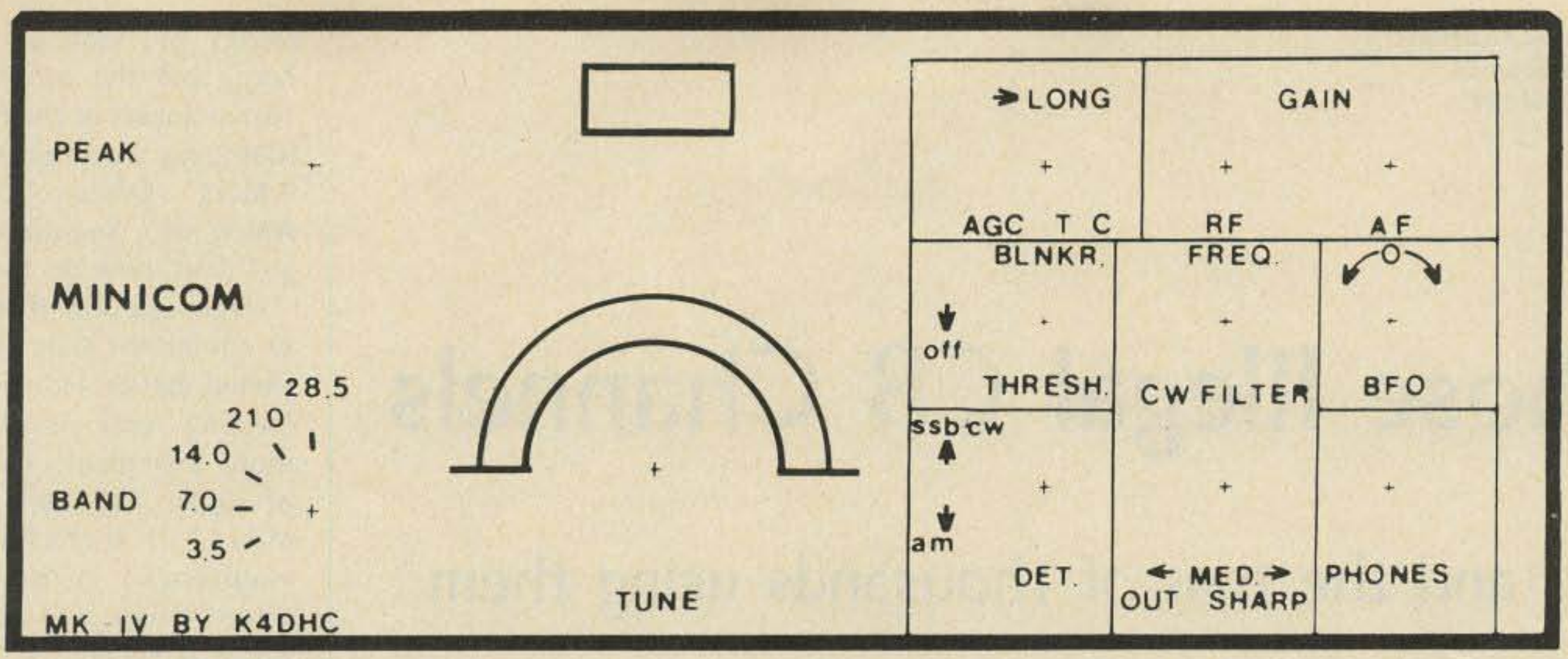


Fig. 10. Front panel layout for the Radio Shack cabinet.

thing is mounted and wired in its final form.

Conclusion

The MK IV was fun to build and operate. The biggest improvement to me was the CW filter. It really peaks up a signal buried in a pile of 2 or 3 others. Incidentally, the 4 mylar capacitors used in this circuit should be matched as closely as possible so that the 2 sections track fairly well.

The noise blanker has also proven to be a big blessing at times. On many occasions it has made unreadable signals perfect copy.

One final point before concluding might be worth mentioning. As I noted earlier, the BFO tuning is not linear due to diode characteristics, so you may want to shift the zero beat point down towards the low resistance end of the pot. The knob can be offset so that the pointer is straight up at zero beat.

Using a generator with crystal checkpoints or some other accurate signal source, mark the calibration points on the dial scale and fill in the numbers with transfer lettering. Voila! It is done. ■

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2. Ray Megirian K4DHC, "Miniaturized Communications Receiver," *Ham Radio*, September, 1974, page 24.
3. Ray Megirian K4DHC, "Solid State Communications Receivers," *Ham Radio*, April, 1976, page 18.
4. Charles B. Andes WB2VXR, "Threshold Detectors in a CW Audio Filter," *QST*, December, 1971, page 20.

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Those Illegal CB Channels

-- and the tens of thousands using them

Yes, believe it or not, there *are* some significant differences between the CB sidebanders and the AMers. Such as local on-the-air conduct. On CB AM it is common to hear something like: "Howaboutcha, Ratchet-jaw? We're a-lookin' fer that Ratchet-jaw, one more time!" The CB sidebanders usually talk in ham-type monologues. During round table (net) discussions, the monologing per person is shorter. But not always! Sound familiar? They talk about technical radio subjects, if not about their own rigs. Sound familiar? When the skip is in, a lot of them "let their hair down" and get a bit excited, and their conduct deteriorates, depending upon the individual. Sort of like our weekend contests!

Fancy handles such as "Jailbird," "Sneaky-Snake," and "Buckeye-Badboy" are not condoned. Any newcomers to sideband who bring fancy handles along with them are soon told about it, either politely — or in no uncertain terms! The sidebanders give their first names or nicknames, such as "John," "Mike," "Carol," and "Dave." There is also a tendency to refrain from excessive tens-code use. Personally, "10-4" and "Roger" sound no more weird than our use of "fine business."

Some of our "ham codes" are used the same way, some differently. They use QSO, QTH, and XYL, for example, verbally the same. However, QRX and QRT are used together: "We'll pass along our 73 to you fellows; we're going to QRX and QRT." Yes, the sidebanders usually "73" instead of "seventy-thirds" or "Threes to ya, Guy!"

The term "CQ" isn't generally used, except a little by a few during skip conditions. Those who use it, use it as we do or some use it in place of the term "break," to catch the attention of skip QSOs already in progress. The latter does sound weird from a ham's point of view. Try to imagine suddenly hearing "CQ-CQ-CQ" from a third party in between transmissions!

Illegalities

Yes, CQing in any matter on the Citizens Band is an FCC no-no. So is working skip. Not to mention general "ragchewing." That's just the beginning!

Ever hear of a Siltronix 1011? Well, for about 650 bucks, this transceiver (that bears a remarkable likeness to Swan's* rigs) will vfo you, not only on all legal 23 class D channels, but also in between, below and well above them! And it will do all this with 100 to 150 Watts output, depending on how hard the finals are blasted! Not bad, 'eh?

Do these rigs sound familiar: Kenwood TS-520, Heath HW-101, Tempo One, Drake's T4X and TR4, and Yaesu FT-101? All of these are very popular with the CB sidebanders. Often these rigs are featured as first prizes at CB gatherings, such as jamborees! These rigs are easily modified to cover eleven meters (the ones without 11 meter bandswitch position). The "10 A" crystal, or its equivalent, is replaced with one suitable to tune "all around" the CB channels.

Maybe we hams are missing out on something here. Do we need more elbow room on 20 phone? Is "75" getting a bit too crowded now, with the foreign broadcasters moving in? Forty meters? And, just think, we can all use that new proposed 10 MHz band *right now!!!* OK fellows — I was only kidding. Besides, it would only mess up our QSL system, because we would have to resort to phony callsigns (usually assigned by a regional club) and central P.O. boxes.

Many CB sidebanders start out with regulation FCC, DOC type accepted radios. However, the "urge-to-slide (vfo)" becomes irresistable. Perhaps the chief reason is to escape from the AM crowd. Channel 16 is the unofficial "sideband-only" slot, but things get kind of crowded here, and the other twenty-two channels in the metropolitan areas are smothered with AMers. Often "16" gets AMed also. So where do they go? And, how do they do it?

Well, one way is those ham or equivalent type rigs I mentioned earlier. However, using existing gear is sometimes more expedient. The owners of older Hy-Gain CB sets merely purchase the accessory, type-accepted, *receiving* vfo, and plug it into the vfo socket on the rear panel. Then, by snipping "that famous yellow wire" inside the vfo, a relay is disabled and your set can slide around from a little below channel one clear up to 27.430 MHz, on both receive and transmit! See Fig. 1. Many "friendly dealers" would kindly snip that wire for you. Other brands of CB sets that use a 38 MHz output synthesizer are easily adapted to the Hy-Gain vfo. I quote from part of Hy-Gain's vfo ad: ". . . and tune in ALL the action!"

Another way to "tune in all the action" is to install one of the other commercial vfos made by such companies as Siltronix (remember them?) and PAL. They have outputs comparable to one of the crystal oscillators in the synthesizer. All you have to do is pull out one of the crystals and run in the vfo line. The AMers do all of this vfo stuff also, but the sidebanders seem to do as much or more of it, percentagewise.

A popular method is to slightly modify one of the synthesizer oscillators by installing a slug-tuned coil, such as a Miller 4204 in series with the crystal switch and transistor base lead. Tuning the slug will easily get you 10 kHz lower in channel frequency. 27.145 is very popular on sideband. See Fig. 1.

Some Surprises

Would you believe that the vast majority of all those ham rigs I mentioned are *not* illegally used on our own bands?

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*I am *not* implying that Swan®, of Swan Electronics, Oceanside, California, is producing illegally-used, non type-accepted CB rigs, being marketed under a different name. *(Siltronix and Swan are both part of Cubic Corp. — Ed. note)*

Most of the CB operators have only an eleven meter beam. (Many of these are 60 to 100 feet high! Legal height for beam-type antennas is 20 feet, and 60 feet for omni-directional.)

Quite a few CB sidebanders: A) are considering, B) are studying, or C) have taken the amateur exams. This is almost nil with the AMers.

You may find this hard to believe, but it seems that those who become hams will operate legally in the amateur bands. I guess our own peer group won't put up with too much illegal operation.

It's interesting to note that many CB AMers who have listened to two meter FM liked it. However, many CB sidebanders didn't care for it because (quote), "It sounded a little like AM CB!" *Darn* little, I might add!

More Surprises

There are a lot of licensed amateur radio operators using CB sideband. Many use it as personal communications to "home base" and such, complete with FCC callsigns and legal rigs. A few find it fun to "join the crowd" – if you know what I mean! Hm-m-m. Did "2" or "75" get boring?

CB sideband has many regional and state-wide clubs. Their original intent was and for the most part still is (quote), "To keep (CB) sideband from becoming another mess like (CB) AM!" It's too bad that most of them didn't also try to uphold entirely legal operation in terms of using FCC callsigns, unmodified type-accepted radios, and limited ragchewing, because I believe that as unified groups they had the potential power to speed up the pending extra "sideband-only" channels legislation, etc. As it now stands, I think they would only get the cold-shoulder treatment, due to the illegal operations by their members.

. . . And More Opinions

From my own observations and very rough headcount, I will venture to say that less than one percent of the AM CBers use or have possession of illegal, high power gear. The CB sidebanders, however, I suspect are up to 40 percent with high power equipment, mostly from base stations.

While looking at the ham gear ads (by *dealers*, not the manufacturers) in the Citizens Band publications and club newsletters, and listening to all of those same rigs in use "all over" eleven meters, I get the distinct impression that we hams comprise only about 50 percent of total amateur radio type gear sales here in North America!

As it stands, I believe that there is absolutely no need for a code-free Communicator Class amateur radio license. Because it's already here on eleven meters – clear up to 28 MHz! In fact, it's here in two stages: 1) Basic Communicator, starting with AM CB, and essentially cheaper radios; 2) Advanced Communicator, or sideband CB, for those who get tired of infantile type of operations, and can afford the higher priced gear. As I stated earlier, it's mostly the sideband CBers who move up to an amateur radio license. ■

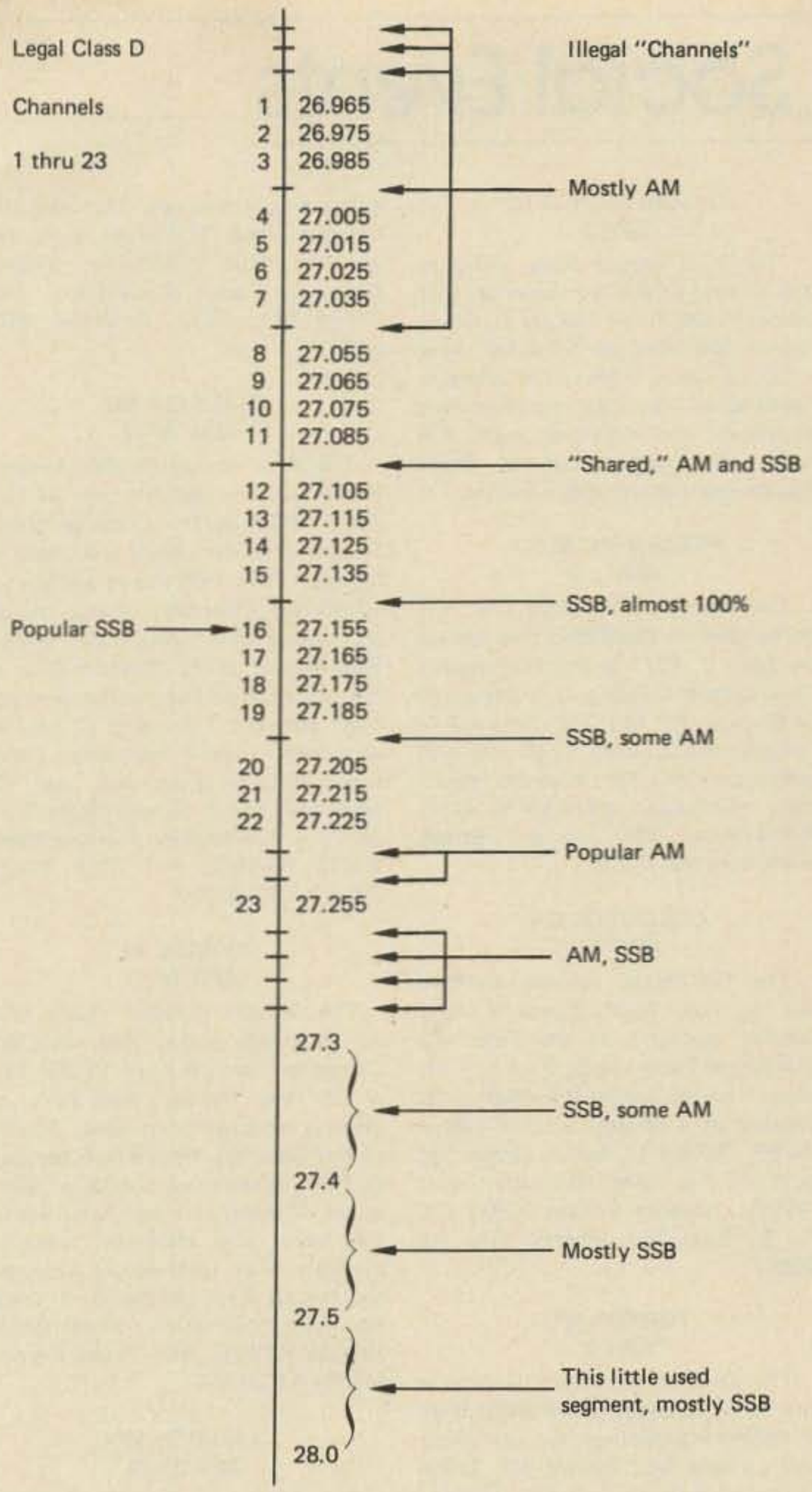


Fig. 1. Actual composite Citizens Band.

Leading Zero Suppression

W. R. Kappele W6AVL
3030 Oceanside Blvd. #7
Oceanside CA 92054

From the articles on counter construction I have seen, it appears that a feature of the 7446, 7447 and 7448 decoders has been overlooked.

These little gems, along with their uncanny ability to make numbers out of pulses, have the added capacity to automatically suppress leading zeros.

Pin 5 on one of these items, when grounded, suppresses the zero. Pin 4, normally high, becomes low when the zero is present and suppressed. Therefore, in order to suppress all leading zeros, one grounds pin 5 on the highest decade, connects pin 4 to pin 5 of the next decade and so on, leaving the last decade open.

Now, when a zero is presented to the highest decade, it is blanked. Pin 4 goes low, arming the second highest decade, whose pin 5 goes blank when a zero is presented there.

When any number but zero is presented on any decade, the zero suppression on all lower decades is automatically lifted. Since about the only thing we are allowed to suppress any more is zeros, let's get up to date and do it. ■

Social Events

GRAND RAPIDS MI
APR 2

The Third Annual Swap and Shop will be held at the Northeast Jr. High School, 1400 Fuller Ave., N.E., Grand Rapids, Michigan, on Saturday, April 2 from 9 am to 5 pm in the cafeteria. Featured will be: CBs, monitors, ham equipment and electronic parts. For further information contact Grand Rapids React at the above address.

FRAMINGHAM MA
APRIL 2

The Framingham Radio Club will be holding an Electronic Flea Market on April 2, 1977 at the Framingham Civic League building, 2 miles south of Rt. 9 on Rt. 126. The doors will be open from 8:30 until 12:30 with a $1 admission fee. For advance indoor table reservation send $5 to W. R. Armstrong, 386 Howard Street, Northboro MA 01532.

COLUMBUS GA
APR 2-3

The Columbus, Georgia Hamfest will be held April 2 and 3, Palm Sunday weekend, at the Fine Arts Building at Fairgrounds, 9 am to 4 pm daily. Flea market, ham auction, prize drawing at 1:30 pm Sunday, talk-in 28/88, 3975 kHz, buffet dinner Sat. at 8 pm. For more information write K4JNL. Advance tickets: K3MTY/4, Rt 5, Box 750, Phenix City AL 36867.

TOWSON MD
APR 3

The Greater Baltimore Hamboree will be held Sunday, April 3rd at 9 am at Calvert Hall College, Goucher Blvd. and La Salle Rd., Towson MD 21204 (1 mile south of Exit 28, Beltway-Interstate 695). Food service, prizes, giant flea market. Admission charge $2. 225 tables inside gym. Over 1700 attended last year. Information and table reservation: Contact Bro. Gerald Malseed W3WVC at school address or call 301-825-4266.

ST. CLAIR SHORES MI
APR 3

The South Eastern Michigan Amateur Radio Association is holding its Nineteenth Annual Hamfest on April 3, 1977 from 8 am EST to 3 pm EST. It will be held at the South Lake High School in St. Clair Shores, Michigan, 21900 Nine Mile Road and Mack Avenue. For further information contact Dorothy Spilski WB8PRJ, Secretary S.E.M.A.R.A., 11906 Riad Avenue, Detroit, Michigan 48224, 313-521-6646.

CANBERRA
AUSTRALIA
APR 8-11

The ACT Division of the WIA would like to announce that the Canberra Easter Convention will be held April 8-11 in Canberra, Australia. There will be plenty of time for sightseeing embassies, the lake, the Captain Cook Memorial Water Jet, etc. For more information contact: Canberra Easter Convention, Post Office Box E338, Canberra, ACT, 2600.

RALEIGH NC
APR 16-17

The fifth annual Raleigh Amateur Radio Society Hamfest will be held April 16-17 at the Crabtree Valley Shopping Center, lower level rear, on highway 70W. FCC exams will start at 12:30 pm, Saturday sharp, by appointment only through the Norfolk FCC district office. There will be an eyeball social and doorprizes Saturday night between 7 pm and 12 pm. An expanded covered fleamarket, meetings, ladies program, and over 100 prize awards on Sunday from 9 am to 3 pm. For additional info contact: RARS Hamfest, P.O. Box 17124, Raleigh, NC 27609.

MOBILE AL
APR 16-17

The Mobile Amateur Radio Club will hold its annual Ham Fest and Computer Fest on April 16 and 17th — all the newest equipment on display, computers too. Swap & Shop all day Saturday from 9 to 5, banquet at 7 pm, doors open Sunday at 9 am, prizes, drawing at 1 pm. Activities for the ladies and children, campsites available, over 1500 people expected, the biggest Fest on the Gulf Coast. For more information contact Marvin Uphaus K4BVG, 512 Tuttle Avenue, Mobile AL 36604.

LIBERTY MO
APR 23-24

The P.H.D. Amateur Radio Assn., Inc., of Liberty MO (Kansas City area) will sponsor the Eighth Annual Northwest Missouri Hamfest on Saturday and Sunday, April 23 and 24, 1977 at the Kansas City Trade Mart, Exhibit Hall 2 (Municipal Airport terminal building). There will be a complete program of forums both days, a large number of commercial exhibits, swap tables, YL-XYL program. Doors open from noon to 6 pm on Saturday, April 23; and from 9 am to 5 pm on Sunday, April 24. Setup time for commercial and swappers will be from 10 am to noon on Saturday. There will be a Saturday night banquet at the world famous Gold Buffet, with ARRL president Harry Dannals W2HD, as guest speaker. Pre-registration is $2, admission at the door will be $2.50. Pre-registration including banquet is $8. Talk-in on 146.34/.94 and 3.925 MHz. For information and pre-registration write to: PHD Amateur Radio Assn., PO Box 11, Liberty MO 64068.

GREENVILLE SC
APRIL 24

The Blue Ridge Radio Society of Greenville SC announces its annual hamfest for 1977. The event will take place April 24th at the Thunderbird Motel on Highway 291 in Greenville. A flea market and dealer's display area will be featured at the motel. Doors open at 8 am.

SULLIVAN IL
APR 24

The Moultrie Amateur Radio Klub will have its 16th Annual Hamfest Sunday, April 24th at Wyman Park, Sullivan, Illinois. Heated indoor area and large outdoor parking area. No charge to vendors. For information write: MARK Radio Klub, PO Box 327, Mattoon IL 61938. Talk-in 146.94.

AMBOY IL
APR 24

The Rock River Radio Club Hamfest will be held April 24, 1977 at Amboy, Illinois (Lee County), at the 4H Center, Routes 30 and 52. Same place as last year. Tickets $1.00 advance. $2.00 at gate. Camper parking available at a nominal fee. Write: Carl Karlson W9ECF, Nachusa IL 61057. Indoor and outdoor facilities.

LAS CRUCES NM
APR 24

The Mesilla Valley Radio Club sponsors Whitey's Bean Feed and Swap-Fest Sunday, April 24th, at 10 am. Located near Las Cruces, New Mexico at La Mesa with talk-ins on 16-76, 04-64 and 3940 kHz. Fun for all the family with big prizes, plenty of food and the usual beverage truck. All included for $5.00 for adults, $1.75 for kids. Eat, drink and win a prize with Whitey K5ECQ as host. Free overnight parking at grounds so come for a spell. All correspondence should be made to: Thomas B. Rapkock Jr., 640 W. Las Cruces Avenue, Las Cruces NM 88001.

DAYTON OH
APR 29

The 8th Annual FM B*A*S*H will be held on the Friday night of Dayton Hamvention, April 29, 1977, at the Dayton Biltmore Towers (hotel), Main at First Streets, from 8 pm til midnight. Admission is free to all hams and their friends. Sandwiches, beverages, snacks and C.O.D. bar will be available. A live floor show will be presented by TV personality Rob Reider WA8GFF and his group. It will be followed at 11 pm by a fabulous prize drawing featuring an Icom IC-245 and many others. See you where the action is!

BROWNFIELD TX
MAY 1

The Brownfield Amateur Radio Club will hold a Swapfest on Sunday, May 1, 1977, in Brownfield, Texas.

WEST TRENTON NJ
MAY 1

The annual Delaware Valley Radio Association (W2ZQ/WR2ADE) flea market and auction will be held on Sunday, May 1, 1977, 9 am rain or shine at the Villa Victoria Academy in West Trenton, New Jersey (the school is located adjacent to Rt. 29 near the junction of Rt. 29 and I-95). Talk-in on 07/67 and 146.52. Refreshments are available. Advance registration $1.00; $1.50 at gate. For additional information or tickets write: DVRA, PO Box 7024, West Trenton NJ 08628, SASE please.

FRESNO CA
MAY 6-8

The Annual Fresno Amateur Radio Club Hamfest will be held this year at the Airport Holiday Inn on May 6 and 8, 1977. For more information write Fresno Amateur Radio Club, Inc., 4788 N. Safford, Fresno CA 93704.

MEADVILLE PA
MAY 7

The Third Annual Northwestern Pennsylvania Hamfest will be held May 7 at Crawford County Fairgrounds, Meadville PA. Free admission. Flea market begins at 10 am. $2 to display — hourly door prizes — refreshments — commercial displays welcome. Indoors if rain. Talk-in 146.04/64 and 146.52. Details C.A.R.S., PO Box 653, Meadville PA 16335.

SUPERIOR WI
MAY 7

The Twin Ports Two Meter Club will hold its Second Annual Swapfest on Saturday, May 7, 1977, in the hall of the Duluth First Methodist Church from 11 am to 3 pm. Pre-registration and door prizes will be awarded. Admission is $1.00 in advance and $1.25 at the door. Selling space is $1.50 additional — $1.00 with your own table. Food available on the premises. Plenty of parking. Talk-in on 34/94. For flyers and/or tickets, contact Twin Ports Two Meter Club, c/o Libby Welsh WB9MLN, 525 Homecroft Court, Superior, Wisconsin 54880.

BINGHAMTON NY
MAY 7

The 18th Annual STARC Hamfest will be held Saturday, May 7, 1977 at Binghamton, New York. Take exit 71N from NY-17, go 3.8 miles north on Stella-Ireland Road. Flea market, tech talks, hourly door prizes. General admission $2.00/person. Banquet by pre-reservation at $6.00/person. Indoor exhibit space by pre-registration at $5.00 per table. Outdoor exhibit flea market space free. Talk-in 146.22/82 and 94/94. For details and reservations, contact STARC, PO Box 11, Endicott NY 13760.

HERNDON VA
MAY 7

The Potomac Area VHF Society will hold its sixth annual hamfest on Saturday, May 7, 1977, from 8 am to 5 pm at Frying Pan Park on West Ox Road in Herndon, Virginia, which is approximately 15 miles west of Washington DC. Registration of $3 includes flea market or tail gate sales. Professional food and beverage catering and unlimited parking will be available. Talk-in on 146.52 and 31-91. repeater. This is the hamfest formerly held in Westminster MD, but moved to Virginia because of the recently en-

acted Maryland traders law. For further information contact K3DUA or WA3NZL.

BIRMINGHAM AL
MAY 7-8

The Birminghamfest Amateur Radio Convention will be held May 7 and 8, 1977 at the Alabama State Fairgrounds, Birmingham and Rodeway Inn, Oxmoor at I-65 and Oxmoor Road. One of the country's largest flea markets, technical and operating forums, huge prize drawing, manufacturers' and distributors' displays, ladies' and children's activities. Booth display area will be offered free of charge to bona fide distributors, manufacturers, publishers, etc., on a first-come, first-served basis. Others may rent space in inside or outside flea market areas at a small charge. No admission charge. Prize ticket donations — $1. Talk-in 34/94, 3965 kHz. For booth display space, information, and reservations, write: Birminghamfest, PO Box 603, Birmingham AL 35201.

WARMINSTER PA
MAY 15

The Warminster Amateur Radio Club's "HAMMART," Flea Market and Auction will be held Sunday, May 15 from 9 to 4 at William Tennent Intermediate High School, Street Road (Route 132), 2 miles East of York Road (Route 263), Warminster, Bucks County, Pa. Registration $1, tailgating $2 additional. Talk-in on 147.69-09; 146.16-76 and 146.52. For further information write to Horace Carter K3ZAC, 38 Hickory Lane, Doylestown PA 18901.

SANTA BARBARA CA
MAY 13-15

The 22nd annual West Coast VHF Conference will be held on May 13-15, 1977 at the Miramar Hotel on the beach in Santa Barbara CA. The event opens with registration at 6 pm Friday (May 13), followed by a full day of technical presentations starting at 9 am, Saturday. Pre-registration fee is $2 until April 30. After that and at the door, $3. Registration forms, hotel information, and further details may be secured by writing Dr. Overbeck at the Communication Division, Pepperdine University, Malibu CA 90265.

VANCOUVER WA
MAY 21-22

The Fort Vancouver Hamfair will be held Saturday and Sunday, May 21 and 22 at the Clark County Fairgrounds, 7 miles north of Vancouver on I-5. Sponsored by W7AIA, Clark County Amateur Radio Club, in cooperation with W7KYC, Portland Amateur Radio Club. Camping, contests, swap & shop, prizes, displays, and many other activities. Registration donation $3. Send registrations to Dorman Stafford W7ZDR, Registration Chairman, Fort Vancouver Hamfair, 3509 E 21st St., Vancouver WA 98661. Make checks payable to Fort Vancouver Hamfair. Talk-in on 2 and 75 meters.

An FM Gadget

-- timer for the long-winded -- plus!

Bruce Fette WA7NMO
2310 W. Del Campo
Mesa AZ 85202

A field strength meter is a universal instrument in any ham radio shack. It tells you when your final transistor goes soft due to high swr, when your push-to-talk switch goes bad or the connector gets flaky, and the most insidious of all, when the swr shuts you off. But how many hams use their field strength meters?

This design promises to be a more useful ham shack toy than most. In addition to being an FSM, it is a timer to let you know when you have talked too much. This function is particularly useful to several Phoenix hams.

The front panel indicates relative field strength with a sensitivity adjustment, has a switch for time out ranging from .5 to 5 minutes, and displays an on-the-air light. At the end of the selected time-out interval (cleverly chosen to be equal to your neighborhood repeater), an internal loudspeaker signals a tone indicating "time out." So let up on the mike.

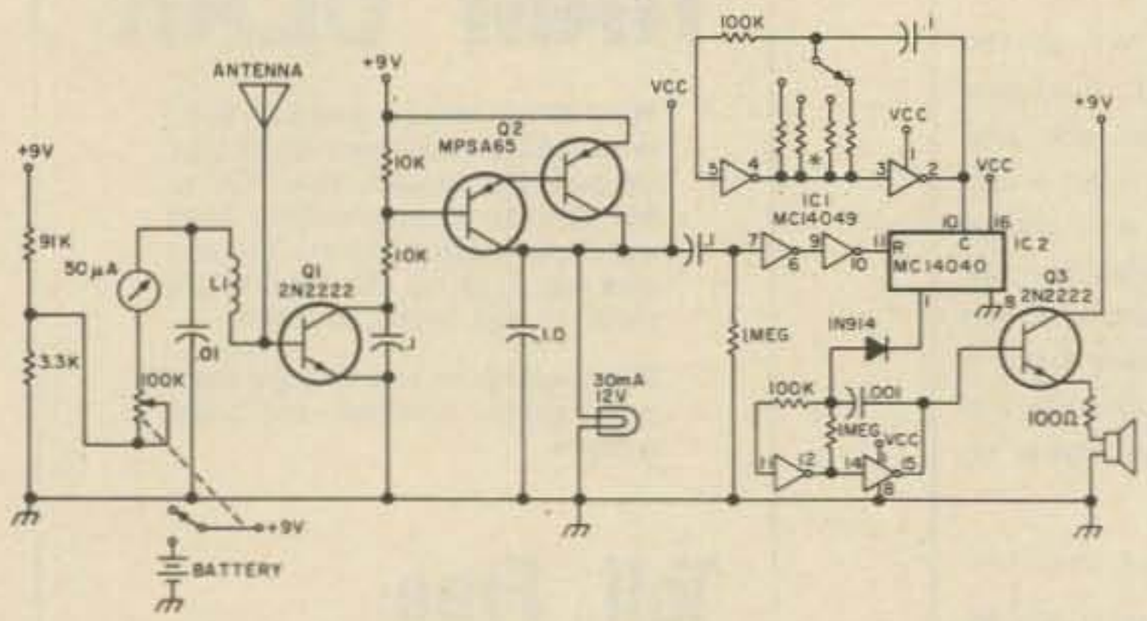


*Fig. 1. L1 = 3 turns #20 on 5/16" form. *Timing resistors:*

R	*Time-Min*	*Freq. Osc. Hz*
47k	*.5*	*82*
100k	*1.0*	*37*
220k	*2.0*	*18.6*
390k	*3.0*	*12*
510k	*5.0*	*7.3*

Circuit Operation

The antenna drives the base of Q1, which rectifies the signal and provides meter current. The sensitivity is adjusted by the 100k pot. The presence of base current turns on Q1, discharging the .1 uF capacitor in its collector and providing base current for Q2. The .1 uF capacitor could be as large as 100 uF, forcing you to let up on the mike button for one second before it would reset the timer.

When Q2 turns on, it provides current to the "on-the-air" lamp, a lamp carefully selected to draw 30 mA at 9 V so that it doesn't drain the battery. It also provides current to the CMOS integrated circuitry to begin timing the transmission. The timer consists of a hex inverter (MC14049) and a 12 bit ripple counter (MC14040). The combined current drain of these circuits is 1 mA consumed in the timebase oscillator. When Q2 turns on, an 8 V jump in voltage is coupled through the .1 uF capacitor to pin 7 of IC1, but slowly discharges to ground in .1 sec through the 1M resistor. The two inverters (7-6, 9-10 of IC1) square this pulse to reset all stages of the IC2 counter. An oscillator consisting of two inverters (5-4, 3-2 of IC1) runs at the frequency shown in Table 1. IC2 counts the cycles of this oscillator. On the 2049th count, Q12 of this counter will go high, and no longer will disable the audio oscillator (500 Hz, 11-12, 14-15 of IC1).

When this oscillator runs, a square wave is produced at pin 15 of IC1 which is buffered by Q3 to drive the loudspeaker. A resistor is used to limit the current to the loudspeaker, but lower values (or a transformer) would be required for adequate audio in mobile operation.

This unit was built into a Radio Shack minibox (1-5/8" x 2-5/8" x 5-1/8"), but that is a tight fit. The majority of the circuitry was built on one PC card. All ¼ Watt resistors and chip capacitors were used to keep down the size, as well as the smallest loudspeaker I could find. A 9 V alkaline battery is used for long life. The ICs should be kept wrapped in aluminum foil until ready to be soldered in (after all other parts have been soldered in). Pin 6 of IC2 must be cut off the IC, or bent away from the hole before it is inserted and soldered in. Solder pin 8 of the ICs first, thus grounding the static protection devices inside. Grid dip the tuned circuit to put it on the appropriate band or use values shown for 2m. The capacitor in this tuned circuit should be retweaked for maximum sensitivity with an on-the-air signal. On 2 meters the base emitter capacitance of Q1 is almost enough to tune L; however, adjustment of the antenna from ¼λ will optimize the sensitivity. ■

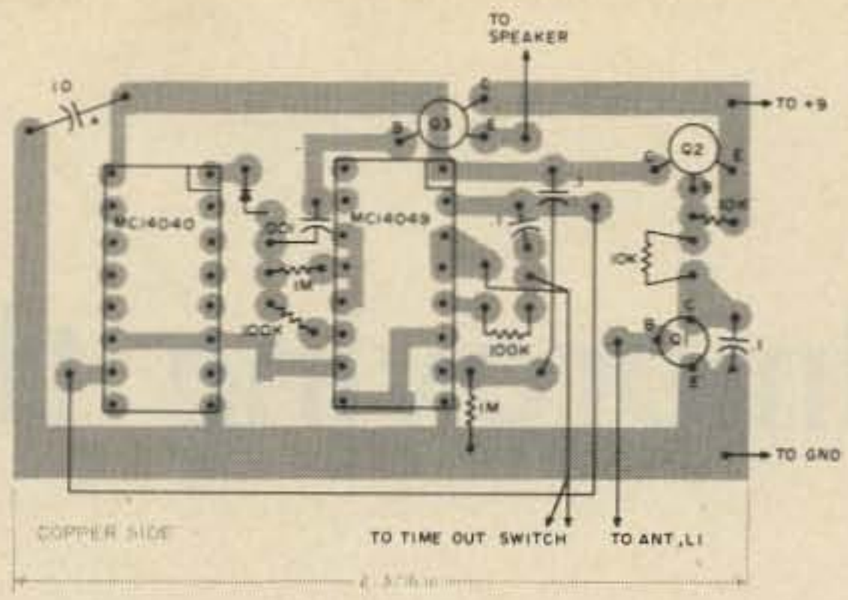


Fig. 2. PC board.

H. A. Ray WB5IAM
1406 San Rafael
Dallas TX 75218

The Real Truth About SWR

- - if the transmitter loads okay, forget it

Everyone writing on swr states some truths but invariably adds more mystery and confusion to the subject in the process. There is no question about whether energy or power flows in both directions on a transmission line. The existence of standing waves on the line is a summation of the forward and reverse waves and can be predicted with mathematical accuracy.

The confusion is in what the swr meter is saying to us. It is saying that "potential" energy is passing the meter in both directions and *if* this line were terminated at both ends in its characteristic impedance, that energy would be dissipated at a certain rate (which is called power). Note the *if*.

Let us take a few examples. If we have an infinitely long line with no loss and we turn a transmitter on for one second, a block of energy 186,000 miles long would propagate down the line and keep going long after the transmitter was shut off. The forward swr meter would read the transmitter power for one second as the block passes it. The meter simply says that *if* the far end of this line is terminated in its characteristic resistance, there would be the transmitter power in Watts dissipated in this resistor for one second when this energy block reaches it. It is perfectly respectable to call this energy flow, but it must be called "potential" energy and, at a certain time rate, "potential" power.

The forward swr meter doesn't know whether power was extracted at the far end or not. If the far end of the line is open or short circuited, then all of this potential energy will reflect and flow as a block in the reverse direction on the line. Now, suppose we turn the transmitter on for one more second. We now have two blocks of energy flowing toward each other. When they meet they will cause a standing wave on the line for one second where they overlap.

Now, let's turn the transmitter on a third time just as the first block of energy reaches its terminals. Depending upon the transmitter matching conditions, the first block of energy will reverse and combine with the transmitter power. We now have a new block of energy which will be read by the forward swr meter as greater than the transmitter power. This is not surprising, as we know part of it came from the transmitter and the rest of it was the reverse power, reversing again when it hit the transmitter.

This is not just a fictitious example. Time domain reflectometers show us pictures of the forward and reverse energy flow on lines. In fact, all calculations of impedance and standing waves on lines are derived from the forward and reverse energy flow on transmission lines.

Standing wave meters are just what they say they are. They show the magnitude of the forward and reverse waves which are propagating on the line and they convert this to the power that could be absorbed *if* the line were terminated in its characteristic impedance.

The above example illustrates that on a good line with large conductors or on a lossless line, there is no power loss due to large swr or reflected power. The power delivered to the line simply flows back and forth until it is dissipated in the antenna or load. Large standing waves produce points of high current on the line. The current squared times the resistance of the copper wire at this point is the loss in Watts. It is usually insignificant on amateur transmission lines. If the transmitter will load up to power, forget the swr. ■

Improving the Dipole

- - omnidirectionalization modification

73 Magazine *Staff*

Any dipole antenna, when it is reasonably well elevated, exhibits very definite directional properties. Maximum radiation occurs broadside (or at right angles) to the line of the antenna and minimum radiation occurs in-line or off of the ends of the antenna. Some amateurs put up a dipole antenna to take advantage of the directional properties of this type of antenna. But most amateurs really only put up a dipole antenna because it fits into the space available for putting up a simple antenna. The directional properties are simply a disadvantage of the antenna which have to be accepted. Most amateurs with restricted space available would probably prefer a good omnidirectional antenna for general purpose work on any one band. The vertical antenna is one solution, of course, but it requires a good ground system to be effective and should also be constructed in an area which is reasonably free of obstructions. Obstructions around the ground end, or high current and hence high radiation portion, of a vertical antenna are particularly destructive of its real efficiency. Vertical antennas are also not the least conspicuous of antennas, in situations where that is a consideration, as compared to a wire-type dipole antenna. So, what to do about making a simple dipole antenna have a better general-purpose omnidirectional radiation pattern? One possibility is to construct the dipole antenna in an inverted V fashion with the center point at the most elevated position and the sides having about a 90 degree angle to each other. A fairly omnidirectional pattern will result but with reduced radiation, as compared to a regular dipole, both broadside to and off the ends of the dipole. An alternative solution is the form of extended dipole antenna presented in this article. It offers broadside radiation efficiency equal to that of a regular dipole, radiation in the "off of the ends" direction only 3 dB down from the broadside radiation, and is extremely easy to construct or add to an existing dipole.

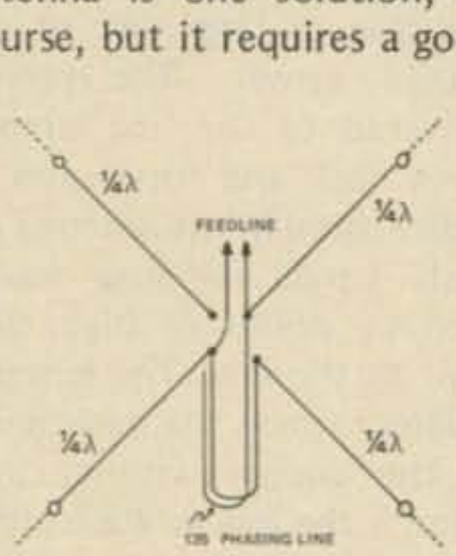


Fig. 1. Turnstile is an excellent form of omnidirectional dipole but obviously difficult to support since four elevated support points are needed.

Some old-timers will remember when horizontal polarization was the accepted practice on VHF. Many antenna forms were developed for mobile use to achieve horizontal polarization and yet obtain a reasonably uniform omnidirectional radiation pattern. Most such antenna forms have long since faded into obscurity, but two of them still retain some degree of significance. By far, the most remembered form is the turnstile or crossed dipole configuration (Fig. 1). By properly current phasing two dipole (or folded dipole) antennas erected horizontally and at right angles to each other, one could obtain an almost omnidirectional pattern with the gain in any direction almost equal to that of an individual dipole. The design is still used for some omnidirectional type FM antennas. The second, and usually most forgotten, type of omnidirectional type of horizontally polarized dipole antenna is shown in Fig. 2. It lends itself particularly well to adaptation to HF wire type dipole antennas, although it seems to have practically disappeared from the VHF scene once the latter went "vertical" for most amateur radio usage.

The antenna form is simply that of a regular half wave dipole flat-top with quarter wave extension legs added vertically at each end of the basic dipole. The extension legs should be at right angles to the flat-top to achieve the best omnidirectional pattern, although if they are displaced by about 30 degrees or less no great harm will result. Preferably, the bottom ends of the extension legs should be themselves about a quarter wave above ground if the radiation off the ends of the antenna is to remain also horizontally polarized. If this distance is less, there still will be significant radiation off the ends of the antenna but its polarization will be a combination of horizontal and vertical components.

Changing the overall length of a dipole antenna will, of course, change the feed point impedance seen at the center of the antenna.

Any of the various matching methods described in antenna handbooks can be used to re-match the coaxial feedline normally used with an unmodified dipole to the modified dipole. One of the simpler methods which has worked out well in practice, however, is the use of a quarter wave matching section made from 300 Ohm

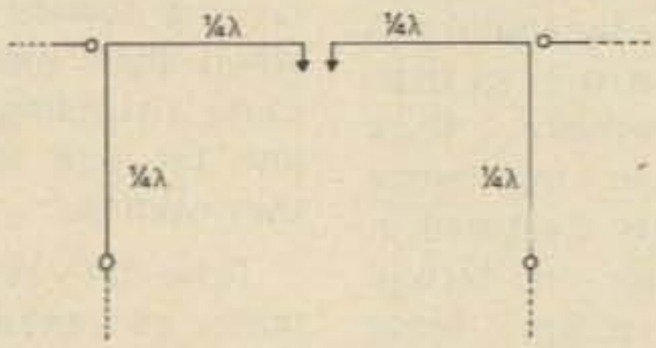
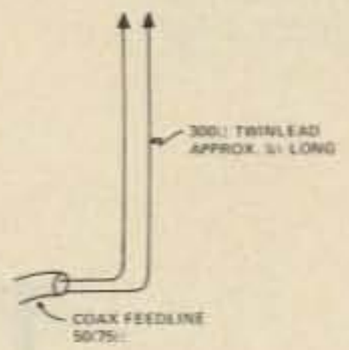


Fig. 2. Two vertical quarter wave sections are added to regular half wave horizontal dipole. Change in dipole feedpoint impedance must be compensated for.

twinlead between the antenna and coaxial line as shown in Fig. 3. One should be prepared to do a bit of pruning of the 300 Ohm matching section. Start with a full quarter wave section and cut it back a bit at a time until an swr meter placed in the coaxial line shows the lowest reading. A balun transformer can be used between the coaxial line and the 300 Ohm twinlead for balance purposes if desired. Be sure to use a 1:1 ratio balun. The idea is not to use a 4:1 setup balun to match the coaxial line to the 300 Ohm section, as this would prevent the latter from acting itself as an impedance transformation device between the coaxial feedline and antenna.

When adding the extension legs to an existing dipole, they can be simply secured to the ground using a length of heavy duty plastic clothesline to keep them in position. Such line has enough give to it to act as a spring and thus keep moderate tension on the extension wires. Clothesline with a nylon core and not that with a metal core should be used.

Fig. 3. Needed matching line for dipole in Fig. 2. Twinlead length should be trimmed for lowest swr.



This dipole modification is not new. It has been used with success over a number of years in different installations. Although no comparison was made with a dipole oriented at right angles to a modified dipole, stations could be worked off the ends of the modified dipole which could not be worked before modification. ■

Anthony Sperduti WB2MPZ
4740 Newton Road
Hamburg NY 14075

The 60 WPM Conversion

- - using 100 TTY on 60 wpm circuits

By now you have more than likely been hearing about the UART. This is, in long form, Universal Asynchronous Receiver Transmitter. This chip can receive, serially, signals with start and stop pulses of any 5, 6, 7 or 8 level data. The Baudot code used on amateur RTTY is (5) five level. Which it will work on is determined by putting a jumper on the chip or leaving it off.

The receiver's input recognizes serial input and converts it to parallel. This output is available on pins 26, 27, 28, 29, 30, 31, 32 and 33. The speed at which the receiver will operate is set by the frequency of pulses that one applies to pin 27. This is determined by multiplying 16 times the baud rate of the speed you wish to operate. To calculate this, use 7.5 as your unit per character of (5) five level code. For example, if you want 60 wpm, that is one word per second. One word in RTTY is five characters plus one character for space that must be printed, or six characters per second. Six x 7.5 equals 45 baud; 45 x 16 = 727 Hz.

The transmitter's input is parallel on pins 5, 6, 7, 8, 9, 10, 11 and 12. Its output is serial, with start and stop pulses on pin 25. The speed at which the transmitter operates is set by the frequency of pulses applied to pin 40. This tool is 16 times the baud rate of the speed you wish to operate. For example, if you wish to run 100 wpm, that is six characters per word, equaling 600, which divided by 60 seconds gives you 10 characters per second, which times 7.5 equals 75 baud.

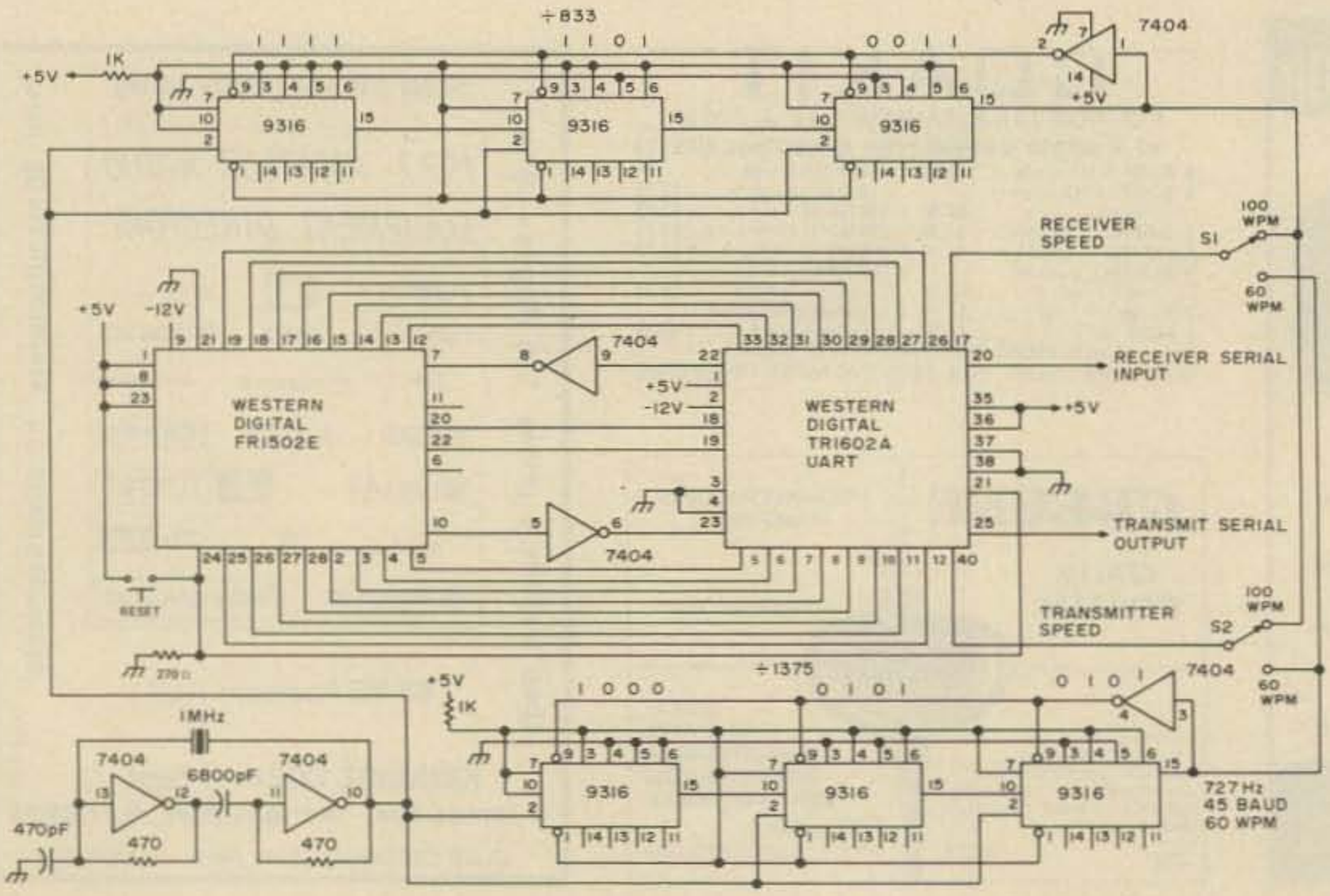


Fig. 1. Speed changer.

Multiply this by 26 and it gives you 1200 Hz. To make life easier, use the formula:

$$FREQ = \frac{OPM \times 16 \times 7.5}{60}$$

Remember, FREQ is the clock frequency you want in Hertz and OPM is the operation per minute you wish to run. For example, six characters per word, 100 words per minute, is 600 OPM. Six characters per word at 60 wpm is 360 OPM.

Now that we have all this, what are we going to do with it? The easiest thing would be to connect the parallel output of the receiver to the input of the transmitter. If we clock both at the same speed we have just made ourselves a regenerative repeater. This does not excite many hams at first, but let's go over it a bit.

Irv Hoff W6FFC and Howard Nurse W6LLO, as well as Paul Satterlee, Jr. WA5IAT, have written two very good articles on the UART in the *RTTY Journal*, April and May, 1974, issues. They say "most companies claim that signals within plus-minus 47-48 percent bias can be handled with perfect output timing being generated in the transmit section." In marginal copy, there should be a significantly fewer number of errors printed. By clocking the receiver and transmitter at different frequencies, we can build a digital speed converter to either go up or down in speed.

The schematics in this article should enable you to build a digital speed converter. You will note that I have added a FR15202E FIFO (First In First Out). This is only a 40 character 9 bit storage chip. As you load each 8 bit character into the input, it just drops through until it hits the output. Or, if there is memory in it, it will load up to that point.

Just think of it as a long hollow tube that you drop ping pong balls into. They will fall to the bottom if there are no other balls in the

way. The UART will release the balls one at a time as it wants them, via pins 22 and 23. The purpose of this is that when you are keying at 100 wpm and sending at 60 you will have a 40 character storage. The whole idea of this circuit is to run your machine at 100 wpm. Now you can copy 60 wpm or 100 wpm by changing the clock frequency of the receiver, and be able to leave the transmitter output at 100 wpm. You can also connect up your 100 wpm keyboard to the receiver and transmit either 100 wpm or 60 wpm by changing the clock frequency of the transmitter and be able to leave the receiver at 100 wpm.

The only problem you might run into is if you run a TD at 100 wpm and transmit at 60 wpm. You can see that if you did that you would soon fill up the FIFO. You could build up a circuit that would recignize a filled up FIFO and stop the TD for a preset time. If you are typing on the keyboard, you will have to take a break once in a while if you type faster than 60 wpm for more than 100 characters at a time. I don't seem to have any trouble there, but I think a fast typist might have to slow down. The reset is used when you first turn the unit on, as you don't know what will be loaded in the FIFO.

Both frequencies are divided down from the 1 MHz clock. Any clock frequency you want can be used as long as you divide it down to the ones we discussed. If you don't like the clock I am using, there is a very good one by Irv Hoff W6FFC called the Mainline XB-6 UART Clock in the May, 1974, issue of the *RTTY Journal*. The 9316s are programmable dividers by Fairchild. For those who don't know how to program these dividers, let's look into them a bit.

The idea is to program dividers up so that when they reach the number you want, the output of the last device goes high. You use this output to feed back or reset the dividers back to the programmed number. Since the input is a crystal clock, you can see now that the output should be as stable as the input but divided by the preset number entered into the divider.

To calculate how to program the divider, you first convert the divisor to binary. Then take the 2's complement of this number and load it into the dividers. Each divider is a divide by 16, so you must load 4 binary codes into each one. The program inputs to each chip are pins 3, 4, 5 and 6. Pin 3 is the least significant number and pin 6 is the most significant number. A 1 is loaded as +5 and a 0 is connected to ground. Let's go over one to be sure you understand it.

To get 1200 Hz for the 100 wpm clock, we first divide this into our clock frequency of 1 MHz. This comes out to 833. Now this means we must program our divider to give us an output at every 833rd count of the clock. If you look at the circuit, you will see that this will also give us the feedback for the reset pulse. The easiest way I know of to convert 833 to binary is to just keep dividing by 2. If 2 divides into it evenly it is 0; if you have a remainder it is 1.

For example:

```
        1 - - - 1   MSN
  2 |3   - - - 0
  2 |6   - - - 1
 2 |13   - - - 0
 2 |26   - - - 0
 2 |52   - - - 0
2 |104   - - - 0
2 |208   - - - 0
2 |416   - - - 1   LSN
2 |833
```

```
ADD
0001 - 0100 - 0001
1110 - 1011 - 1110
                +1
-------------------
1110 - 1011 - 1111   2's Complement
   REVERSE
1111 - 1101 - 0111   LOAD
```

Note that the answer came out to only 9 places. You must add the three 0s to make it come out to 12, as each chip has 4 inputs and they must all be set. If the answer had come out to 8 places, we would have had to only use 2 chips. Now to get the 2's complement we invert all the digits – that is, make every 0 a 1 and every 1 a 0. We then add 1 to the least bit and we now have what we want. There's only one problem: They are in reverse. If you look at the circuit, you will note the LSB is pin 3 of the 1st chip and the MSB is pin 6 of the 3rd chip. What we have to do now is just reverse all the digits end for end or tip the sheet of paper upside down. If you want to get fancy, you could put a series of switches on the program inputs and then be able to pick out any frequency of pulses wanted.

There are many ways to interface the UART to the Mainline TT/L or ST-6. Several are in the May, 1974, issue of the *RTTY Journal*. Remember that the input and output are TTL compatible and you can operate the UART with any circuit that will work with TTL logic. Input is +5 volts and is pulled to ground to operate. The output is +5 volts when not being pulsed and goes to ground internally when operating. I am going to operate my unit in a separate cabinet with its own loop supply and optoisolator so it will be independent of my ST-6. Think I could use it better this way. Most people might like to put it into their ST-6, as you already have the 12 V. Coming up with +5 should be no problem. To operate the circuit you will need about 30 mA of 12 V dc and 50 mA of +5 V dc. This should be well-filtered and well-regulated.

I would like to thank Bob Davis W6HUL for all the help he gave me on this article. Without his knowledge, it would not have been possible. ■

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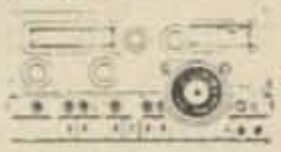

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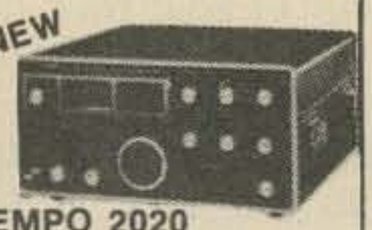

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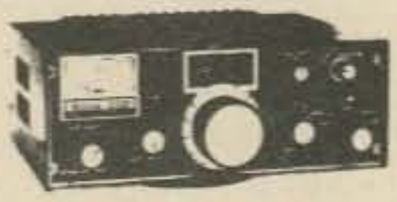

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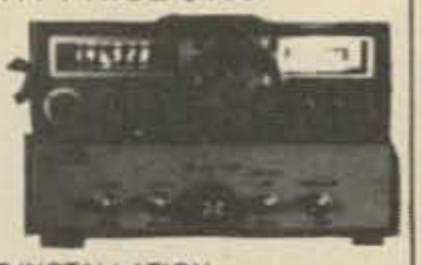

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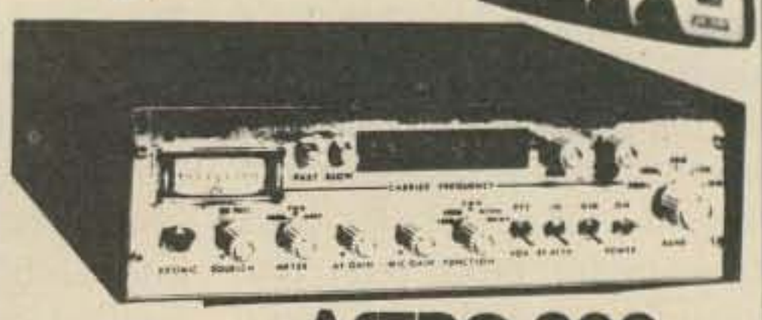

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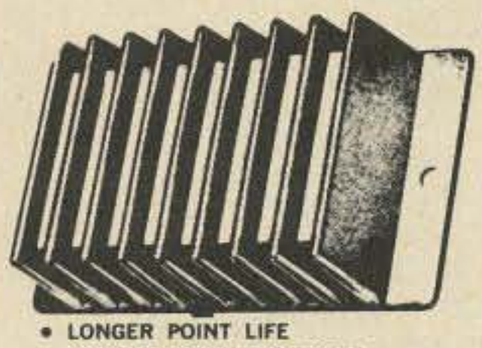

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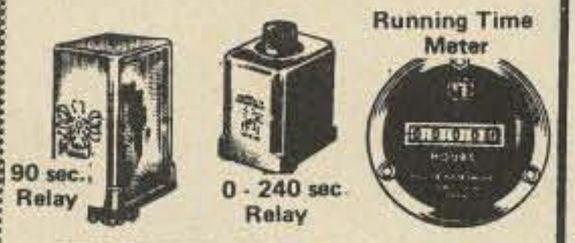

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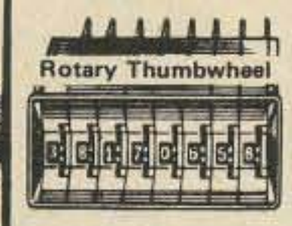

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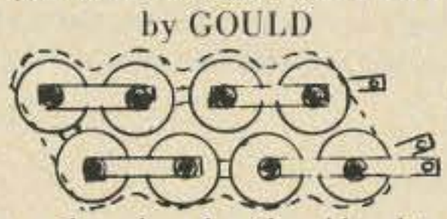

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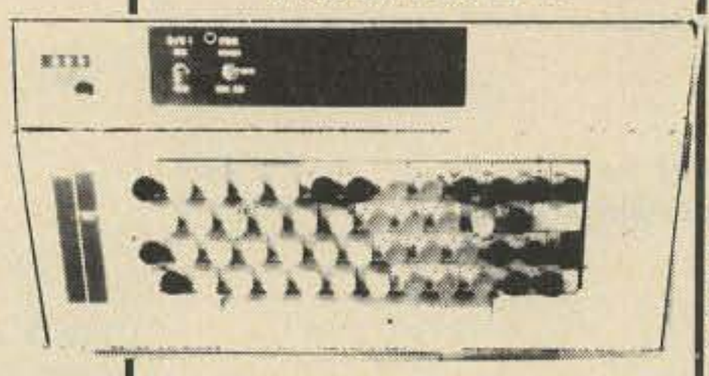

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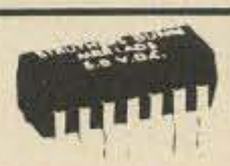

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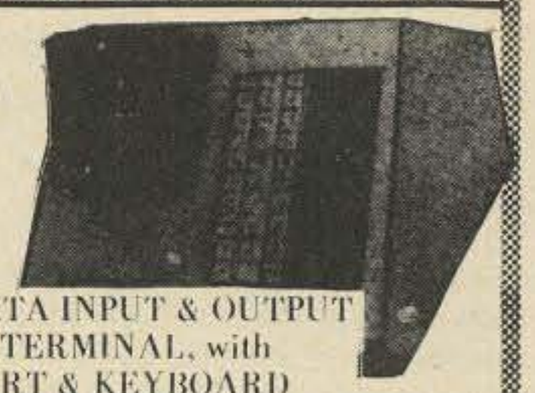
7AAL000028 . . . . . $495.00

DATA INPUT & OUTPUT TERMINAL, with CRT & KEYBOARD



This great microprocessor input/output terminal has ASCII output and comes complete with 128 page tech. manual with operating and repair instructions, which makes it easy to modify the terminal for your applications. The character generation unit was part of a separate control device which is not available. The terminal can be modified however, to be used in conjuction with character generator LSI chips such as the 2513, 2516 or others.

This beautiful CRT terminal with block alpha-numeric keyboard of 50 keys, was made by Bunker-Ramo for use on the N.Y. Stock Exchange, airline reservations, and other applications where it was tied into a central computer. This unit includes CRT, logic power supplies, and some sweep circuits. Some of the digital logic is included. The CRT is a 3" unit mounted with the block-type keyboard in a case which includes the supplies and circuitry. Operates on 115 V, 60 Hz. CRT character capacity can be adjusted: 768 characters (12 lines with 64 char. per line); 364 (12 lines of 32); 256 (8 lines of 64); etc. Sh. Wt. 35 Lbs.
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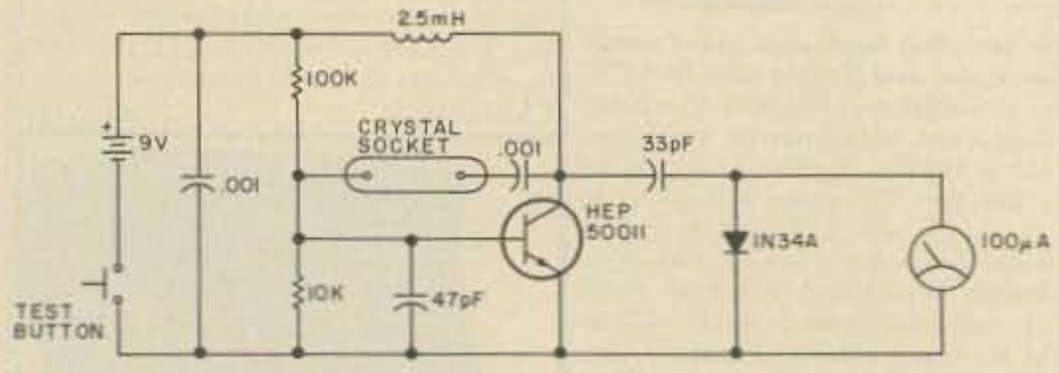
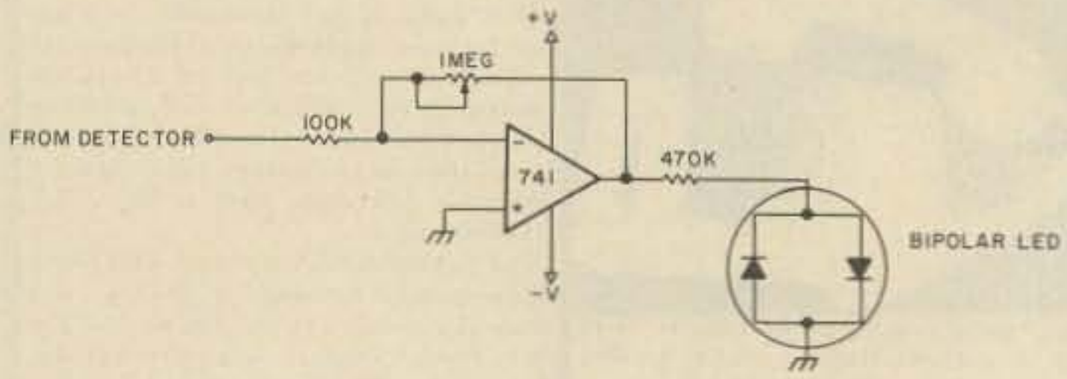
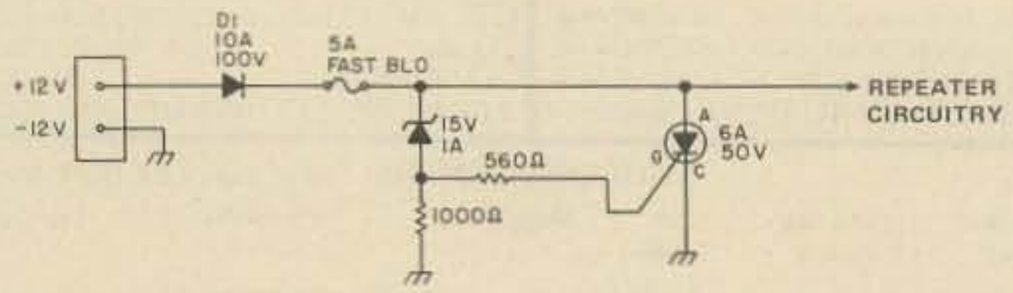


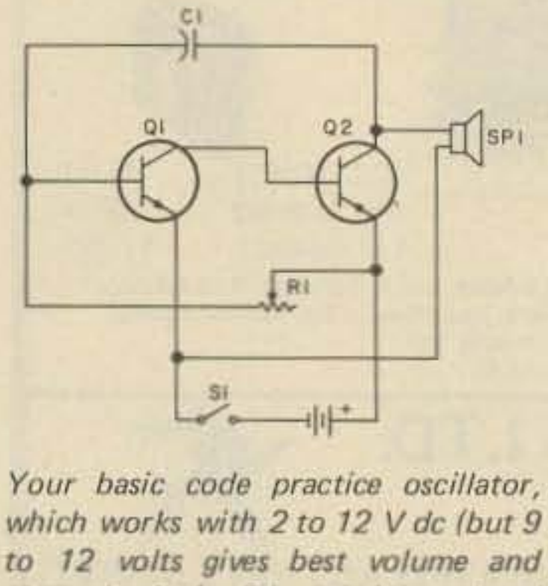
A crystal checker suitable for checking used crystals at hamfests, etc. If the crystal is good, the meter will show a steady indication. A good crystal will cause the circuit to oscillate when the "test" button is pushed, with a half scale reading on the meter. Thanks to John Mairs, Springfield VA.



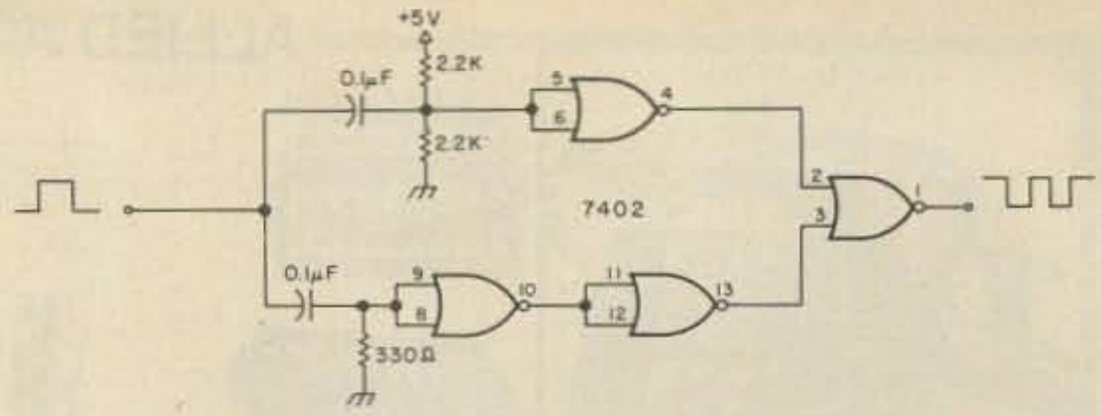
A zero center indicator for FM receivers. To adjust, tune in a station and adjust the 1 megohm pot for a null. Then ask the station to modulate and fine adjust so modulation peaks don't light the LEDs. Stations are properly tuned when neither LED is lit. Thanks to Michael Black VE2BVW.



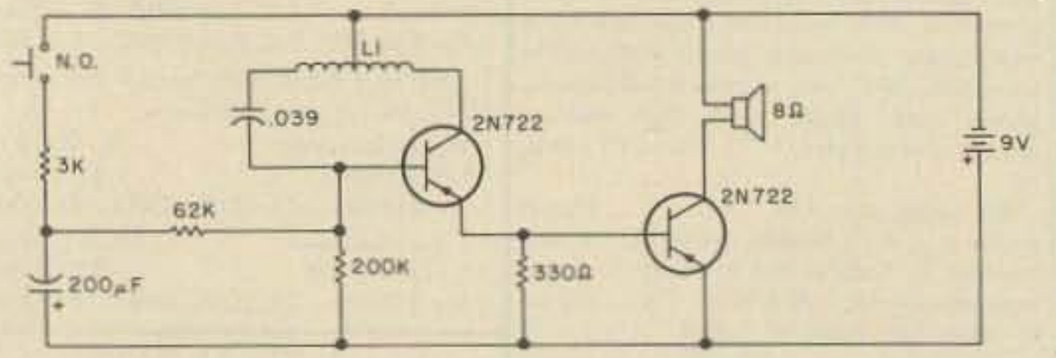
The best way yet to safeguard portable, emergency power repeaters from reverse or excessive voltage. D1 prevents incorrect polarity damage, and zener voltage determines the maximum voltage that will reach the rest of the circuitry. Use fast blowing fuse rated greater than the SCR current rating. Thanks to Paul Hurm WB8CLF.



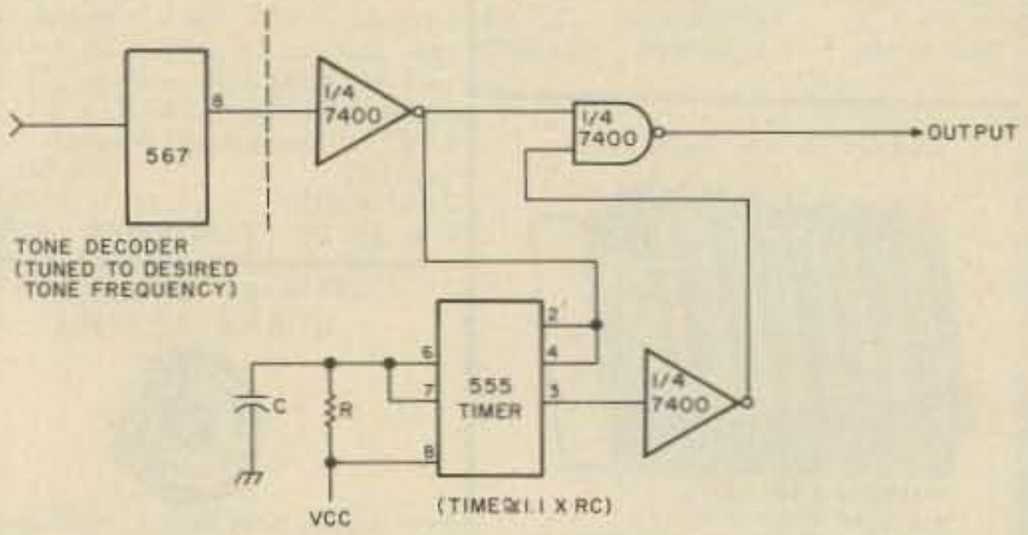
Your basic code practice oscillator, which works with 2 to 12 V dc (but 9 to 12 volts gives best volume and clean keying). R1 can be replaced with a 500k pot and the circuit will sweep the entire audio frequency range. Thanks to Rod Hallen, Tombstone AZ.



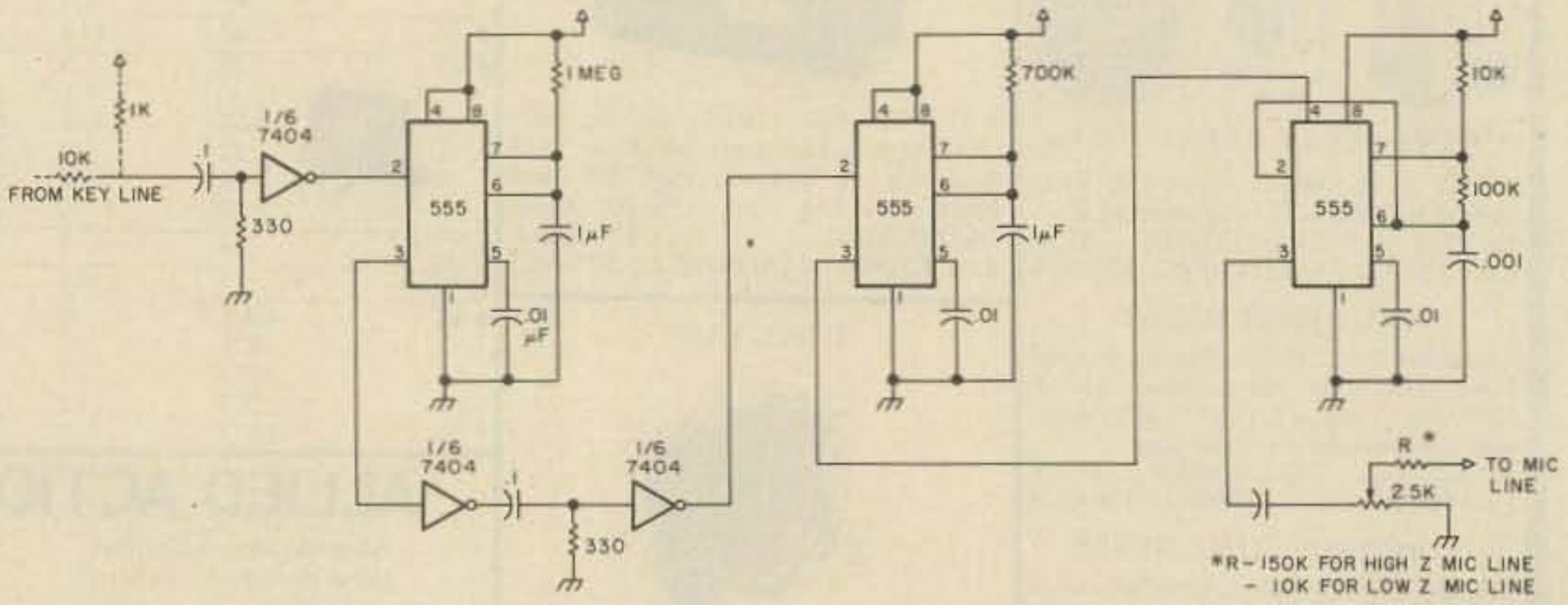
Here's a circuit developed for doubling the frequency of a TTL square wave. It locks onto the rise and fall of the input square wave. If high frequency operation is desired, the capacitors may be lowered in value. Thanks to Howard Gerber WB5YWS.



A siren oscillator that sounds just like an air mechanical device. L1 is one half an audio transformer with a 10k center tap. Thanks to Gary Capek K8NSA/5.



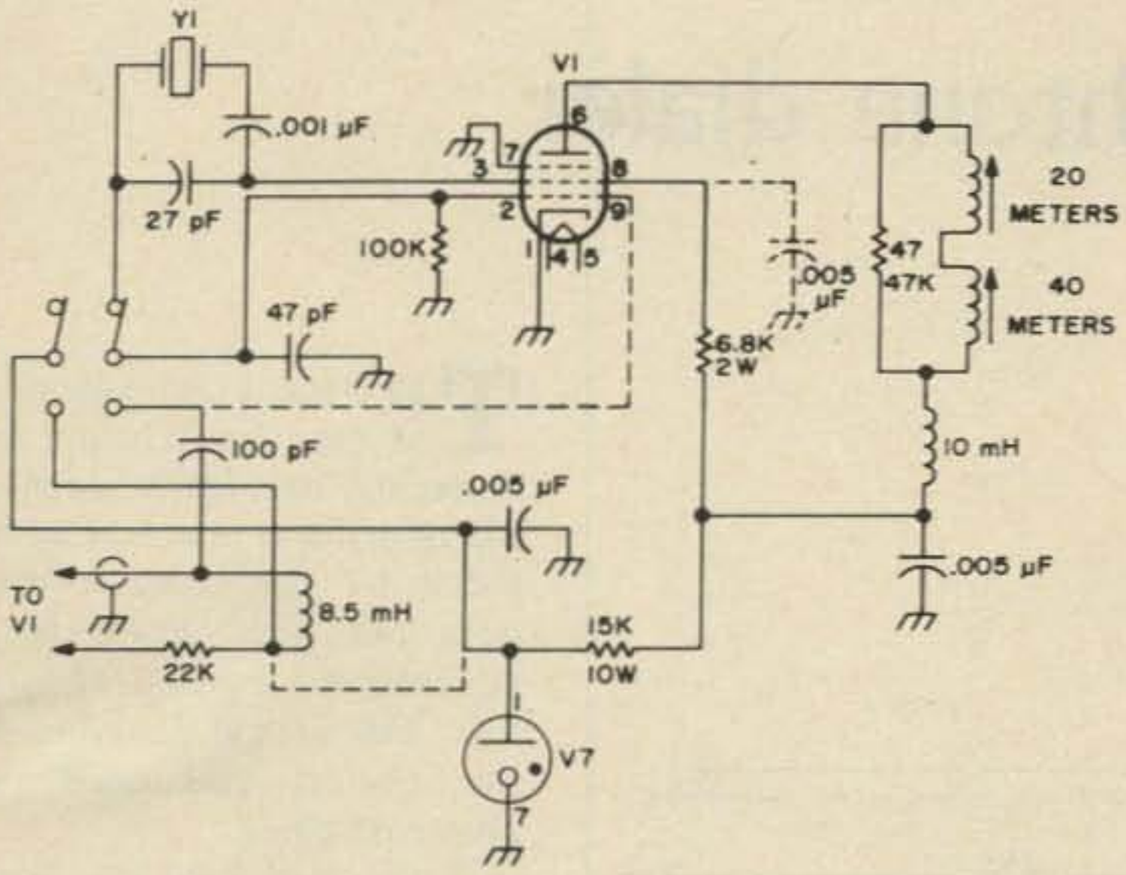
A continuous tone detector using 567, 555, and 7400 ICs. The output goes low only when the tone has been continuous and exceeds the timer pulse. Without a tone, the high at the 567 output is inverted, keeping the timer reset. When the tone comes in, the timer output goes high and, after being inverted, blocks the gate. If continuous tone is used, the gate is opened at the end of the timer pulse. If not continuous tone or shorter in duration than the timer pulse, the output of the gate remains high. The circuit could also be used to reset an alarm system or detect any TTL logic that required a specific length of time. Thanks to Raymond Thompson KH6IEL.



The "Key Up Beeper," designed for use on the Jacksonville FL 16/76. The circuit gives a .75 second tone burst 1 second after the COR is de-energized. Time delay may be changed by substituting another value for the 1 megohm resistor. Tone burst duration is varied by changing the value of the 700k resistor, and the frequency of the tone is changed by varying the resistor-capacitor ratio of the third 555 IC. The circuit is set up for 5 V dc, but can be used for 12 V dc applications by adding the components in dashed lines. Thanks to Jim Arner, Jacksonville FL.

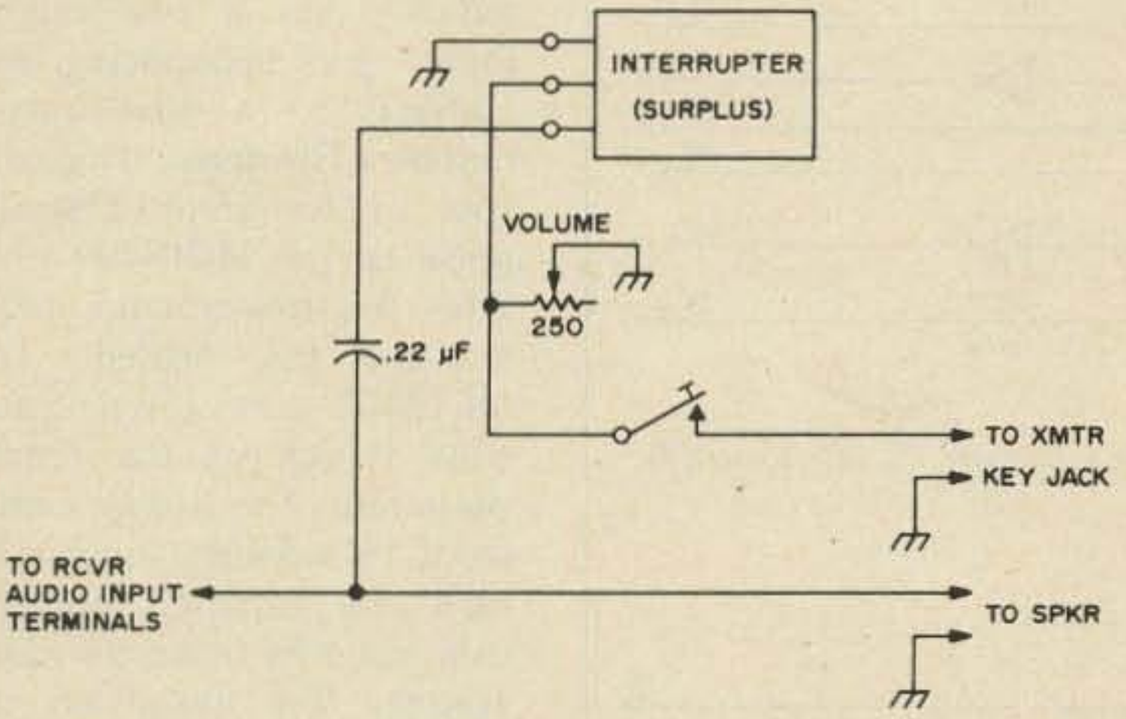
Q&A

This column will be a monthly feature of 73 Magazine. It is hoped that it will be of assistance to beginners and old-timers alike. We only ask that your questions be kept as general as possible. We will try to answer all queries received. Please mail your questions to Technical Editor, 73 Magazine, Peterborough NH 03458.



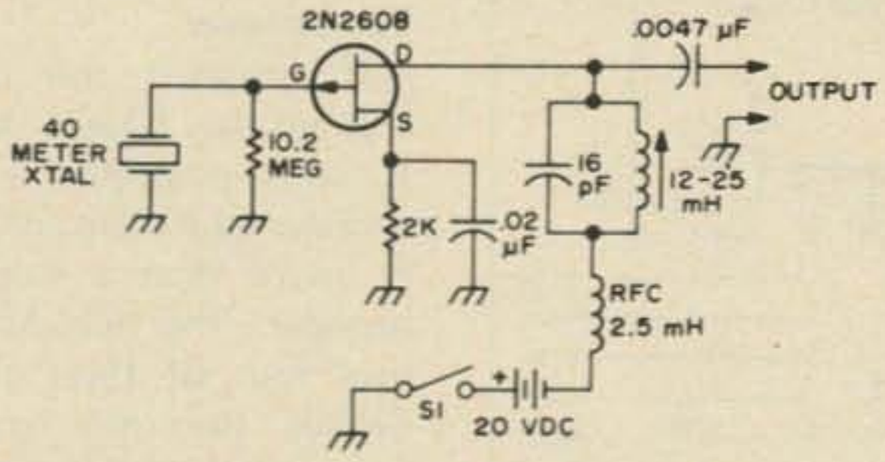
Q. For operation on MARS, CAP, etc., what modifications will allow crystal-controlled as well as vfo operation?

A. This typical-circuit modification (see the figure) will permit crystal-controlled operation and requires only a few small parts for a very worthwhile addition. And, original calibration of the set's vfo is undisturbed.



Q. Is there a diagram for constructing a simple keying monitor?

A. The interrupters in several pieces of surplus equipment, such as telegraph set TG-5, can be converted easily to an excellent keying monitor used with the station receiver and transmitter, as shown in the figure.



Q. Is there a crystal oscillator circuit that will operate at 7 MHz using a Siliconix 2N2608 field effect transistor (FET)?

A. The oscillator circuit in the figure will work very well. Leads must be kept short. The coil can be air-wound or a permeability-tuned unit. If desired, the tuning capacitor can be a variable unit and the value of the coil fixed. The amount of rf output will depend on the crystal (activity) and the voltages used.

Q. What is an integrated circuit?

A. An integrated circuit (IC) is a small piece of a specially treated mineral that has the ability to reproduce entire circuits that might ordinarily require dozens of transistors, resistors, and other components. There is at least one IC that is the size of a transistor that actually replaces a thousand transistors; some replace even more. Being very small, they are perfect for miniaturized construction projects or for simplifying larger projects. Usually they have fourteen or sixteen connections.

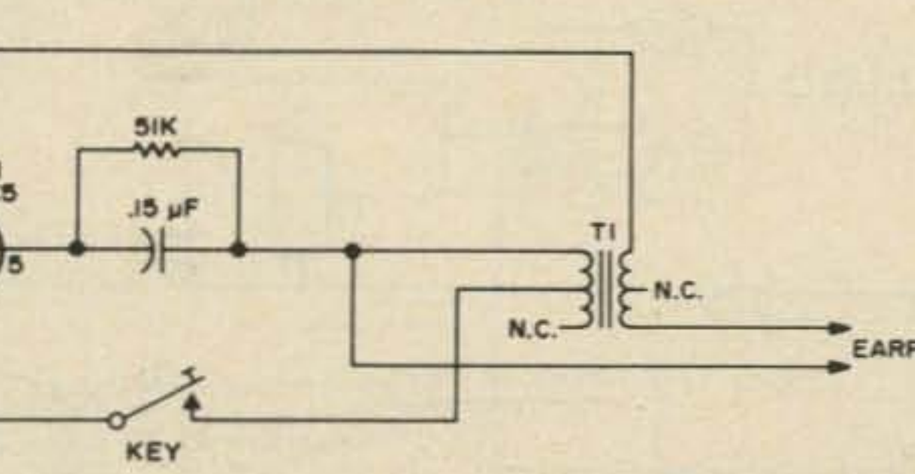
Q. How can a surplus frequency meter rf output be reduced?

A. Simple. To recap, however, the problem occurs when the instrument is tuned to a weak signal. What happens is that a heterodyning effect is produced — and quite an annoying one.

To remedy, a 2 megohm potentiometer should be placed in series with the original screen dropping resistor in the frequency meter. To null or reduce output, merely adjust the newly-installed potentiometer.

Q. If any, what are the advantages of SSB compared to FM?

A. First of all, FM requires more frequency space and more bandwidth. Second, performance of SSB on weak signals is better than FM. Lastly, FM cannot be received properly on an ordinary AM-CW receiver – SSB can, by using the bfo to inject carrier.



Q. Is there a circuit diagram for a transistorized Q-multiplier that can be used with i-fs in the 1400 kHz region?

A. The lead from the Q-multiplier (see figure) to the plate of the mixer stage in the receiver should be shielded. The coil used should have a high Q and, for 1400 to 1450 kHz, should be an iron-core unit having a value of 120 to 130 uH. The resistor tied to the 25k pot will have a resistance of from 3k to 40 kΩ, depending on the transistor used; the value must be obtained experimentally. Try a 5k unit with the HE-3 transistor. Before changing resistors, try various low-voltage dc values. If a 2N1742 transistor is on hand, it will work extremely well in this circuit.

Q. Is there a circuit diagram available for building a code practice oscillator?

A. The code practice oscillator circuit in the figure can be built for approximately $6. This circuit does not require a plate or B-plus supply. It is essential, however, that high impedance headphones be used with the circuit for maximum performance.

Digital Autopatch

- - with touchtone dialer

E.E. Buffington W4VGZ
2736 Woodbury Dr.
Burlington NC 27215

Photos by Danny Turner WB6TUG/4

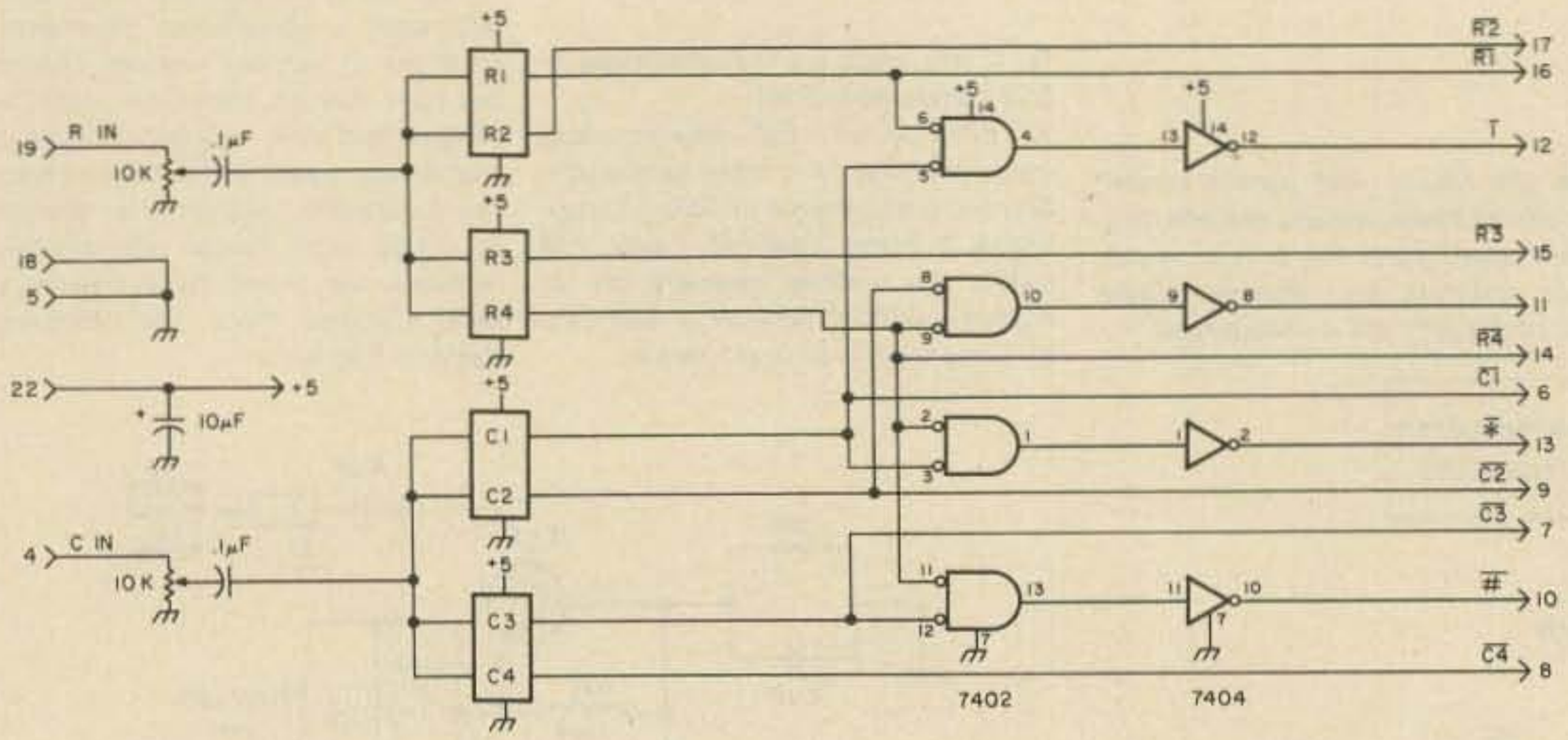


*Fig. 1. Decoder board with NAND gating to supply all rows, all columns, *, #, 1, and 0.*

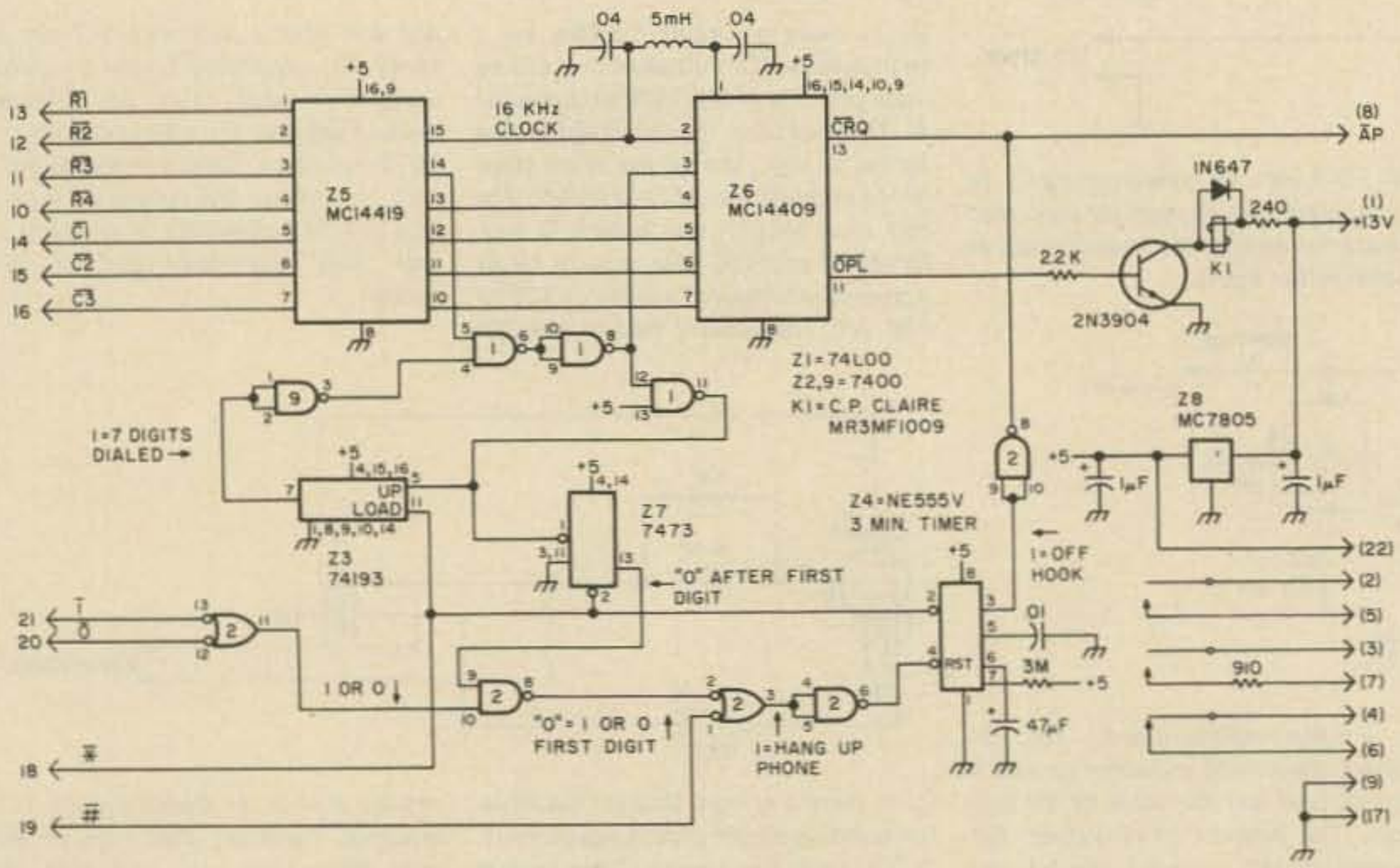


Fig 4. The dialer accepts logic signals from the decoder and dials the phone.

The recent introduction of two new IC chips by Motorola has really opened the door for a practical autopatch for the repeater that does not have access to a touchtone signaled phone line. This article describes all the circuits you need for phone patching.

The MC14419 and MC14409 are the good news items that we have been waiting for. The MC14419 is a 2 of 8 to binary decoder which takes a row-column input, does debouncing, and converts to a 4-bit binary number. The debouncing consists of furnishing a strobe pulse to the MC14409 only after the row-column information has settled. The MC14409 stores this data and dials it out at the proper pulse rate. The storage capacity is 16 numbers and can be read and outpulsed over and over again by using the redial feature. The autopatch described here is in operation on two repeaters presently and is performing just fine.

The Decoder

I designed the decoder around the EXAR XR2567 IC chip because it is a dual decoder and costs only slightly more than a single 567 decoder. The decoder board uses four of these chips to decode the four rows and four columns of the standard 16 button pad. (See Figs. 1 and 2.) There is some "AND" gating done to get (*), (#), (1) and (Ø). These four, plus all rows and columns, are

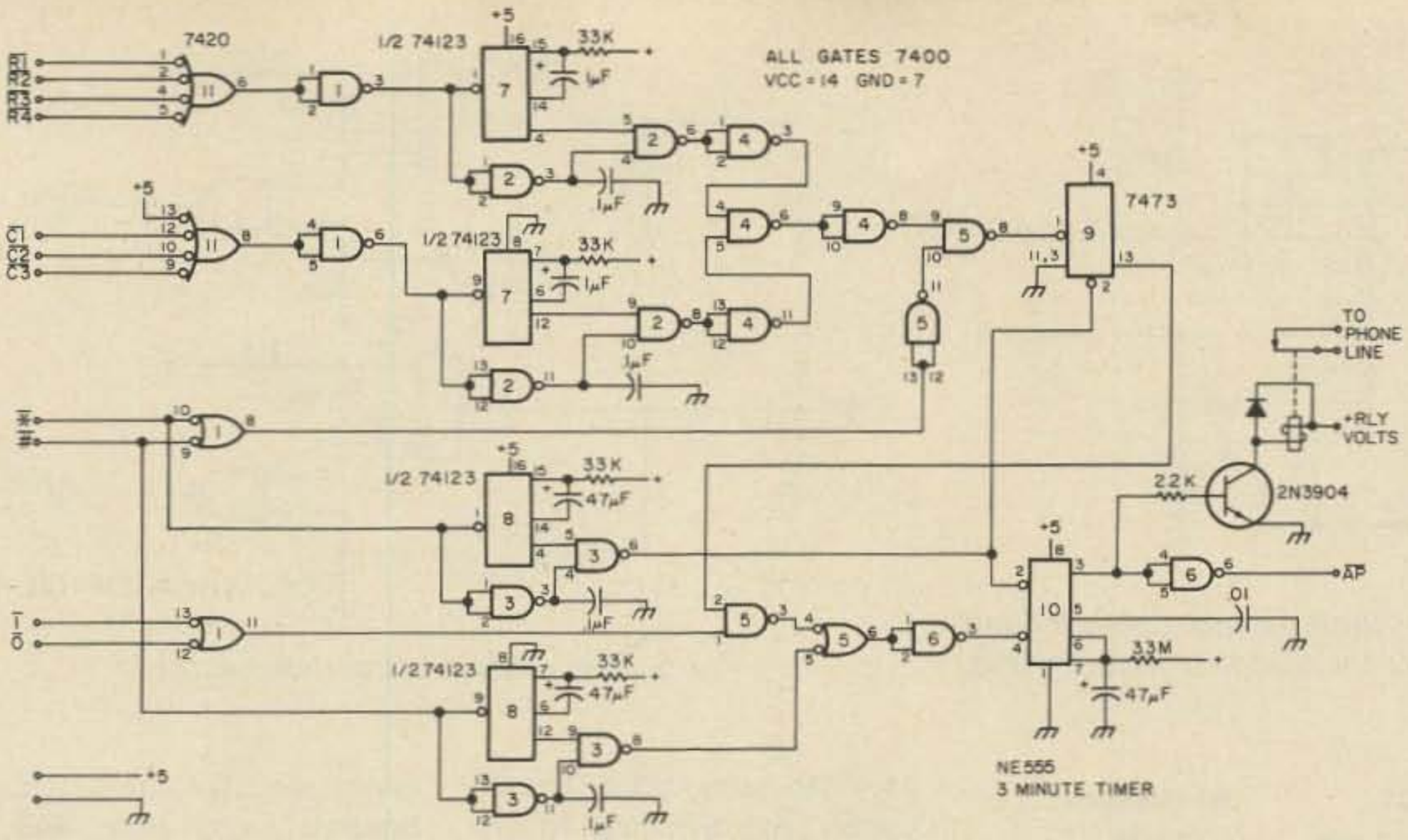


Fig. 7. Control circuit for touchtone signaled phone line.

(Ø) is the first digit, the phone will disconnect."

It was found in the model that some voices would cause a row-column match and keep dialing the phone after the connection was made. This was overcome by limiting the number of digits to 7. The 75192 loads a "1" with (*) and counts to 8, thereafter inhibiting strobe pulses.

The three minute timer will terminate the call after 3 minutes. The call will also terminate with (#) or with (1) or (Ø) as the first digit. The $\overline{AP}$ line is used to turn on the transmitter and the logging tape recorder (third party traffic, you know!).

A fix was also needed to keep voices from "talking up" a dial tone in normal repeater operation. A retriggerable multivibrator (74123) was used to insure that $\overline{*}$ or $\overline{\#}$ must be held low continuously for one second before the output goes low. I don't have a circuit board layout on this feature yet, but the schematic is shown in Fig. 5.

Touchtone Signaled Line Control Circuit

Fig. 7 is the logic for a control system that will initiate the call, start the timer, and provide lockout for (1) or (Ø) as the first digit. The operation of the circuit is pretty straightforward, except for the debounce feature. Begin with (*) going low for one second. This sets the J-K flip-flop ($\bar{Q}$ output goes high) and starts the three minute timer. The output of the timer is inverted and is furnished as a signal to start the tape recorder, make the phone line connection, and keep the transmitter on. If the next digit is a (1) or (Ø), the timer will reset and the phone connection will be broken. The first digit dialed will clear the J-K flip-flop so the next or any subsequent digit can be any digit including (1) and (Ø). A (*) or (#) is not recognized as a digit. The retriggerable multivibrator 74123 is used as a debouncer. The any-row or any-column debouncer is set at 20 milliseconds; the (*) and (#) debouncer is set for 1 second. A logic low must be present for the full time in order to get an output after that time. Any glitching or contact bouncing that takes

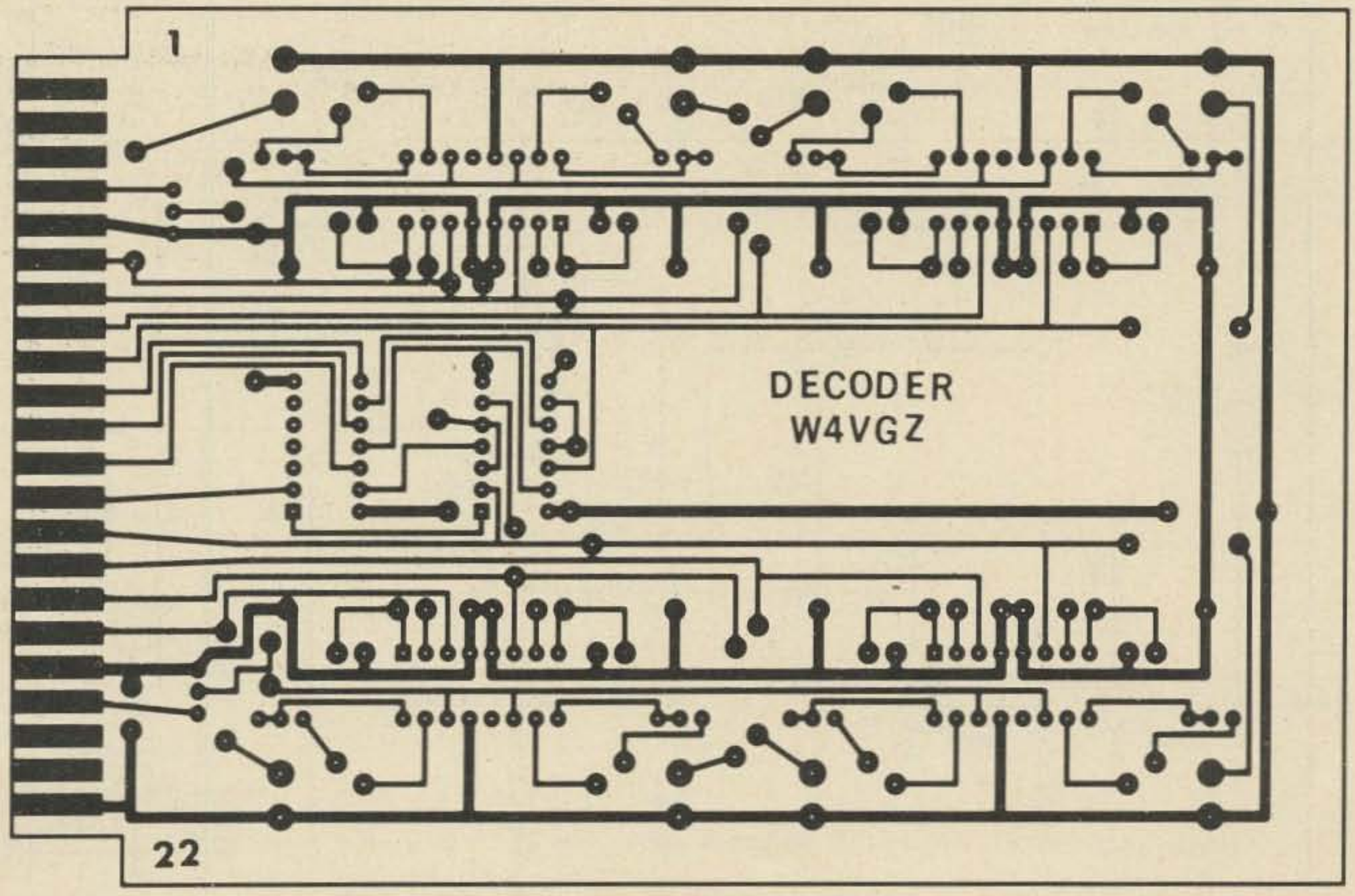


Fig. 8(a). Decoder board.

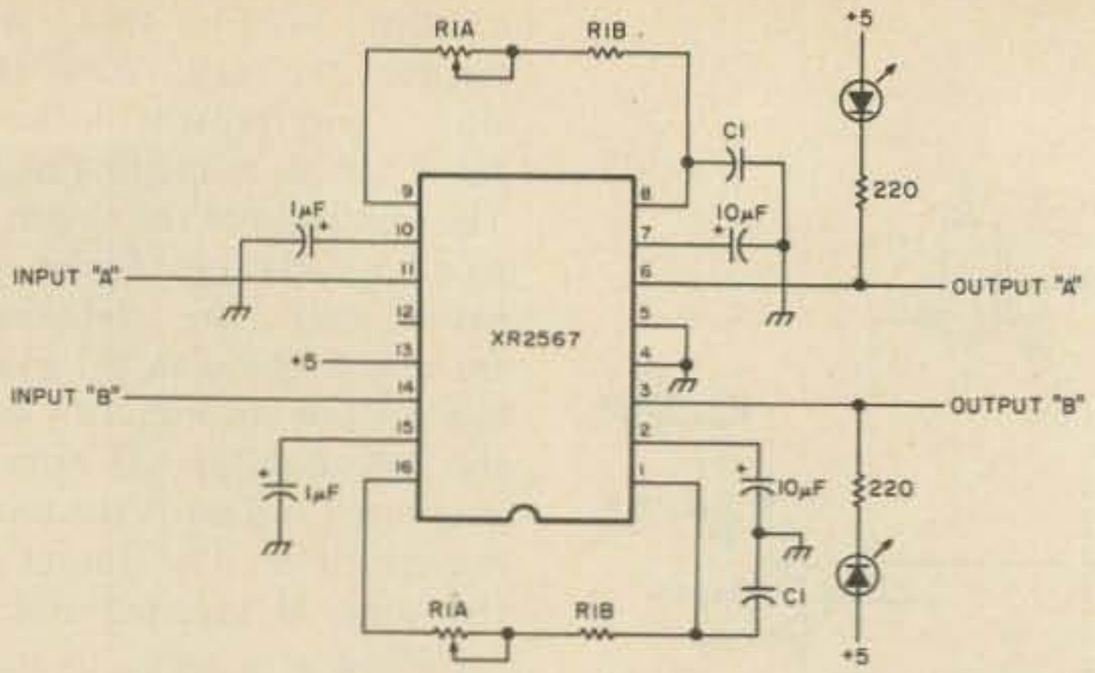


Fig. 2. Dual tone decoder. Four of these decoders with R1 and C1 values from Fig. 3 are used for the complete decoder (Fig. 1).

	Freq.	C1	R1 (Nominal)
Row 1	697 Hz	0.1 mF	14.3k
Row 2	770 Hz	0.1 mF	13.0k
Row 3	852 Hz	0.1 mF	11.7k
Row 4	941 Hz	0.1 mF	10.6k
Column 1	1209 Hz	.047 mF	17.6k
Column 2	1336 Hz	.047 mF	16.0k
Column 3	1477 Hz	.047 mF	14.5k
Column 4	1633 Hz	.047 mF	13.0k

Fig. 3. Decoder frequencies and timing resistor and capacitor values.

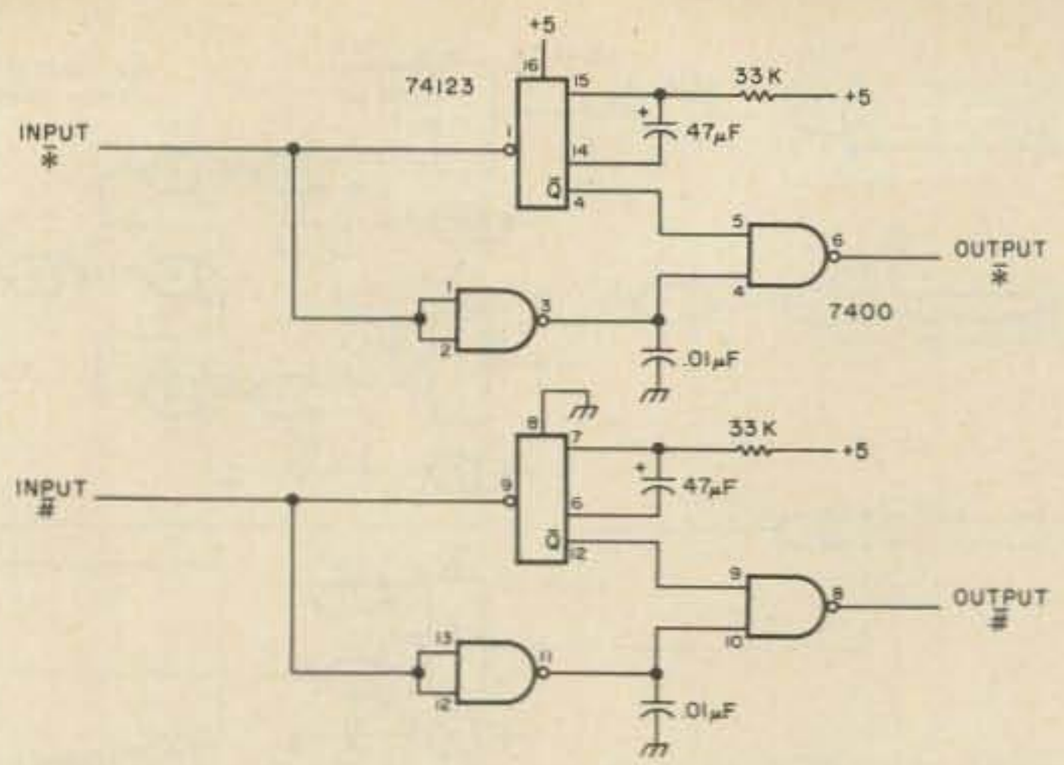


Fig. 5. Dual contact bounce eliminator.

provided as outputs. The decoders are trimmed to frequency by monitoring pin 9 or 16 of the XR2567 and adjusting the pot for a free-running frequency equal to the desired lock frequency. This is done, by the way, without an input signal. The nominal value of R1 is shown in Fig. 3. The fourth column is not used for autopatching; however, you may find it useful for control of some repeater functions.

The Dialer (Fig. 4)

I decided that I didn't want to pay for someone else's toll calls, so I put in a "fix." This fix makes the logic statement: "If a (1) or

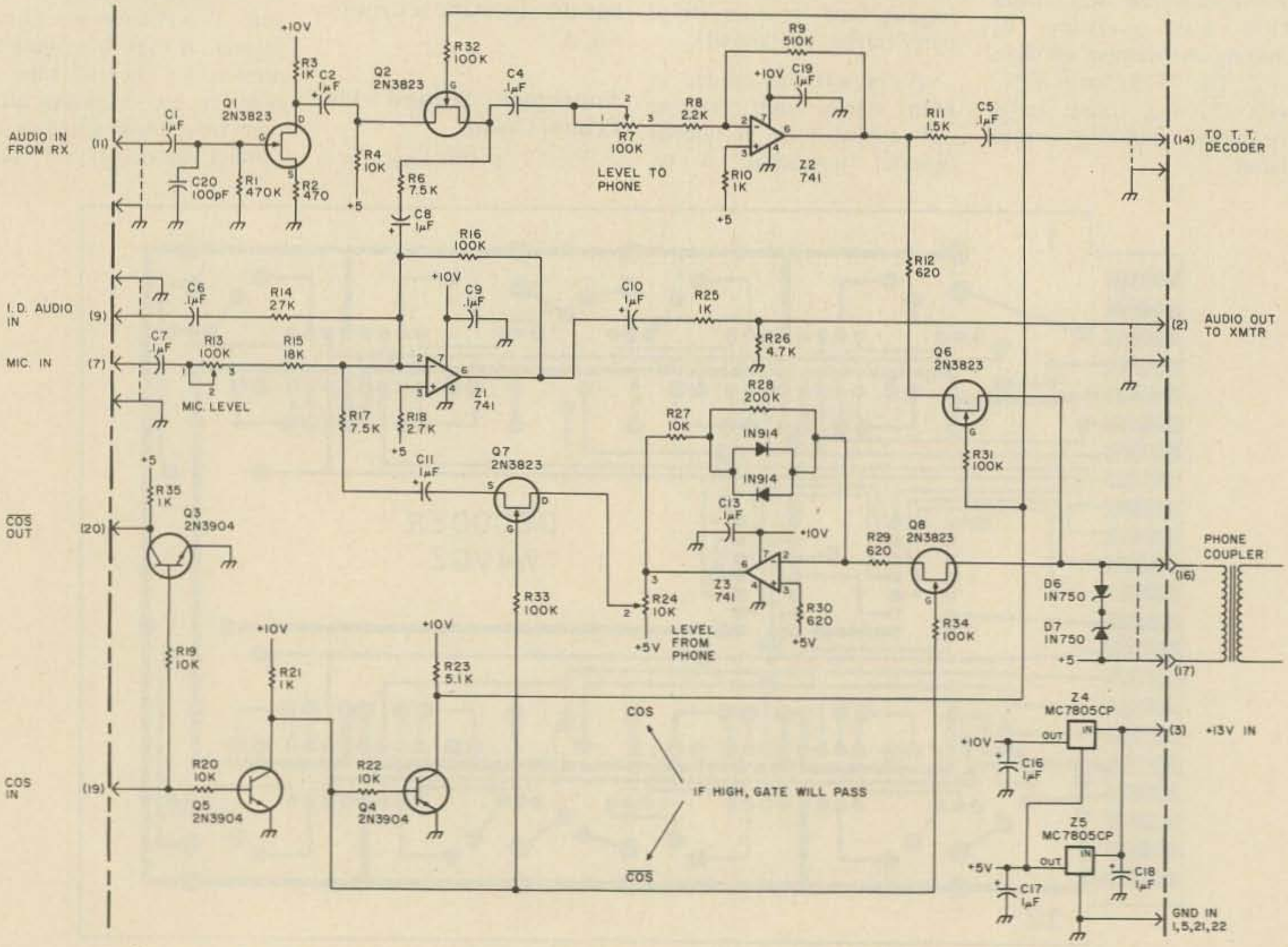


Fig. 6. Audio interface board. R5, Q3 not used. Highest R = 31; highest C = 20.

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R1

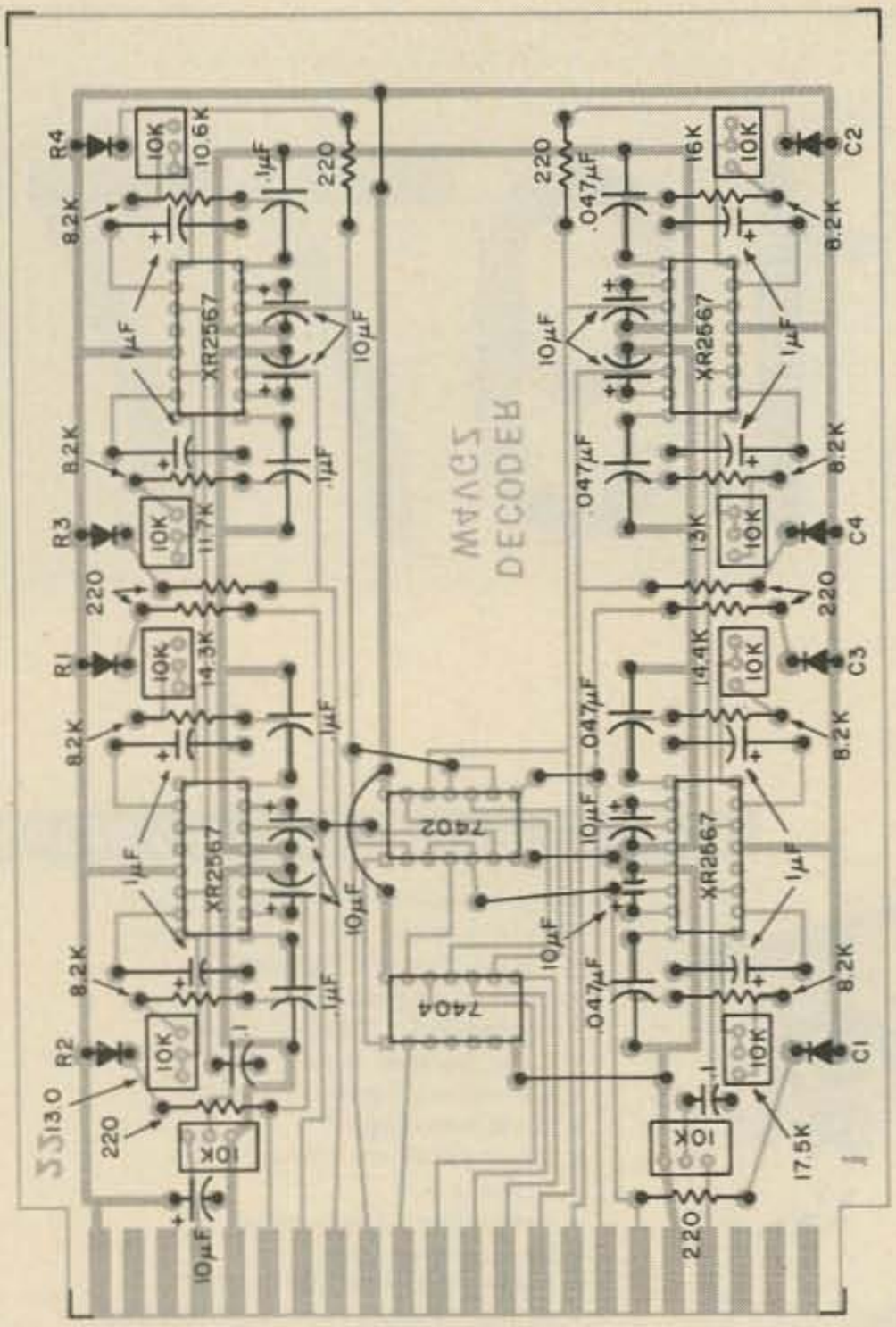
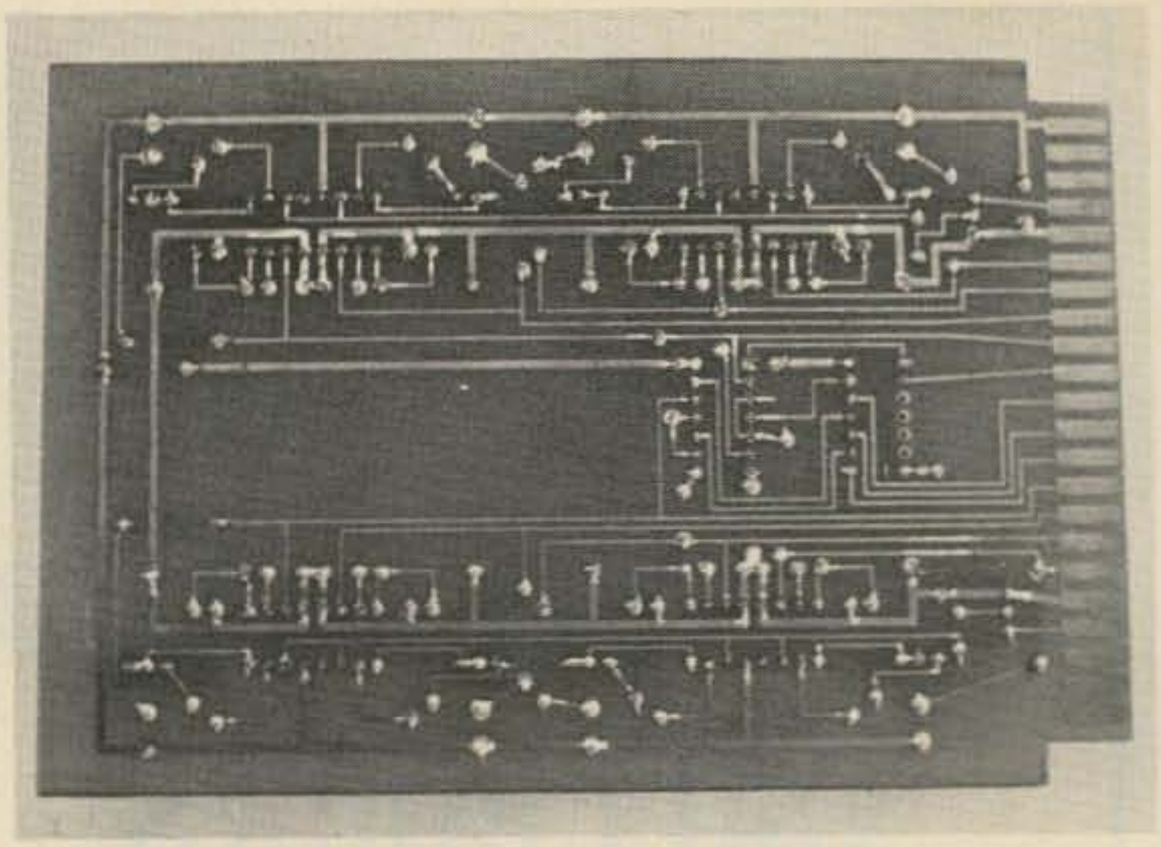
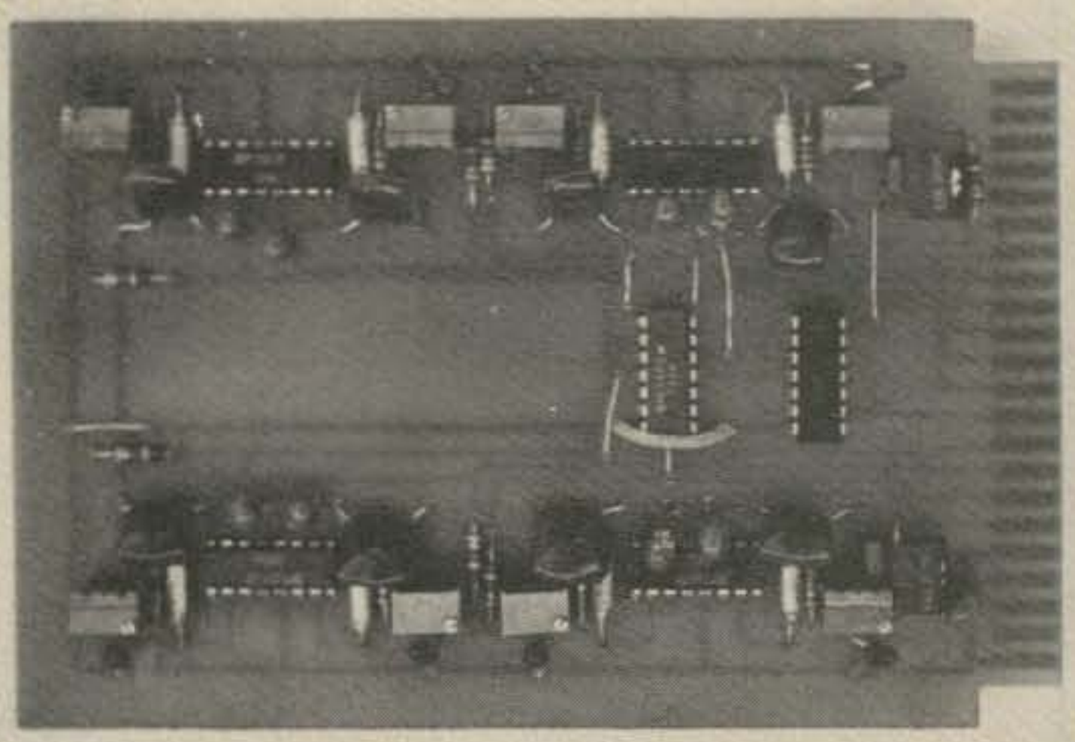


Fig. 8(b). Decoder board component layout.



Decoder board, foil side view.



Decoder board, component side view.

place before this time is over will retrigger the single shot and extend the time by the single shot period.

Audio Interface

The audio board (Fig. 6) connects the receiver output to the transmitter, phone

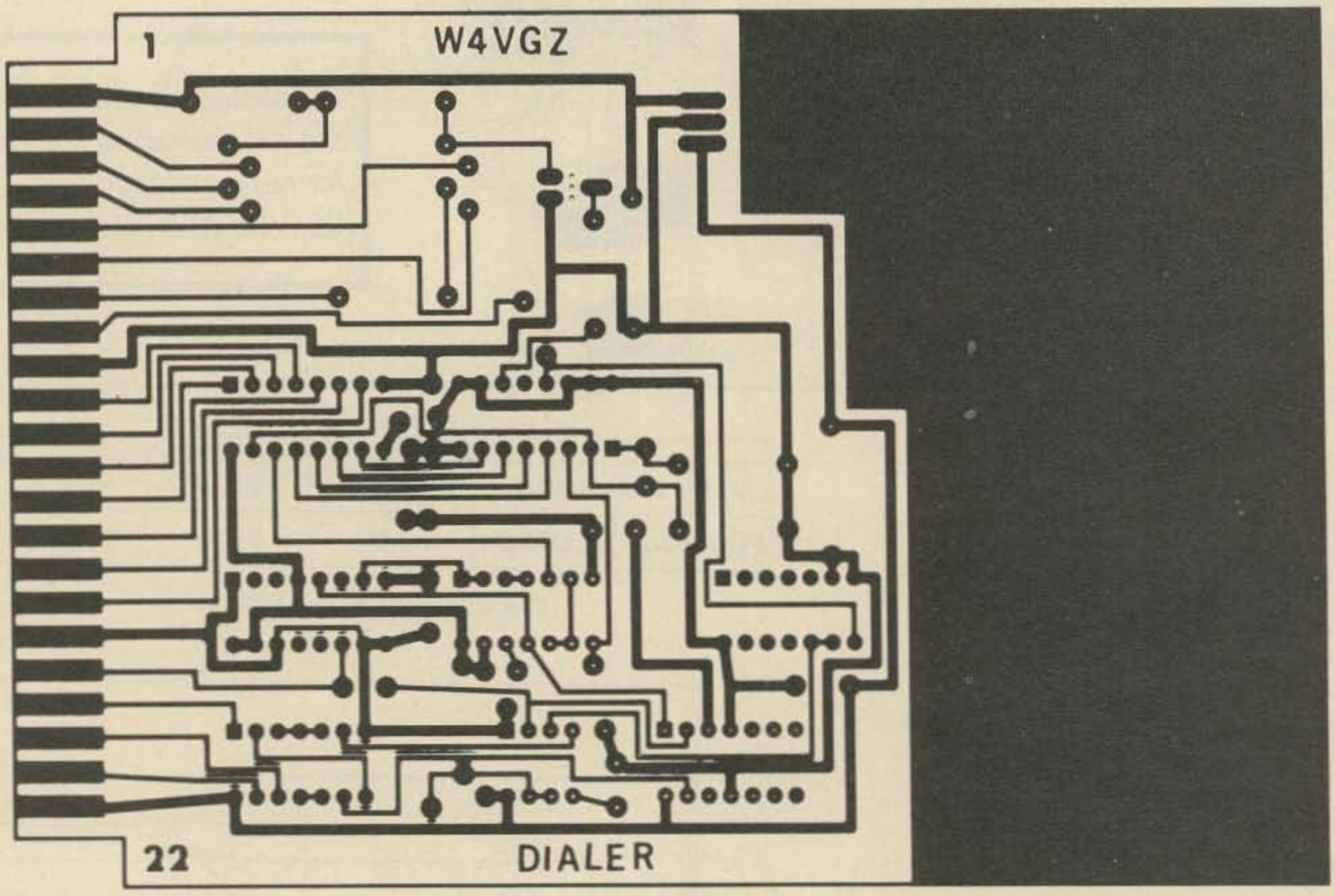


Fig. 9(a). Dialer board.

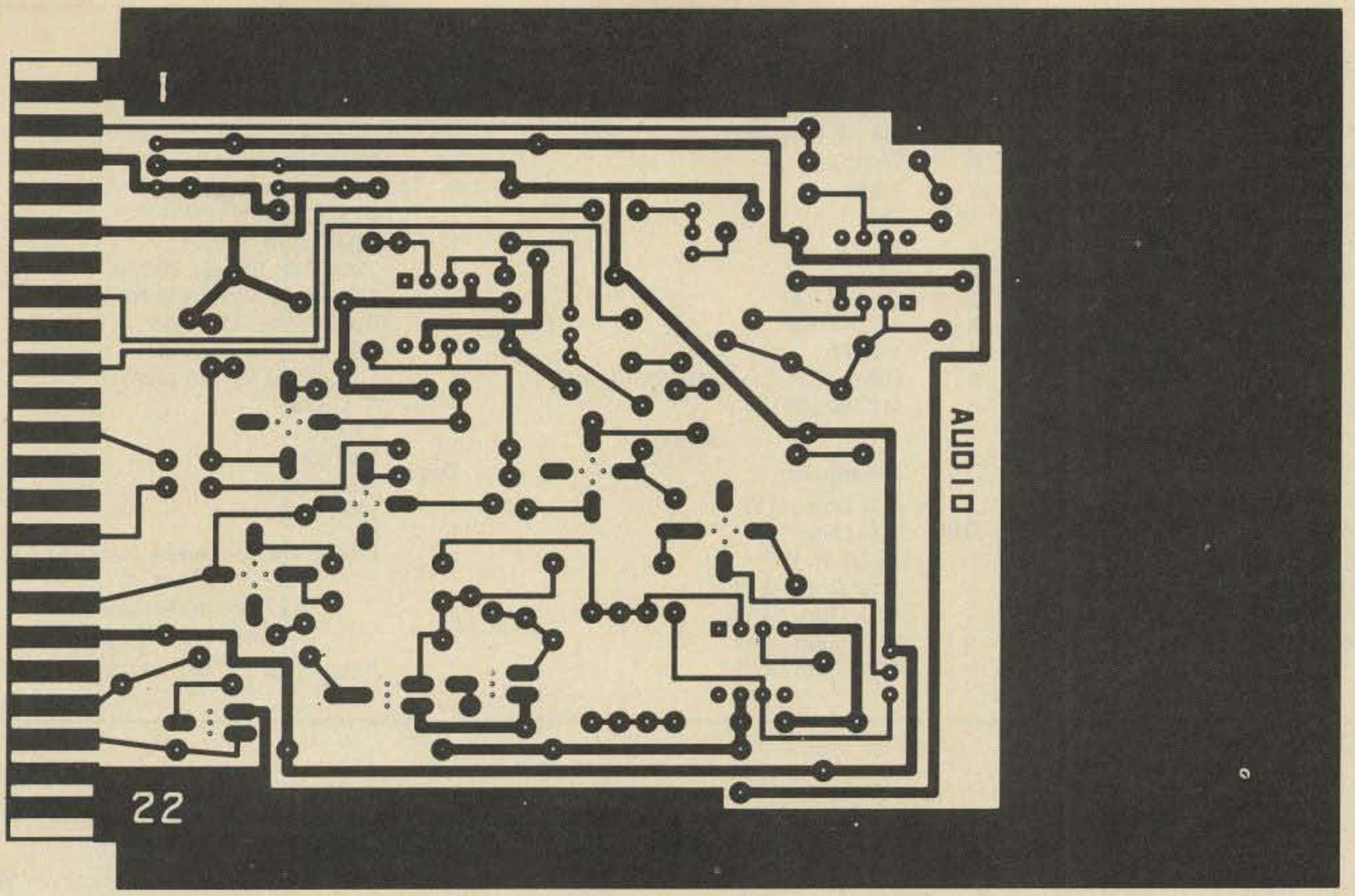


Fig. 10(a). Audio board.

line, and decoder. It has provision for local microphone and ID audio, and has a compression amplifier for

boosting the phone line signals. The compression amplifier has high gain for weak signals and less gain for strong

signals. All switching is done by FETs. The carrier operated switch (COS) input is active high. If you have

touchtone signaled exchange, the audio board, the decoder board, and the additional logic (Fig. 7) are all you need.

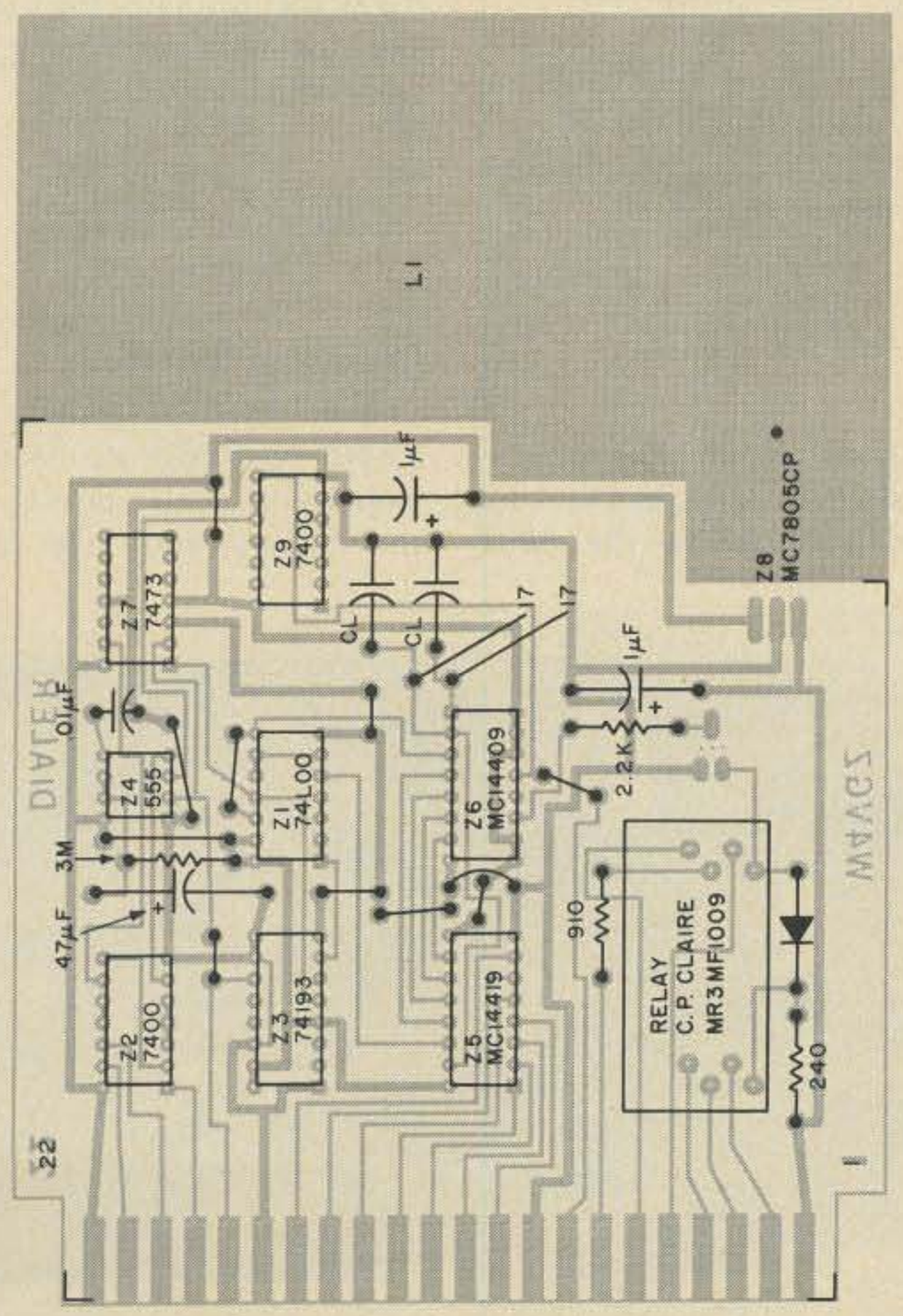


Fig. 9(b). Dialer board component layout.

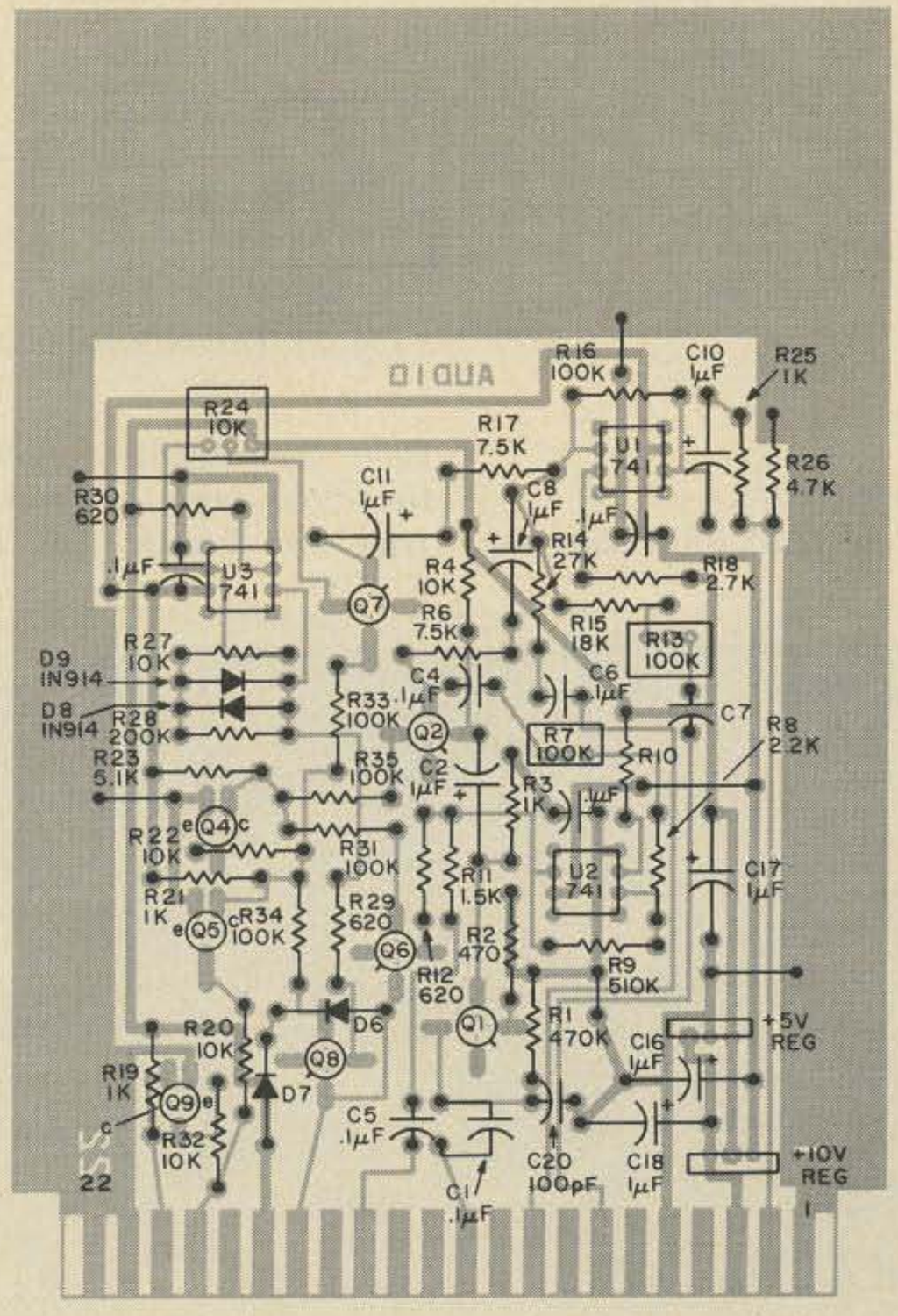


Fig. 10(b). Audio board component layout.

Parts List

Decoder

Description	Qty
220 Ohm, ¼ W	8
8.2k Ohm, ¼ W	8
10k Ohm, Pot, Bourns 3299W	10
0.1 uF, 100 V, Dipped Mylar	4
0.047 uF, 100 V, Dipped Mylar	4
0.1 uF, Disc Ceramic	2
1.0 uF, Axial, 20 V, Tantalum	8
10 uF, 20 V, Dipped Tantalum	9
10 mA Red Light Emitting Diode	8
XR2567 Dual Decoder	4
7402	1
7404	1

Dialer

Description	Qty
910 Ohm, ¼ W	1
3.0 Megohm, ¼ W	1
240 Ohm, ¼ W	1
2.2k Ohm, ¼ W	1
47 uF, 20 V, Tantalum	1
0.01 uF, Disc Ceramic	1
1.0 uF, 20 V, Tantalum	2
5 mH (See Text)	1
.04 uF (See Text)	2
74L00	1
7400	1
555	1
74193	1
7473	1
MC14419P	1
MC14409P	1
1N647	1
Relay, C.P. Clare, MR3MF-1009	1
MC7805CP	1

Audio

Description	Qty
470 Ohm, ¼ W	1
620 Ohm, ¼ W	3
1k Ohm, ¼ W	5
1.5k Ohm, ¼ W	1
2.2k Ohm, ¼ W	1
2.7k Ohm, ¼ W	1
4.7k Ohm, ¼ W	1
5.1k Ohm, ¼ W	1
7.5k Ohm, ¼ W	2
10k Ohm, ¼ W	5
18k Ohm, ¼ W	1
27k Ohm, ¼ W	1
100k Ohm, ¼ W	5
470k Ohm, ¼ W	1
510k Ohm, ¼ W	1
100k Pot, Bourns 3389W	2
10k Pot, Bourns 3389W	1
0.1 uF, Disc Ceramic	8
100 pF, Disc Ceramic	1
1.0 uF, 20 V, Tantalum	7
2N3823	5
2N3904	3
1N750	2
MC7805CP	2
LM741CN	3

Circuit Boards can be obtained from:
O. C. Stafford
427 South Benbow Road
Greensboro NC 27401
Price is $20.00 per set, postpaid.

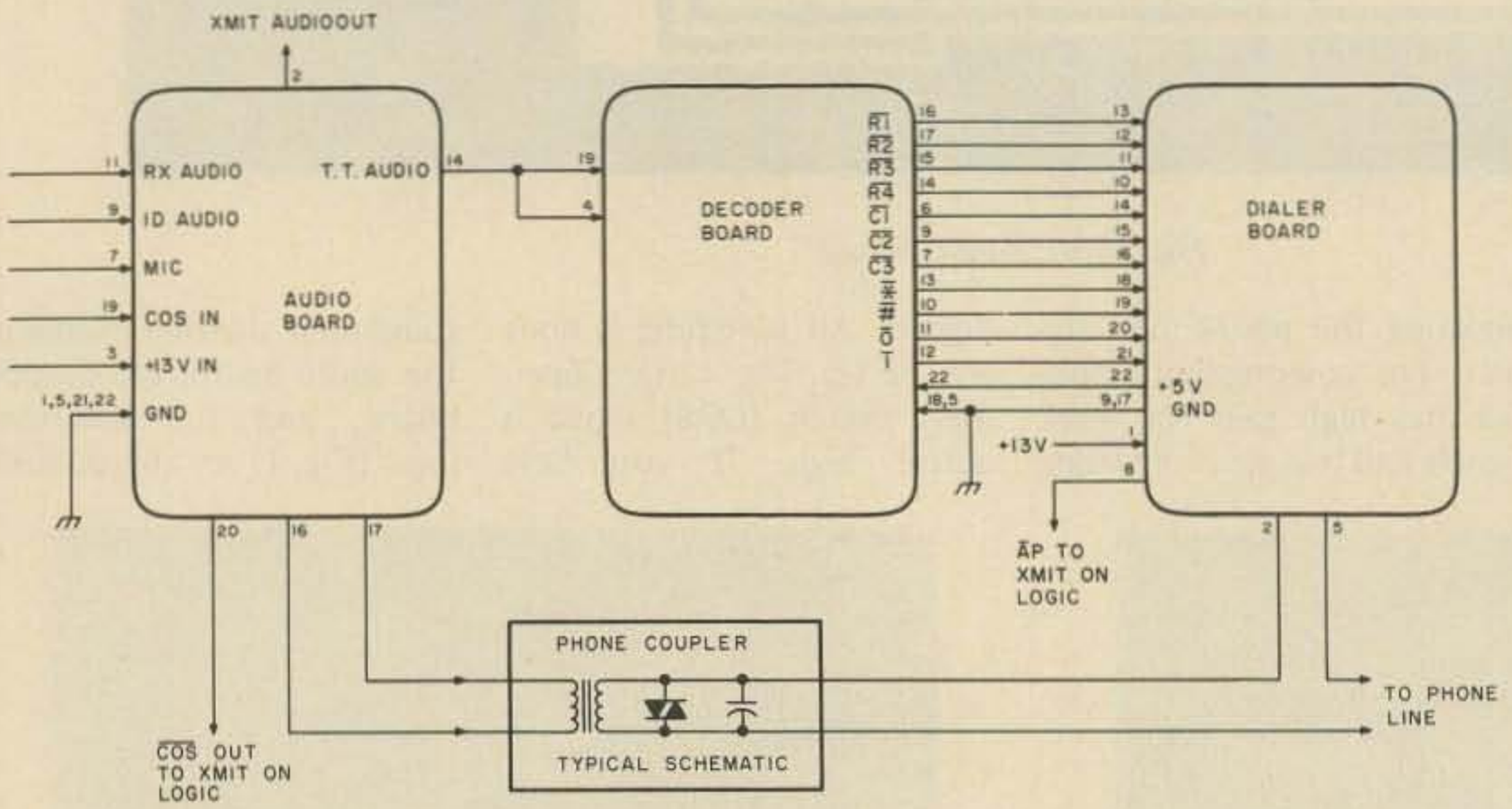


Fig. 11. Overall schematic.

Construction

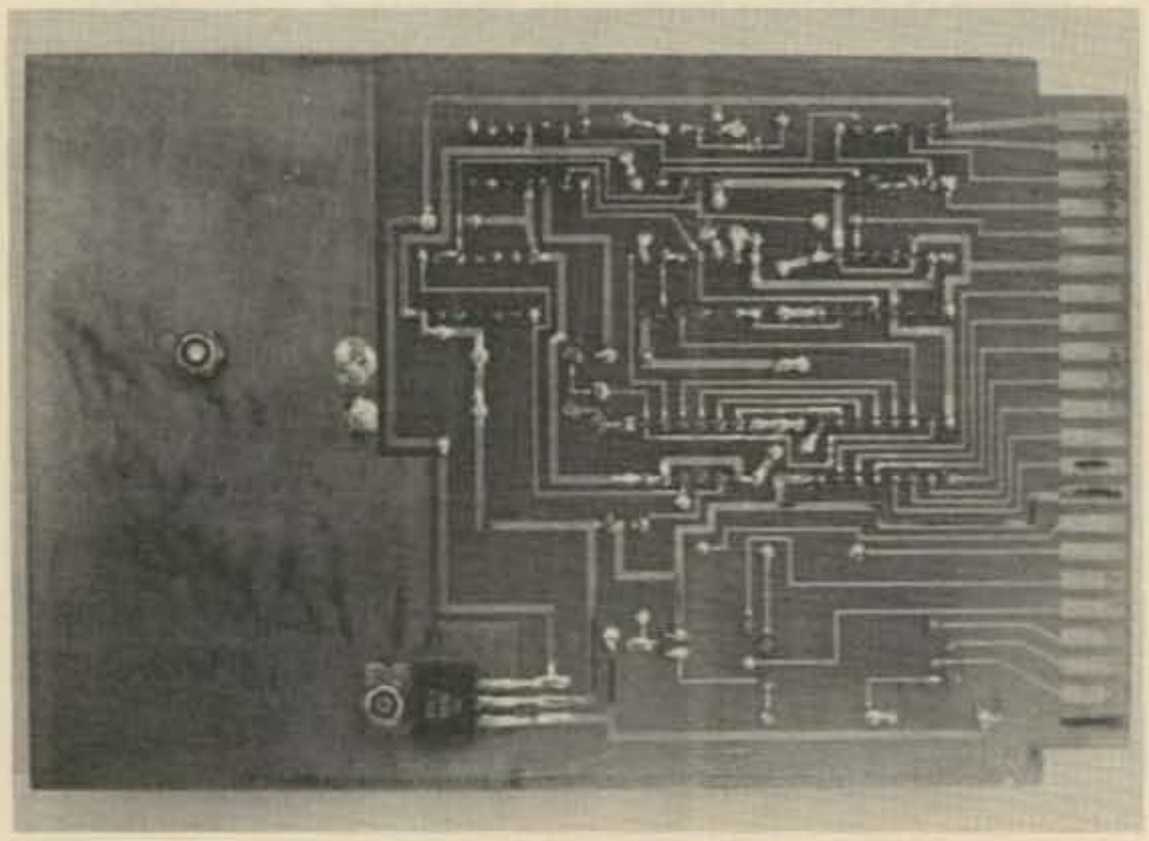
Any local print shop can make the negative (or positive) you need for making your own boards. You can purchase, from Kepro, presensitized boards in the 4 x 6 size. Just follow the directions given in every package of boards and you shouldn't go wrong.

The inductor for the 16 kHz clock oscillator shouldn't be a problem. I have used coils from 3 to 10 millihenries (with the appropriate capacitors) and they worked OK. You can mount the coil on the area used for the 5 volt regulator heat sink. The formula for finding the value of the capacitors is:

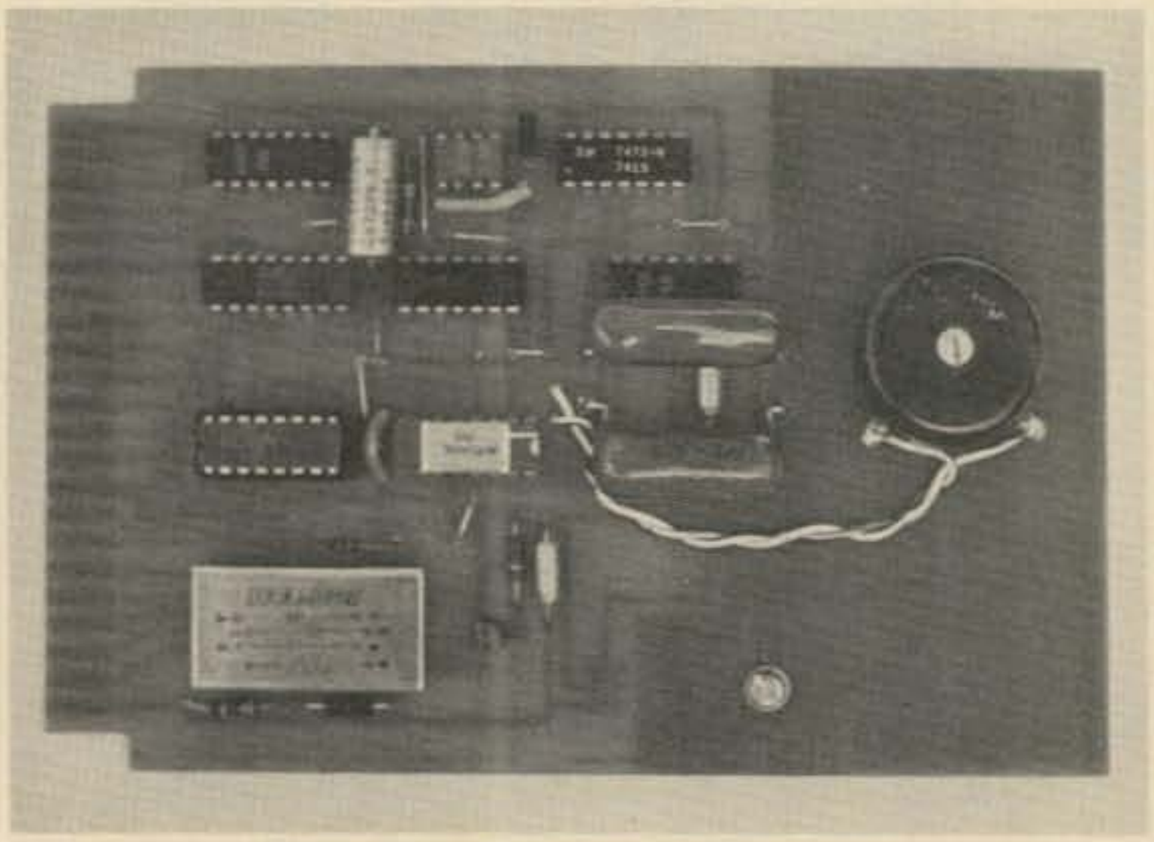
$$C_L\ (uF) = \frac{2}{10\ L(mH)}$$

Cheapskate Shortcuts

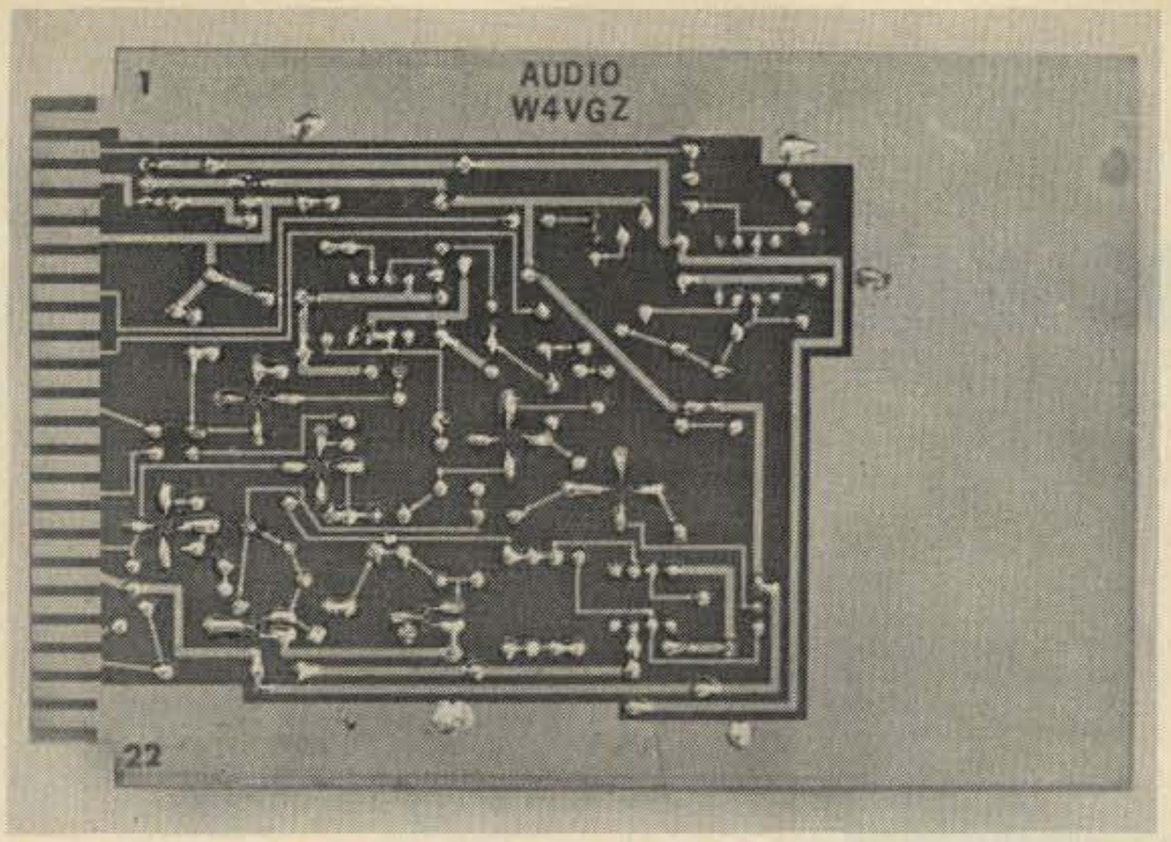
All boards mount in 22-pin card edge connectors. You could solder directly to the fingers and save some



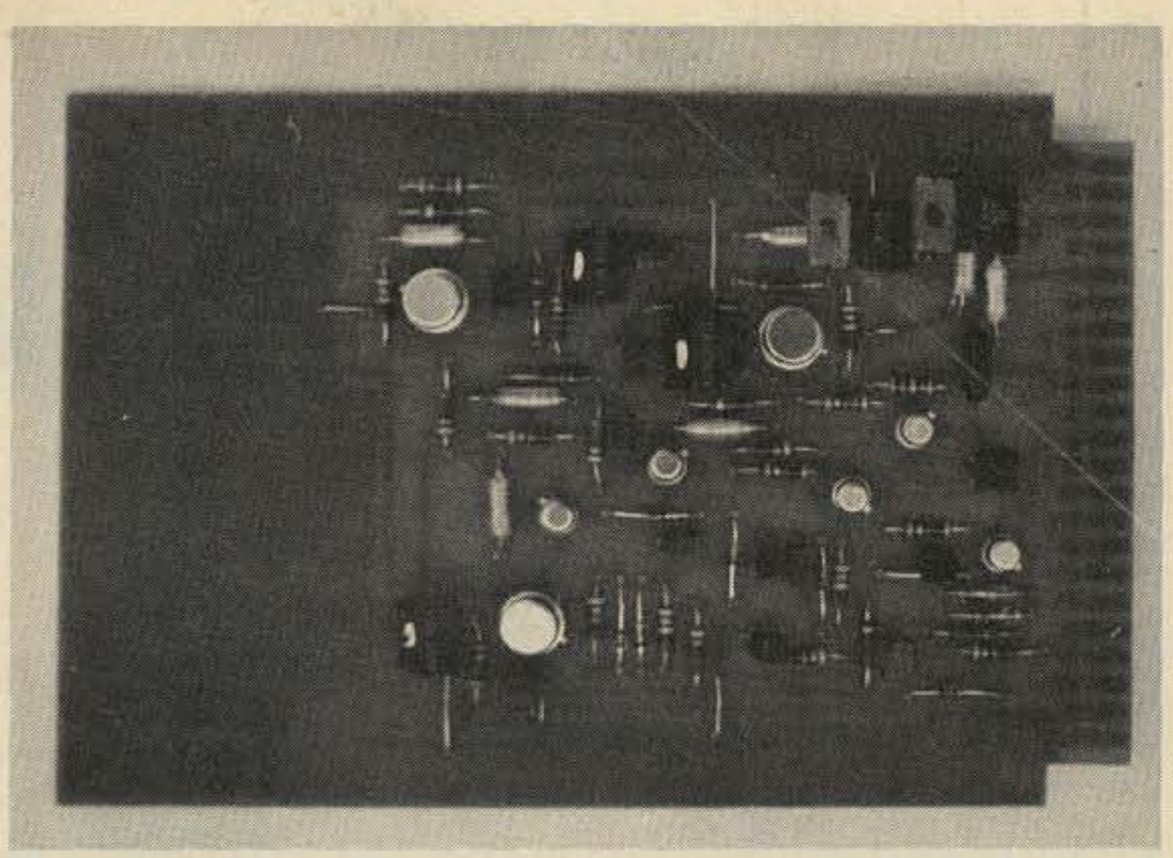
Dialer board, foil side view.



Dialer board, component side view.



Audio board, foil side view.



Audio board, component side view.

money. Fixed value resistors could be used for the audio input on the decoder board to limit the input to less than a quarter of a volt rms or so. The level is not critical at all. You could soldertack a pot to find the value needed for proper frequency and then substitute fixed resistors if you want to save about $15 in pots. Watch out for the orientation of ICs, especially the MC14409. Make sure you don't put them in backwards. Pin 1 on the PC board is square instead of round. You could get by without the LEDs. Just increase the load resistor from 220 Ohms to 1k or so, and put in a strap for the LEDs. A junk box relay could be used (instead of the reed relay specified) and mounted externally to the circuit board; just put in jumpers over to the contact fingers.

Parting Shots

An attempt was made to keep a constant impedance on the phone line between transmit and receive. If there is any problem with the phone company on this, you will have to put in a hybrid coil and take out the FET switch Q6.

One day you might find yourself getting wrong numbers. Check first to determine if the phone company is set up for dual mode signaling on the line. They have a setup so that either dial pulses or touchtone will work. The system used here does not mute the tones, so that both the tone and dial pulses will be present on the line. I have not encountered this personally but have talked to others who have. The circuit shown in Fig. 7 should be used if this is the case.■

Cyril Lievesley WA1LET
142 Brightman St.
Fall River MA 02720

Harness the Wind

- - practical hints

The wind bloweth, and the hams want to use it. The articles that I have been perusing are good in theory. In practice they do not work, period. Even the commercial wind electric generators are very disappointing in performance. I know; when I was young I was making a living making those stupid contraptions work. When the power company brought in the wires, I looked for another job.

If you are interested in putting up a wind electric system, follow the outlines of a good theorist, but do the main things he leaves out, which are: You cannot charge a 12 volt battery with a 12 volt generator, the generator being 30 feet in the air, and the battery under cover at ground level. Even the commercial units try to do this. Also, you cannot light a 12 volt bulb with a 12 volt battery over the house wiring. All that you will get is a red light, depending if the battery is fully charged or not. The secret of a successful wind electric system is to have the generator rated at twice the voltage of the lights, to a voltage regulator positioned close to the battery, with the battery one and one third times the voltage of the lights.

At that time I used a six volt system. Thus, a 12 volt generator to a six volt regulator to an eight volt battery. Four batteries were wired in series-parallel. The wiring must be as heavy as you can afford.

Practicality works when the theory leaves much to be desired. The alternators of today would greatly increase the efficiency of the device, as the wind does not blow steadily. Any questions? ■

APRIL						
SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1 G	2 F
3 P	4 P	5 F	6 F	7 G	8 G Good Friday	9 F
10 P Easter	11 F	12 G	13 G	14 F	15 F	16 G
17 G	18 F	19 G	20 G	21 G	22 G	23 G
24 G	25 F	26 G	27 G	28 G	29 F	30 P

propagation

by
J. H. Nelson

A = Next higher frequency also may be useful

B = Difficult circuit this period

F = Fair

G = Good

P = Poor

EASTERN UNITED STATES TO:												
GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7	7	7A	7A
ARGENTINA	14	14	7B	7	7	7	14	14	14A	21	14A	14
AUSTRALIA	14	14	7B	7B	7B	7	7	7	7	7B	14	14
CANAL ZONE	14	7A	7	7	7	7	14	14	14	14A	14A	14
ENGLAND	7	7	7	7	7	7	7A	14	14	14	14	7A
HAWAII	14	14	7B	7	7	7	7	7	14	14	14	14
INDIA	7	7	7B	7B	7B	7B	14B	14	14	14	14B	7
JAPAN	14	7A	7B	7B	7	7	7	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14B	7B	7B	7B	7B	7	7	7	7A	14B	14
PUERTO RICO	14	7	7	7	7	7	7A	14	14	14	14	14
SOUTH AFRICA	14	7	7	7	7B	14B	14	14	14A	14A	14	14
U. S. S. R.	7	7	7	7	7	7	14B	14	14	14	14B	7
WEST COAST	14	14	7	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:												
ALASKA	14	14	7A	7	7	7	7	7	7	7	7A	14
ARGENTINA	14	14	7B	7	7	7	7A	14	14	14A	21	14A
AUSTRALIA	14	14	7B	7B	7B	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7A	14	14	14	14A	14A
ENGLAND	7	7	7	7	7	7	7	7A	14	14	14	7A
HAWAII	14	14	14B	7	7	7	7	7	14	14	14	14
INDIA	14	14	7B	7B	7B	7B	7B	7B	7	7	7	14B
JAPAN	14	14	7A	7B	7B	7	7	7	7	7	14	14
MEXICO	14	14	7	7	7	7	7	7A	14	14	14	14
PHILIPPINES	14	14	14B	7B	7B	7B	7B	7	7	7A	14B	14
PUERTO RICO	14	7A	7	7	7	7	7A	14	14	14	14	14
SOUTH AFRICA	14	7	7	7	7B	7B	14	14	14	14	14	14
U. S. S. R.	7	7	7	7	7	7	7	7	14	14	7	7

WESTERN UNITED STATES TO:												
ALASKA	14	14	7A	7	7	7	7	7	7	7	7A	7A
ARGENTINA	14	14	7B	7	7	7	7	14	14	14A	21	14A
AUSTRALIA	21	21	14	14	7B	7	7	7	7	7B	14	14A
CANAL ZONE	14	14	7A	7	7	7	7	14	14	14	14A	14A
ENGLAND	7	7	7	7	7	7	7	7	7B	14	14	7A
HAWAII	21	21	14	14	7A	7	7	7	14	14	14	14A
INDIA	14	14	14B	7B	7B	7B	7B	7B	7	7	7	7A
JAPAN	14	14	14	7B	7	7	7	7	7	7	14	14
MEXICO	14	14	7	7	7	7	7	7A	14	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7A	14B	14
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	14	7	7	7	7B	7B	7B	14B	14	14	14	14
U. S. S. R.	7	7	7	7	7	7	7	7	14	7A	7	7
EAST COAST	14	14	7	7	7	7	7	14	14	14	14	14

DIODES/ZENERS

1N914	100v	10mA	.05
1N4004	400v	1A	.08
1N4005	600v	1A	.08
1N4007	1000v	1A	.15
1N4148	75v	10mA	.03
1N753A	6.2v	z	.25
1N758A	10v	z	.25
1N759A	12v	z	.25
1N4733	5.1v	z	.25
1N5243	13v	z	.25
1N5244B	14v	z	.25
1N5245B	15v	z	.25

SOCKETS/BRIDGES

8-pin	pcb	.25	ww	.45
14-pin	pcb	.25	ww	.40
16-pin	pcb	.25	ww	.40
18-pin	pcb	.25	ww	.75
22-pin	pcb	.45		
24-pin	pcb	.35	ww	1.25
28-pin	pcb	.35	ww	1.45
40-pin	pcb	.50	ww	1.95

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25 Amp Bridge 200-prv 2.50

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2N2222	NPN			.10
2N2907	PNP			.15
2N3740	PNP	1A	60v	.25
2N3906	PNP			.10
2N3055	NPN	15A	60v	.50
T1P125	PNP	Darlington		.35

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D.L.747 7 seg 5/8" high com-anode 1.95

XAN72 7 seg com-anode 1.50

FND 359 Red 7 seg com-cathode 1.25

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4000	.20
4001	.20
4002	.25
4004	4.95
4006	1.20
4007	.40
4008	1.20
4009	.25
4010	.45
4011	.20
4012	.20
4013	.40
4014	1.10
4015	.95
4016	.35
4017	1.10
4018	1.10
4019	.70
4020	.85
4021	1.35
4022	1.15
4023	.25
4024	.75
4025	.35
4026	1.95
4027	.50
4028	.95
4030	.45
4033	1.95
4034	2.45
4035	1.25
4040	1.35
4041	.69
4042	.95
4043	1.25
4044	.95
4046	1.50
4049	.80
4050	.70
4066	1.35
4069	.40
4071	.35
4082	.45

— T T L —

7400	.15	7475	.45	74193	.85	74S04	.45
7401	.15	7476	.20	74194	1.45	74S05	.45
7402	.20	7480	.65	74195	.95	74S08	.45
7403	.25	7481	.99	74196	1.50	74S10	.45
7404	.15	7483	1.00	74197	1.25	74S11	.45
7405	.25	7485	1.05	74198	2.35	74S20	.50
7406	.35	7486	.40	74367	.85	74S40	.30
7407	.55	7489	2.50			74S50	.35
7408	.25	7490	.55	75108A	.35	74S51	.45
7409	.15	7491	1.15	75110	.35	74S64	.30
7410	.15	7492	.95	75491	.50	74S74	.50
7411	.25	7493	.45	75492	.50	74S112	1.50
7412	.30	7494	1.25			74S133	.45
7413	.65	7495	.85	74H00	.25	74S140	.75
7414	1.10	7496	.95	74H01	.25	74S151A	.45
7416	.25	74100	1.85	74H04	.25	74S153	.45
7417	.50	74107	.45	74H05	.25	74S158	.45
7420	.15	74121	.40	74H11	.25	74S194	1.50
7426	.40	74122	.55	74H15	.30	74S257 (8123)	.25
7427	.45	74123	.55	74H20	.30	74LS00	.45
7430	.15	74125	.45	74H22	.40	74LS01	.45
7432	.45	74132	1.35	74H30	.25	74LS02	.45
7437	.45	74141	1.30	74H40	.25	74LS04	.55
7438	.35	74150	1.00	74H51	.25	74LS08	.45
7440	.25	74151	.95	74H52	.15	74LS09	.45
7441	1.15	74153	.95	74H53J	.25	74LS10	.45
7442	.65	74154	.75	74H55	.25	74LS11	.45
7443	.95	74156	1.15	74H72	.55	74LS20	.50
7444	.55	74157	.75	74H101	.75	74LS21	.25
7445	.95	74161	1.25	74H103	.75	74LS22	.25
7446	.95	74163	1.25	74H106	.95	74LS32	.55
7447	.95	74164	.95	74L00	.35	74LS37	.40
7448	1.20	74165	1.50	74L02	.35	74LS40	.55
7450	.25	74166	1.35	74L03	.30	74LS42	1.75
7451	.25	74175	.95	74L10	.35	74LS74	.95
7453	.25	74176	1.25	74L30	.45	74LS90	1.30
7454	.25	74180	.85	74L47	1.95	74LS93	1.00
7460	.40	74181	3.25	74L55	.65	74LS107	.95
7470	.45	74182	.95	74L72	.45	74LS153	1.20
7472	.45	74190	1.75	74L75	.55	74LS157	.85
7473	.35	74192	1.65			74LS164	1.90
7474	.40			74S00	.55	74LS367	.85
				74S02	.55	74LS368	.70
				74S03	.50		

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LM308AH	1.00	LM339	.95	LM340K-24	1.25	LM747	1.10
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LM311D (Mini)	.95	LM340T-18	1.65	LM711	.45	LM75451	.65
						NE555	.50
						NE556	1.10
						NE565	.95
						NE566	1.75
						NE567	1.35
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						SN72820	.35

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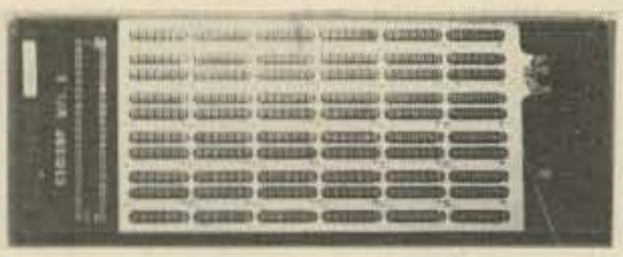

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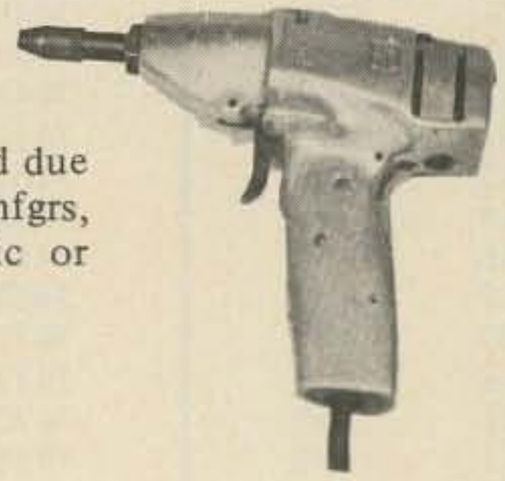

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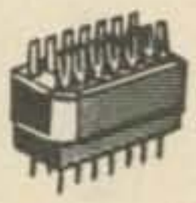

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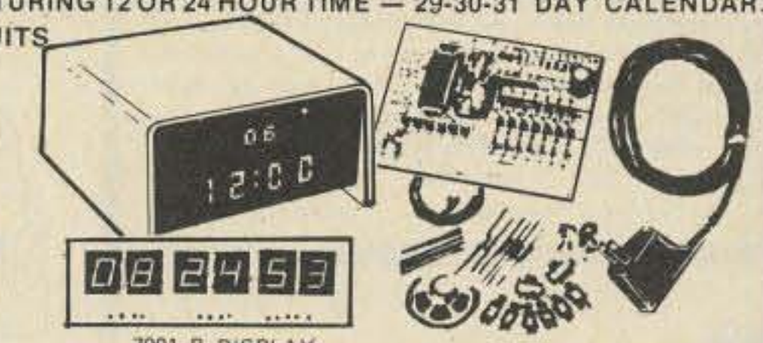

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7001C DISPLAY

7001 B DISPLAY

KITS ARE COMPLETE (**LESS CABINET**) WITH PC BOARDS, POWER SUPPLY, IC & SOCKET, 16 TRANSISTORS, 9 SWITCHES AND ALL REQUIRED PARTS. ALL 7001 KITS FIT CABINET I AND ACCEPT (OPTIONAL) QUARTZ CRYSTAL TIME BASE KIT # TB-1

$39.95 ea.

6 DIGIT LED CLOCK KIT #850-4

12/24 HR. OPERATION BIG .4" DIGITS - 50/60 HZ OPERATION.

KIT INCLUDES
- INSTRUCTIONS
- QUALITY COMPONENTS
- 50 or 60 Hz OPERATION
- 12 or 24 HR OPERATION

6-LED Readouts (FND-359 Red, com. cathode)
1-MM5314 Clock Chip (24 pin)
13-Transistors
3-Switches
6-Capacitors
5-Diodes
9-Resistors
24-Molex pins for IC socket

LARGE .4" DIGITS! ORDER KIT #850-4 AN INCREDIBLE VALUE!

$11.95 ea. QTY. 1-5
$10.95 ea. QTY. 6-11
$9.95 ea. QTY. 12 OR MORE

"Kit #850-4 will furnish a complete set of clock components as listed. The only additional items required are a 7-12 VAC transformer, a circuit board and a cabinet, if desired."

PRINTED CIRCUIT BOARD FOR KIT # 850-4, SCREEN PRINTED DRILLED AND SOLDER PLATED FIBERGLASS $2.95
MINI-BRITE RED LED'S (FOR COLON IN CLOCK DISPLAY) ..... Pkg. of 5-$1.00
MOLDED PLUG TRANSFORMER 115/10 VAC (WITH CORD) $2.50

NOTE: Entire Clock may be assembled on one PC Board or Board may be cut to remote display. Kit # 850-4 will fit Plexiglas Cabinet II.

MOBILE LED CLOCK

12 OR 24-HOUR OPERATION
12 VOLT AC or DC POWERED FOR FIXED OR MOBILE OPERATION.
SIX LARGE .4" DIGITS!
Approx. Size: 1¾"H x 4"W x 4½"D

MODEL #2001

- 6 JUMBO .4" RED LED'S BEHIND RED FILTER LENS WITH CHROME RIM
- SET TIME FROM FRONT VIA HIDDEN SWITCHES • 12/24-Hr. TIME FORMAT
- STYLISH CHARCOAL GRAY CASE OF MOLDED HIGH TEMP. PLASTIC
- BRIDGE POWER INPUT CIRCUITRY — TWO WIRE NO POLARITY HOOK-UP
- OPTIONAL CONNECTION TO BLANK DISPLAY (Use When Key Off in Car, Etc.)
- TOP QUALITY PC BOARDS & COMPONENTS - EXCELLENT INSTRUCTIONS
- MOUNTING BRACKET INCLUDED

KIT #2001 COMPLETE KIT (Less 9V. Battery) **29.95 EA.** 3 OR MORE **$27.95 EA.**
115 VAC Power Pack #AC-1 **$2.50 EA.**

ASSEMBLED UNITS WIRED & TESTED ORDER #2001 WT (LESS 9V. BATTERY) **$39.95 EA.** 3 OR MORE **$37.95 EA.** Assembled Units May Be Mixed With Kits for Qty. Price
WIRED FOR 12 HR. OP. IF NOT SPECIFIED OTHERWISE

JUMBO DIGIT CLOCK KIT
A complete Kit (less Cabinet) featuring: six .5" digits, MM5314 IC, 12/24 Hr. time, 50/60 HZ., Plug-Transformer, Line Cord, Switches, and all Parts. (Ideal Fit in Cabinet II) Kit # 5314-5 ..... **$19.95 ea 2/$38.**

JUMBO DIGIT CONVERSION KIT $ 9.95 ea.
Convert small digit LED clock to large .5" displays. Kit includes 6 - .5" LED's, Multiplex PC Board & easy hook-up info.
Kit # JD-1CC For common Cathode
Kit # JD-1CA for common Anode

PRINTED CIRCUIT BOARDS for CT-7001 Kits sold separately with assembly info. PC Boards are drilled Fiberglass, solder plated and screened with component layout.
Specify for 7001 *B, C or D - $7.95*

TELEPHONE FORMAT KEYBOARD
BY Chomerics
$4.95 2-1/4"x3" 5/32" thick
6/$28. # EF-21360

25 AMP BRIDGE

$1.95 ea. 3/$5.00
100 PIV

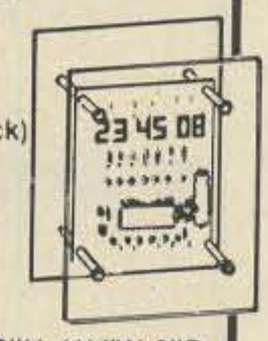
CABINET I
3"H, 6¼"W, 5½"D
CABINET II
2½"H, 5"W, 4"D
Great for Clocks or any LED Digital project. Clear-Red Chassis serves as Bezel to increase contrast of digital displays.
Black, White or Clear Cover
ANY SIZE/COLOR **$6.50 ea. 2/$12.**

RED OR GREY PLEXIGLAS FOR DIGITAL BEZELS
3"x6"x1/8" **95¢ ea. 4/$3**

60 HZ. XTAL TIME BASE
Will enable Digital Clock Kits or Clock-Calendar Kits to operate from 12V DC.
1"x2" PC Board
Power Req: 5-15V (2.5 MA. TYP.)
Easy 3 wire hookup
Accuracy: ± 2PPM
#TB-1 (Adjustable)
Complete Kit **$4.95 ea.**
Wir & Cal $9.95

SEE THE WORKS Clock Kit
Clear Plexiglas Stand
Kit #850-4 CP
- 6 Big .4" digits
- 12 or 24 hr. time
- 3 set switches (back)
- Plug transformer
- all parts included

Plexiglas is Pre-cut & drilled



Size: 6"H, 4⅓"W, 3"D

A SUPER LOOKING CLOCK!
$23.50 ea. 2/$45.

7-SEG LED

COMMON CATHODE

	COLOR	HT.	DEC PT.	PR EA.
FND-359	RED	.4"	RHDP	$ .95
FND-503	RED	.5"	RHDP	$1.35
DL-750	RED	.6"	LHDP	$2.95
XAN-654	GREEN	.6"	NDP	$1.95
XAN-664	RED	.6"	NDP	$1.95

COMMON ANODE

DL-747	RED	.6"	LHDP	$1.95
XAN-72	RED	.3"	LHDP	$1.25
MAN-72	RED	.3"	LHDP	$1.25
XAN-81	YELLOW	.3"	RHDP	$1.75
XAN-351	GREEN	.3"	RHDP	$1.50
XAN-361	RED	.3"	RHDP	$1.50
XAN-362	RED	.3"	LHDP	$1.50
XAN-662	RED	.6"	NDP	$1.95
XAN-692	RED	.6"	NDP	$1.95

SET OF 6 FND-359 WITH MULTIPLEX PC BOARD — 6.95

Fairchild Super Digit FND-359
.4" Char. Ht. 7 segment LED RED Com. Cath. Direct pin replacement for popular FND-70.

95¢ ea, 10/$8.50 100/$79.00

MOLEX PINS
Form Inexpensive Sockets

100 for $1.25
Reel of 1000 - $8.50

SCHOTTKY TTL

74S00	$ .35
74S01	.40
74S04	.55
74S05	.60
74S09	.55
74S10	.40
74S20	.50
74S22	.45
74S40	.45
74S50	.45
74S51	.55
74S60	.85
74S64	.55
74S74	.85
74S75	1.75
74S78	1.50
74S86	.95
74S107	.95
74S112	.95
74S113	1.40
74S114	.95
74S133	.75
74S134	.75
74S138	1.75
74S139	1.50
74S151	1.95
74S153	1.95
74S155	1.95
74S156	1.95
74S157	1.80
74S158	2.50
74S174	2.50
74S175	2.50
74S181	2.95
74S182	1.95
74S251	2.75

DIGITAL CLOCK IC's

MM 5312	$ 4.95
MM 5314	3.95
MM 5375 AB	3.95
CT-7001	7.95
CT-7002	13.95
50380	3.95
MM 5369	2.50

LED DRIVERS

7447	$ .95
7448	.95
75491	.65
75492	.65

VOLTAGE REGULATORS

LM 309 H	TO-5	$ .95
LM 309 K	TO-3	1.25
7805	TAB	.95
7812	TAB	1.25
7812	TO-3	1.50
7815	TO-3	1.25
7815	TAB	1.25
78L 15	TO-5	.75
7824	TO-3	1.25
723	DIP	.75
723	TO-5	.75

PROM

1702	E Prom $8.95
5203	E Prom $8.95

SWITCHES

ROCKER SPDT	6/$1.
MINI-SLIDE SPDT	5/$1.
REG. SLIDE DPDT	6/$1.
PUSH BUTTON N.O.	3/$1.
MINI SPDT	$1.30
TOGGLE DPDT	1.50

IC SOCKETS

PINS	1-24	25	100
8	$ .25	$ .22	$ .20
14	.25	.22	.20
16	.28	.25	.23
18	.31	.28	.26
24	.50	.45	.40
28	.60	.55	.50
40	.75	.70	.65

XTAL
3.579545 MHZ. $1.95

EXAR

XR 2556	$ 1.75
XR 2567	$ 1.95

TRANSISTORS

2N2222	TO-18	5/$1.00
2N2554	TO-5	2/$1.00
2N2712	TO-98	5/$1.00
2N3415	TO-98	5/$1.00
2N3704	TO-92	5/$1.00
2N4400	TO-92	5/$1.00
2N4125	TO-92	5/$1.00
2N4249	TO-92	5/$1.00
2N4437	TO-92	5/$1.00
2N6027	PUT	2/$1.00
2N5457	N J-Fet	2/$1.00

DIODES

IN 4002	1A, 100 PIV	12/$1.00
IN 4005	1A, 600 PIV	11/$1.00
IN 4007	1A, 1000 PIV	10/$1.00
RECTIFIER	2.5A, 1000 PIV	4/$1.00
IN 914	SIL. SIGNAL	20/$1.00
IN 4148	SIL. SIGNAL	20/$1.00
DYAC	28V.	4/$1.00

LINEAR

555 TIMER	2/$1.00
556 DUAL TIMER	.95
565 PLL	.95
566 FUNCTION GEN.	1.75
567 TONE DECODER	1.75

TRANSISTOR SOCKET TO-5/18 GOLD PINS
5/$1.00

NYLON WIRE TIES
.8" TIE-WRAP 100/$1.95
4" TIE-WRAP 100/$1.75

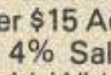
MOLEX PINS
REEL OF 1000 $ 8.50
STRIP OF 100 1.25

PLUG TRANSFORMERS

12 VAC at 150 MA	$ 2.50
12 VAC at 500 MA	3.50
7VAC at 1.75 VA	$3.50

OP AMPS
3/$1.00
301 TO-5
709 TO 5
741 DIP
741 M-DIP
741 TO-5
748 DIP

DISCRETE LED's
JUMBO RED



10 FOR $1.00
100 FOR $9.50

PC TRIM POTS
25K 6/$1.00
4.7K 6/$1.00

SPECTROL 10K 10 TURN
95c
4/$3.00

PRESCALE

11C90DC	$15.95
95H90	9.95

MEMORY
450 ns Fairchild 1K Ram low, low, low power.
2102L1PC
25-99 $1.95 ea.
100-199 $1.75 ea.
200 or more $1.60 ea.
$1.45 ea.

CPU NS8080AD
Micro Processor Chip
Prime National LSI
$19.95 ea.
40 Pin socket **$.50** with each 8080A!

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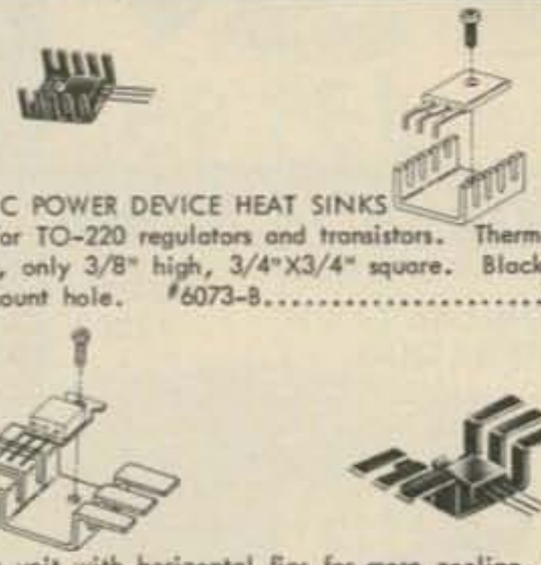
OTHERS ADD 5%, 10% AIR MAIL. **03**

- Accuracy: ±0.05% of Reading ±1 Count
- Two Voltage Ranges: 1.999 V and 199.9 mV
- Up to 25 Conversions/s
- Z_{in} > 1000 M ohm
- Auto-Polarity and Auto-Zero
- Single Positive Voltage Reference
- Standard B-Series CMOS Outputs--Drives One Low Power Schottky Load
- Uses On-Chip System Clock, or External Clock
- Low Power Consumption: 8.0 mW typical @ ±5.0 V
- Wide Supply Range: e.g., ±4.5 V to ±8.0 V

MC14433 SINGLE CHIP 3½ DIGIT A/D
Single chip combines linear and CMOS digital to bring you the simplest yet DVM approach. Requiring only 4 external passive parts, this subsystem gives you: Auto polarity, auto zero, single voltage reference, 8 mW operation, overrange, underrange signals, 25 conversions per second and .05% ± 1 count accuracy! 100 uV resolution. 24 Pin DIP.
MC14433P.....with specs.....$19.55



PLASTIC POWER DEVICE HEAT SINKS
Ideal for TO-220 regulators and transistors. Thermalloy low profile, only 3/8" high, 3/4"X3/4" square. Black anodized, with mount hole. #6073-8..... 4/$1

Larger unit with horizontal fins for more cooling. Still only 3/8" high for board to board clearance. #6070-8.... 3/$1

12 AMP 50 VOLT BRIDGE
Motorola MDA-980-1..... $1.49

2N2222 .....PRIME PARTS.....5/$1.00

CONVERTER/REGULATOR COMPONENT SET
Set of two parts to build small highly efficient voltage converter/regulator. Consists of a T.I. switching regulator and a miniature power inductor. You add 3 ordinary resistors (or pot) and 2 capacitors to make a complete system which can be mounted on your P.C. board.

3 Operating Modes:
.Regulates down
.Converts up and regulates
.Converts negative and regulates

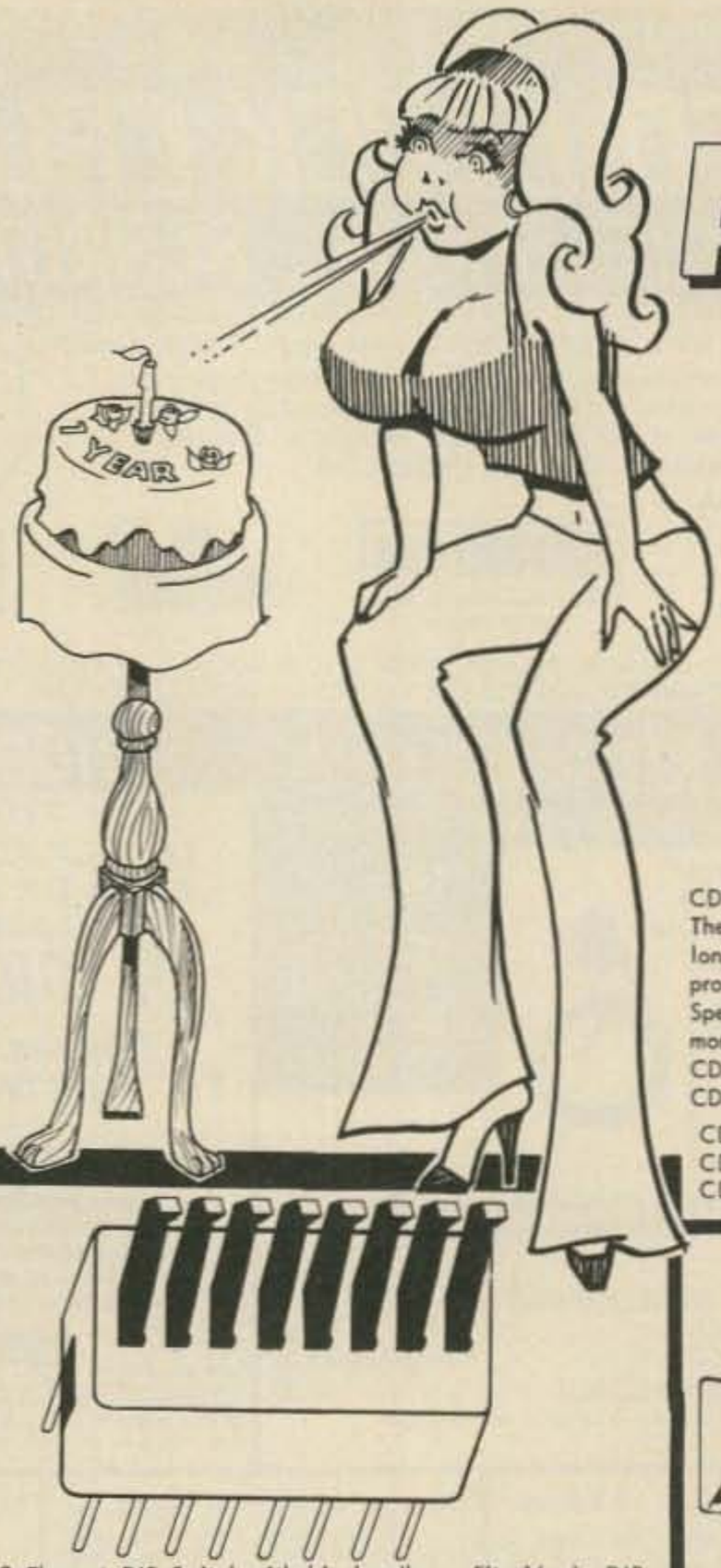
Input: +4.5V to +12V
Output: Up to +30V
Down to -25V
500mA max
Can be current limited for extra safety.
Use external diode and buffer transistor for greater current capacity.

Ideal for use with single channel MOS memories, UARTS, microprocessors, portable and 6V automobile clocks.
Set of 2 parts and specs and application data.....$9.50

MM5865 UNIVERSAL TIMER I.C.
A truly universal timer can be used for a stopwatch, kitchen timer, oven timer, event timer/counter, rally timer-----. 7 functions, two counters, internal comparators, on chip oscillator. Memory for rally with total elapsed time. Can be cascaded---selectable resolution--count up or down ---selectable modulo for time or event count. Operate on 7 to 20 volts at about 7mA.
MM5865N..... $8.75
Specs and applications..... 60¢

MIL RANGE 5V REGULATOR.
Want a little better performance from your 5V supply? LM140K in TO-3 from contract cancellation brings you a superior part at the price of plastic regulator.
LM140K.....$1.95

LM1889 TV VIDEO MODULATOR
The LM1889 is designed to interface audio, color difference, and luminance signals to the antenna terminals of a TV receiver. It consists of a sound subcarrier oscillator, chroma subcarrier oscillator, quadrature chroma modulators, and R.F. oscillators and modulators for two low-VHF channels.
The LM1889 allows video information from VTR's, games, test equipment, or similar sources to be displayed on black and white or color TV receivers.
LM1889 with 16 pages of data $9.95, data only, $1.00



AMP'L ANNY Says

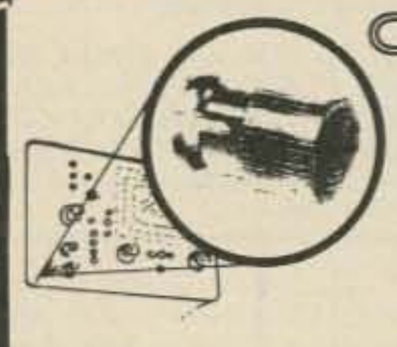
I'm one year old this month goin' on two - the folks at Tri-Tek will be bringing you full growed values in electronic parts and the latest in books and data.
They've been doin it for six years now----------

COS-MAC'S BACK!

CDP1802 COSMAC IS BACK IN STOCK !!!!!!!!!
The famous and very popular 1802 is here again after a long dry spell. This is the little 8 bit CMOS microprocessor which sold out on our first offering.
Special AMP'L ANNY birthday price of $29.95 for the month of APRIL only!!
CDP1802.....$29.95
CDP1852..... Parallel adapter..... $15.95
CDP1821SCD.....$24.62
CDP1822SCD.....$25.80
CDP1824CD.....$13.35

8 Element DIP Switch with big handles. Fits 16 pin DIP sockets. Right for those on board programs.
DIS-MX08.....$1.79

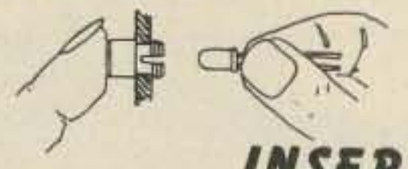
DATA BOOKS BY NATIONAL SEMICONDUCTOR
DIGITAL. Covers TTL, DTL, Tri-State, etc.....$3.95
LINEAR. Covers amplifiers, pre-amps, op-amps... $4.25
LINEAR APPLICATIONS VOLUME I. Dozens of application notes and technical briefs covering the use of op-amps, regulators, phase locked loops and audio amps..... $3.25
LINEAR APPLICATIONS VOLUME II. Takes up where Volume I left you--All the latest linear devices. Along with Vol I you have a great source of application data on the most widely used devices as well as new types just appearing.....$3.25
CMOS Gates, Flip Flops, registers, etc.....$3.00
VOLTAGE REGULATORS, A must for anyone making a power supply. Complete theory including transformers, filters, heat sinks, regulators etc..... $3.00
MEMORY. Info on MOS and Bipolar memories, RAMS ROMS, PROMS and decoder/encoders..... $3.95
INTERFACE. Covers peripheral drivers, level translators, line driver/receivers, memory and clock drivers, sense amps, display driver and opto-couplers..... $3.95
SPECIAL FUNCTIONS DATA BOOK, Contains detailed information for specifying and applying special amplifiers, buffers, clock drivers, analog switches and D/A-A/D converter products..... $3.25
AUDIO HANDBOOK Contains detailed discussions, including complete design particulars, covering many areas of audio with real world design examples... $3.25
----------SPECIAL----------
DATA BOOKSHELF, Buy all ten of the National Data books at one time and save $5.10!!!.....$30.00
(All books shipped ppd in US only. Foreign orders please add shipping for 1.5 lbs per book)



CLIPLITE™
COMBINATION LENS AND MOUNTING DEVICE FOR T 1¾ LED

REQUIRES NO TOOLS

SNAP CLIPLITE



INSERT LED

AVAILABLE IN TRANSPARENT RED · GREEN · AMBER · CLEAR & YELLOW

CLIPLITE
Combination lens and mounting device for T 1-3/4 LED. The CLIPLITE combines the benefits of the present LED display panel mounting methods and eliminates their deficiencies. Requires no special tools and installs in 6 seconds in .250" hole. Simple two-step installation. Just snap CLIPLITE, insert LED. Available in transparent red, green, amber, clear and yellow. Specify colors, any mix.
5/$1.00, 10/$1.90, 20/$3.50, 50/$7.50, 100/$13.50

30V DIAC. Tiny glass diode for triggering SCR's and triacs. Improve your firing circuit for more reliable and repeatable operations. At a fraction of the O.E.M. price!! DIA-0030.....10/$1

MINIATURE POWER SUPPLY
5V, .25A, P.C. mounting module supplies logic voltage from 105-125VAC input, 50-400HZ. Ultrastable and noise free with external trim capability. Made by PMC. (Model MM-5BL).....$15.95

LINEAR CONTROL DATA BOOK
T.I. linear products data and applications. Price includes shipping charge, U.S. only..... $4.25
Outside U.S., add postage for 2 lbs.

NEW BOOK FROM NATIONAL
MOS LSI. Giant data book filled with Specs and apps on large scale MOS circuits from National Semiconductor Corporation. Price includes shipping in U.S. only...$4.25
Outside U.S., add postage for 2 lbs.

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T1

The SUPER COMPACT
$13.95 Complete

.4" LED

12 or 24 Hr.

Includes: All Parts, PC Board
Power Supply & Case

Colors: Black, Silver, or Gold
Size: 4.75" x 1.8" x 1.4"
Material: Extruded Alum.

OPTION — Temperature Ind. Front Panel — $3.00

BIG-BRIGHT - .5" LED ALARM CLOCK
6 DIGIT AC or DC or ELAPSED TIMER KIT

$19.95 Complete

- PC Board Drilled & Silk Screened (Includes Xtal Time Base Circuitry)
- 5375 Nat. Clock Chip & Fairchild Displays
- Includes EVERY part required for clock and all options except Cabinet and Crystal Time Base components. If desired, see below.
- Brightness Control
- Freeze feat. on every mode
- Field Tested over 1 Yr.
- 24 Hr. Alarm w/snooze
- 0-60 Min. Elapsed Timer
- 12 Hr., 60 Hz oper.

Most Important — Complete Instructions, schematics Pictorials, layouts — everything for trouble free assembly

OPTION — XTAL Time Base Components - $2.95 when purchased w/clock

Clock Kit Accessories

Wooden Case - Walnut gr. incl. Filter ..... **$4.00 each**
Dimension - 6 5/16" W x 2 9/16" H x 3 7/16" D (⅜" Material)

Plexiglass Case (Ch. - Bl., White, Blue, & Smoke) incl. Filter ..... **$3.00 each**
Dimensions - 5 13/16" W x 2 1/4" H x 5 3/8" D (⅛ Material)

Individual Filters - Red, Smoke, Blue, Amber and Green ..... **$.60 each**

60 Hz. Crystal Time Base
For: Cars, Boats Campers, Field Use
$4.95 COMPLETE

KIT INCLUDES: P.C. Board Drilled & Silk Screened
Crystal, MOS 17 Stage Divider IC, all necessary components, Inst. Sheets & Specs.

FEATURES:
- 60 Hz output
- Low Power Drain
- Accuracy
- Small Size
- Direct interface with all MOS Clock Chips

AC/DC - ALARM Clock Kit - 12/24 Hr.
$7.50 quantities of 1-5 **$6.50** quantities of 6 & up

- **Your choice of Display Colors - Red, Green, Blue, Amber**
- Displays Hrs. & Min. - Switch to Min. & Secs. on Command
- AM/PM Indication
- Field Tested for 6 months

The kit will include a 5316 National Clock Chip, 4 Flourescent Display tubes, all electronic components, switches, controls & complete instructions, specs, etc. for clock and all optional Features. Other parts required or if desired are as follows:

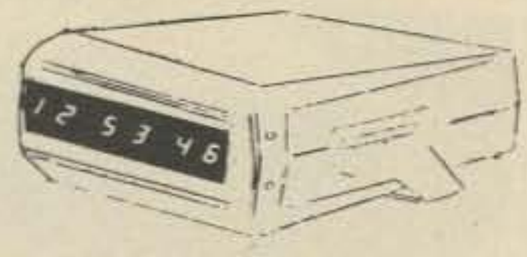
- PC Board, Drilled & Silk Screened for Clock & all options $3.00
- Xformer (for AC oper.) — $1.00
- App. (SCR output) timer kit — $2.00
- Speaker Alarm Kit — $2.00
- Count Down (turn-off) timer kit — $2.00

Blinky/Flasher/Timing Kit
$2.50 each 5 for $10.00

Kit includes:
P.C. Board, 555 Timer, all components and a connector for a 9V Battery

6 DIGIT LED MOBILE
Clock Kit & Elapsed Timer

.4" Digits 12 or 24 Hr.
Quartz Crystal Controlled
12 Volt DC or AC operation



- Protection from noise & High Impulses
- Display Blanking Capability
- Battery Back-Up Capability
- Size: 4" x 1¾ x 4½"
- Rugged High Impact ABS
- Recessed Front Switches

$27.95 Complete
(less 9V battery)

OPTION — AC Adaptor $2.50

Big Digits

THE BIG ONE
.8" LED Alarm Clock Kit

Big Bargain Price

$17.95 ea.

Includes:
PC Board, Clock Chip, Switches
Fairchild .8" Display Module,
xistors, resistors, capacitors,
Complete Instructions

Features:
- Hrs. & Min. Switch to Min. & Sec. on Command
- 12 Hr. - 24 Hr. Alarm
- 10 Min. Snooze
- AM/PM Indicators
- Sleep Output

SPECIALS

8080A Microprocessor	$19.95 ea.
21L02-1 Low Power 500NS RAM	$1.95 ea.
.6" Display Common Anode or Cathode	$1.95 ea.
.5" Fairchild Display Com. Anode or Cathode (Same as FTK 0001 & FTK 0002)	79¢ ea.
.8" 3½ Digit Display Module (Same as FTK 0010)	$5.40
LM340T Series Regs. - 5, 6, 12, 15 & 24 V (pos.) Monthly Special	79¢ ~~99¢~~
LM309K - 5 Volt Regulator - Raytheon	79¢
LM741 Op. Amp. 14 Pin Dip Pkg.	4 for 99¢
2N3055 NPN Transistor TO-3 Pkg.	59¢
2N4904 PNP (complement to 2N3055)	69¢
25 Amp - 200 Volt Full Wave Bridge	$1.49
10 Pk - 220 Power Tab Xistors, NPN & PNP Asst.	$1.49
15 Pk - LED's Assorted Sizes and Colors	$1.49
Bi-Polar LED - Red/Green	$1.00

6 Digit LED Stop-Watch Kit
Split Time **$29.95 complete** Taylor Time

FEATURES:
- Simple construction needing only the parts listed below
- Small enough for hand held case
- Needs only 3-AA cell batteries

KIT INCLUDES:
- Latest Technology Intersil Mos Chip # 7205
- 3.2768 MHz Crystal
- Variable Trimmer Cap
- 2 mini slide & 3 MOM. PB Switches
- 3 pairs (6 digits) Double Digit LED Displays

P.C. BOARD for above

Hand held case designed for above $3.95

HOBB-Y-TRONIX, INC.
Box 511, Edison, N.J. 08817

Orders must incl. Ck. - No COD's - Add $1.00 handling for orders under $25.00
Outside Cont. USA add 5% Postage - 10% Air Mail - N.J. resid. add 5% Tax H11

SIX DIGIT

12/24 HOUR

CLOCK KIT

$22.95

MODEL DC-5

The best looking, most complete kit on the market! Features include: Time set pushbuttons, jumbo .4" readouts, Polaroid lens filter, line cord transformer, super quality PC boards and durable extruded aluminum base in 5 colors. All parts are included which make this kit the best value anywhere. Super instructions reduce assembly time to only 1-2 hours. Fully guaranteed. Colors available: gold, silver, bronze, blue and black (specify).

MOBILE VERSION, .01% accuracy, 12VDC, DC-7	**$25.95**
ALARM CLOCK, 12 HR only, DC-8	**$24.95**
TIME BASE KIT, use with any 60Hz clock	**$ 4.95**

CALENDAR-ALARM-CLOCK
6 digit LED 12/24 Hour

Has every feature one could ever ask for. Kit includes everything except case, build it into wall, station or even car!

FEATURES:

- 6 Digits, .5" High LED
- 12/24 Hour Format
- Calendar shows mo./day
- Snooze button
- True 24 Hour Alarm
- 7001 chip does all!!
- Battery back up with built in on chip time base

Complete Kit, less case, DC-9 ..... $34.95

CHEAP CLOCK $8.95

FEATURES: DC-4

- 12/24 Hour format
- 6 digits, .4" high LED
- Time set buttons
- Instructions
- PC board & transformer not included

Board, etched & drilled	$2.95
Transformer, lug type	$1.49
Transformer line cord	$1.98

30 WATT 2 Meter Power Amp

The famous RE class C power amp now available mail order! Four Watts in for 30 Watts out, 2 in for 15 out, 1 in for 8 out. Incredible value complete with all parts, instructions and details on T R relay. Fully stable, output short proof, infinite VSWR protected! Case not included.

Complete Kit $22.95

600 MHz PRESCALER

$59.95

assembled and tested. Extend the range of your counter to 600 MHz. Works with most counters. Available in kit form for $44.95. Specify -:-10 or -:-100 with order.

COMING SOON:
VIDEO TERMINAL KIT

SEND STAMP FOR DETAILS

$129.95

741 OP-AMP SPECIAL

Factory prime mini dip with both Xerox and 741 part numbers

10 for $2.00

TTL		LINEAR		REGULATOR		TRANSISTORS	
74S00	.35	555	.50	309K	.99	NPN 2N3904 type	10/$1.00
74S112	.75	556	.75	309H	.99	PNP 2N3906 type	10/$1.00
7447	.79	567	1.75	340K-12	.99	NPN Power Tab 40W	3/$1.00
7473	.35	1458	.65	7805	.99	PNP Power Tab 40W	3/$1.00
7475	.50	LED DRIVER		7812	.99	FET MPF-102 type	3/$2.00
7490A	.55	75491	.50	7815	.99	UJT 2N2646 type	3/$2.00
74143	3.50	75492	.50	7818	.99	2N3055 NPN Power	.75

DIODES: 1KV, 2.5A ..... 5/$1.00 100V, 1A ..... 10/$1.00 1N914 type ..... 50/$2.00

LED READOUTS: Com. Anode .5" FND 510 ..... $1.25 Com. Cath .4" FND 359 ..... $.75
Polaroid Filter, red 1.125" x 4.25" ..... $.59 DL-33 3 digit .1" ..... $.50

FERRITE BEADS with info & specs.	15/$1.00
6 hole Balun Beads	5/$1.00
SLIDE POT - 10K linear	4/$1.00
1000uf 15V FILTER CAP	5/$1.00

SOCKETS

14 PIN	5/$1.00
16 PIN	5/$1.00
24 PIN	2/$1.00
40 PIN	3/$2.00

SOCKET KIT

Assortment of 12 most used IC sockets. Good to have around the shop. $1.95

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MINI-KITS

FM WIRELESS MIKE KIT

FM-1 $2.95

Transmit up to 300' to any FM radio. Sensitive mike input requires dynamic, crystal or ceramic mike. Runs on 3 to 9 volts.

TONE DECODER KIT

A complete tone decoder on a single PC Board. Features: 400 to 5000 Hz adjustable frequency range, voltage regulation. 567 IC. Useful for touch-tone decoding, tone burst detection, FSK demod, signaling, and many other uses. Use 7 for 12 button touchtone decoding. Runs on 5 to 12 volts.

Complete Kit, TD-1 ..... $4.95

LED BLINKY KIT

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons or warning type panel lights.

Complete Kit, BL-1 ..... $2.95

SUPER-SNOOP AMPLIFIER

A super-sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as a general purpose test amplifier. Full 2 watts of output, runs on 6 to 12 volts, uses any type of mike. Requires 8-45 ohm speaker.

Complete Kit, BN-9 ..... $4.95

MUSIC LIGHTS KIT

See music come alive! 3 different lights flicker with music or voice. One light for lows, one for the mid-range and one for the highs. Each channel individually adjustable, and drives up to 300 watts. Great for parties, band music, nite clubs and more.

Complete Kit, ML-1 ..... $7.95

SIREN KIT

Produces upward and downward wail characteristic of police siren. 200mw audio output, runs on 3-9 volts, uses 8-45 ohm speaker.

Complete Kit, SM-3 ..... $2.95

CODE OSCILLATOR KIT

Powerful 1 watt audio oscillator of approx. 1 kHz, good for many uses. Great for warning alarm, battery checker, voltage indicator and code oscillator.

Complete Kit, CPO-1 ..... $2.50

POWER SUPPLY KIT

Complete triple regulated power supply provides variable ±15 volts at 200ma and +5 volts at 1 amp. 50mv load regulation good filtering and small size. Kit less transformers. Requires 6-8V at 1 amp and 18 to 30VCT.

Complete Kit, PS-3LT $6.95

DECADE COUNTER PARTS KIT

Includes: 7490A 33 MHz counter, 7475 latch, 7447 LED driver, LED readout, current limit resistors, hook up details and instructions on how to build an easy low cost freq. counter.

Kit of Parts, DCU-1 ..... $3.50

7400N TTL

SN7400N	.16	SN7459A	.25		
SN7401N	.16	SN7460N	.22	SN74154N	1.00
SN7402N	.21	SN7470N	.45	SN74155N	.99
SN7403N	.16	SN7472N	.39	SN74156N	.99
SN7404N	.18	SN7473N	.37	SN74157N	.99
SN7405N	.24	SN7474N	.32	SN74160N	1.25
SN7406N	.20	SN7475N	.50	SN74161N	.99
SN7407N	.29	SN7476N	.32	SN74163N	.99
SN7408N	.25	SN7479N	5.00	SN74164N	1.10
SN7409N	.25	SN7480N	.50	SN74165N	1.10
SN7410N	.18	SN7482N	.98	SN74166N	1.25
SN7411N	.30	SN7483N	.70	SN74167N	5.50
SN7412N	.33	SN7485N	.89	SN74170N	2.10
SN7413N	.45	SN7486N	.39	SN74172N	8.95
SN7414N	.70	SN7488N	3.50	SN74173N	1.50
SN7416N	.35	SN7489N	2.49	SN74174N	1.25
SN7417N	.35	SN7490N	.45	SN74175N	.99
SN7420N	.21	SN7491N	.75	SN74176N	.90
SN7421N	.33	SN7492N	.49	SN74177N	.90
SN7422N	.49	SN7493N	.49	SN74180N	.99
SN7423N	.37	SN7494N	.79	SN74181N	2.49
SN7425N	.29	SN7495N	.79	SN74182N	.95
SN7426N	.29	SN7496N	.89	SN74184N	1.95
SN7427N	.37	SN7497N	4.00	SN74185N	2.20
SN7429N	.42	SN74100N	1.00	SN74186N	15.00
SN7430N	.26	SN74107N	.39	SN74187N	6.00
SN7432N	.31	SN74121N	.39	SN74188N	3.95
SN7437N	.27	SN74122N	.39	SN74190N	1.19
SN7438N	.27	SN74123N	.50	SN74191N	1.25
SN7439N	.25	SN74125N	.60	SN74192N	.89
SN7440N	.15	SN74126N	.60	SN74193N	.89
SN7441N	.89	SN74132N	1.09	SN74194N	1.25
SN7442N	.59	SN74136N	.95	SN74195N	.75
SN7443N	.75	SN74141N	1.15	SN74196N	1.25
SN7444N	.75	SN74142N	4.00	SN74197N	.75
SN7445N	.75	SN74143N	4.50	SN74198N	1.75
SN7446N	.81	SN74144N	4.50	SN74199N	1.75
SN7447N	.69	SN74145N	1.15	SN74200N	5.59
SN7448N	.79	SN74147N	2.35	SN74279N	.90
SN7450N	.26	SN74148N	2.00	SN74251N	1.79
SN7451N	.27	SN74150N	1.00	SN74284N	6.00
SN7453N	.27	SN74151N	.79	SN74285N	6.00
SN7454N	.20	SN74153N	.89	SN74367N	.75

MANY OTHERS AVAILABLE ON REQUEST
20% Discount for 100 Combined 7400's

CMOS

CD4000	.25			74C04N	.75
CD4001	.25			74C10N	.65
CD4002	.25	CD4035	1.85	74C20N	.65
CD4006	2.50	CD4040	2.45	74C30N	.65
CD4007	.25	CD4042	1.90	74C42N	2.15
CD4009	.59	CD4044	1.50	74C73N	1.50
CD4010	.59	CD4046	2.51	74C74	1.15
CD4011	.25	CD4047	2.75	74C90N	3.00
CD4012	.25	CD4049	.79	74C95N	2.00
CD4013	.47	CD4050	.79	74C107N	1.25
CD4016	.56	CD4051	2.95	74C151	2.90
CD4017	1.35	CD4053	2.95	74C154	4.00
CD4019	.55	CD4060	3.25	74C157	2.15
CD4020	1.49	CD4066	1.75	74C160	3.25
CD4022	1.25	CD4069	.45	74C161	3.25
CD4023	.25	CD4071	.45	74C163	3.00
CD4024	1.50	CD4081	.45	74C164	3.25
CD4025	.25	CD4511	2.50	74C173	2.60
CD4027	.69	CD4518	2.50	74C193	2.75
CD4028	1.65	MC14566	3.00	74C195	2.75
CD4029	2.90	74C00N	.39	MC4044	4.50
CD4030	.65	74C02N	.55	MC14016	.56

LINEAR

LM300H	.80			LM1310N	2.95
LM301H	.35			LM1351N	1.65
LM301CN	.35			LM1414N	1.75
LM302H	.75			LM1458C	.65
LM304H	1.00	LM370N	1.15	LM1496N	.95
LM305H	.95	LM373N	3.25	LM1556V	1.85
LM307CN	.35	LM377N	4.00	LM2111N	1.95
LM308H	1.00	LM380N	1.39	LM2901N	2.95
LM308CN	1.00	LM380CN	1.05	LM3065N	.69
LM309H	1.10	LM381N	1.79	LM3900N	.55
LM309K	.99	LM382N	1.79	LM3905N	.60
LM310CN	1.15	NE501K	8.00	LM3909	1.25
LM311H	.90	NE510A	6.00	LM5556N	1.85
LM311N	.90	NE531H	3.00	MC5558V	1.00
LM318CN	1.50	NE536T	8.00	LM7525N	.90
LM319N	1.30	NE540L	6.00	LM7535N	1.25
LM320K-5	1.35	NE550N	.79	8038B	4.95
LM320K-5.2	1.35	NE555V	.39	LM75450	.49
LM320K-12	1.35	NE560B	5.00	75451CN	.39
LM320K-15	1.35	NE561B	5.00	75452CN	.39
LM320T-5	1.75	NE562B	5.00	75453CN	.39
LM320T-5.2	1.75	NE565H	1.25	75454CN	.39
LM320T-8	1.75	NE565N	1.75	75491CN	.79
LM320T-12	1.75	NE566CN	1.25	75492CN	.89
LM320T-15	1.75	NE567H	1.95	75494CN	.89
LM320T-18	1.75	NE567V	1.50	RCA LINEAR	
LM320T-24	1.75	LM703CN	.45	CA3013	2.15
LM323K-5	9.95	LM709H	.29	CA3032	2.56
LM324N	1.80	LM709N	.29	CA3035	2.48
LM339N	1.70	LM710N	.79	CA3039	1.35
LM340K-5	1.95	LM711N	.39	CA3046	1.30
LM340K-6	1.95	LM723H	.55	CA3059	3.25
LM340K-8	1.95	LM723H	.55	CA3060	3.25
LM340K-12	1.95	LM733N	1.00	CA3080	.85
LM340K-15	1.95	LM739N	1.00	CA3081	2.00
LM340K-18	1.95	LM741CH	.35	CA3082	2.00
LM340K-24	1.95	LM741CN	.35	CA3083	1.60
LM340T-5	1.75	LM741-14N	.39	CA3086	.85
LM340T-6	1.75	LM747H	.79	CA3089	3.75
LM340T-8	1.75	LM747N	.79	CA3091	10.20
LM340T-12	1.75	LM748H	.39	CA3123	2.15
LM340T-15	1.75	LM748N	.39	CA3130	1.39
LM340T-18	1.75	LM1303N	.90	CA3140	1.25
LM340T-24	1.75	LM1304N	1.19	CA3600	1.75
LM350N	1.00	LM1305N	1.40	RC4194	5.95
LM351CN	.65	LM1307N	.85	RC4195	3.25

74LS00 TTL

74LS00	.29			74LS139	1.95
74LS02	.29			74LS151	1.55
74LS03	.29	74LS74	.49	74LS153	1.69
74LS04	.35	74LS75	.69	74LS157	1.55
74LS05	.35	74LS76	.49	74LS162	2.25
74LS08	.29	74LS83	1.75	74LS163	2.25
74LS10	.29	74LS85	2.49	74LS164	1.95
74LS13	.69	74LS86	.49	74LS175	1.95
74LS14	1.75	74LS90	1.25	74LS181	3.69
74LS20	.29	74LS92	1.25	74LS190	2.85
74LS26	.39	74LS93	1.25	74LS191	2.85
74LS27	.39	74LS95	1.95	74LS192	2.85
74LS28	.39	74LS96	1.89	74LS193	2.85
74LS30	.29	74LS107	.59	74LS194	1.89
74LS32	.39	74LS109	.59	74LS195	1.89
74LS40	.39	74LS112	.59	74LS257	1.75
74LS51	.29	74LS132	1.25	74LS260	.55
74LS55	.29	74LS136	.59	74LS279	.79
74LS73	.49	74LS138	1.89	74LS670	3.95

CLOCK CHIPS

MM5309	6 Digit, BCD Outputs, Reset PIN.	$9.95
MM5311	6 Digit, BCD Outputs, 12 or 24 Hour	4.95
MM5312	4 Digit, BCD Outputs, 1 PPS Output	4.95
MM5314	6 Digit, 12 or 24 Hour, 50 or 60 Hz	4.95
MM5316	4 Digit, Alarm, 1 PPS Output	6.95
MM5318	Video Clock Chip, For Use With (MM5841 - $9.95)	9.95
CT7001	6 Digit, Calendar, Alarm, 12 or 24 Hour	5.95

DATA HANDBOOKS

7400	Pin-out & Description of 5400/7400 ICS	$2.95
CMOS	Pin-out & Description of 4000 Series ICS	$2.95
Linear	Pin-out & Functional Description	$2.95

ALL THREE HANDBOOKS $6.95

FAIRCHILD TECHNOLOGY KITS FAIRCHILD

DIGITS		
FTK0001	0.5" High Common Cathode Digit	$1.00
FTK0002	0.5" High Common Anode Digit	1.00
FTK0003	.357" High Common Cathode Digit	.75
FTK0004	0.8" High Common Cathode Digit	2.00
FTK0005	0.8" High Common Anode Digit	2.00
0.8" HIGH DISPLAY ARRAYS		
FTK0010	12 Hour, 3½ Digit Clock Display	7.00
FTK0011	24 Hour, 4 Digit Clock Display	8.00
LED LAMPS		
FTK0020	10 Red LED Lamps	1.00
FTK0021	5 Mixed Colored LED Lamps	1.00
FTK0022	10 LED Mounting Clips	1.00
FTK0023	5 Three Piece LED Mounting Adapters	1.00
PHOTO TRANSISTORS		
FTK0030	5 Flat Lens Photo Transistors	1.00
FTK0031	5 Round Lens Photo Transistors	1.00
FTK0032	3 Flat Lens Photo Darlingtons	1.00
FTK0033	3 Round Lens Photo Darlingtons	1.00
PHOTO ARRAYS		
FTK0040	9-Element Tape Reader Array	16.00
FTK0041	12-Element Card Reader Array	24.00
FTK0042	Reflective Opto Coupler	4.00
COUPLERS		
FTK0050	3 General Purpose Opto Couplers	1.00
FTK0051	Darlington Opto Coupler	1.00
MOS CLOCK CIRCUITS		
FTK0400	Digital Clock/Calendar Circuit (FCM7001)	7.00
FTK0401	Digital Clock/Calendar with BCD Outputs (FCM7002)	7.00
FTK0402	Direct Drive Digital Clock Circuit with AC Output (FCM3817A)	5.00
FTK0403	Direct Drive Digital Clock Circuit with DC Output (FCM3817D)	5.00
FTK0405	Direct Drive Digital Clock/Calendar Circuit (FCM7015)	6.00
KITS		
FTK0106	Automobile Clock Kit	40.00

DISCRETE LEDS

	.125" dia.		.185" dia.			.200" dia.			.190" dia.	
XC209	Red	10/$1	XC526	Red	10/$1	XC556	Red	10/$1	XC111	Red	10/$1
XC209	Green	4/$1	XC526	Green	4/$1	XC556	Green	4/$1	XC111	Green	4/$1
XC209	Orange	4/$1	XC526	Yellow	4/$1	XC556	Yellow	4/$1	XC111	Yellow	4/$1
XC209	Yellow	4/$1	XC526	Orange	4/$1	XC556	Orange	4/$1	XC111	Orange	4/$1
	.200" dia								.085" dia.	
XC22	Red	10/$1	XC526	Clear	4/$1	XC556	Clear	7/$1	MV50 — 6/$1	
XC22	Green	4/$1							INFRA-RED LED ¼" x ¼" x 1/16" Flat 5/$1.00	
XC22	Yellow	4/$1								
XC22	Orange	4/$1								
SSL-22	RT	4/$1								

SPECIAL * — XC556 Red 100/$8.00 1000/$60.00 — SPECIAL *

DISPLAY LEDS

DL707 DL339

TYPE	POLARITY	HT		TYPE	POLARITY	HT	
MAN 1	Common Anode	.270	2.95	MAN 3640	Common Cathode-orange	.300	1.75
MAN 2	5 x 7 Dot Matrix	.300	4.95	MAN 4710	Common Anode-Red	.400	1.95
MAN 3	Common Cathode	.125	3/1.00	DL701	Common Anode-red	.300	.99
MAN 4	Common Cathode	.187	1.95	DL704	Common Cathode	.300	.99
MAN 7	Common Anode	.300	1.25	DL707	Common Anode	.300	.99
MAN 7G	Common Anode-green	.300	1.95	DL 728	Common Cathode	.500	1.95
MAN 7Y	Common Anode-yellow	.300	1.95	DL741	Common Anode	.600	1.50
MAN 52	Common Anode-green	.300	.99	DL 747	Common Anode	.600	2.25
MAN 64	Common Anode-red	.400	.99	DL 750	Common Cathode	.600	2.49
MAN 74	Common Cathode	.300	1.50	DL 338	Common Cathode	.110	.50
MAN 82	Common Anode-yellow	.300	.99	FND70	Common Cathode	.250	.75
MAN 84	Common Cathode-yellow	.300	.99	FND503	Common Cathode	.500	1.00
MAN 3620	Common Anode -orange	.300	1.75	FND507	Common Anode	.500	1.00

FACTORY REJECTS

ATARI GAME BOARDS

BOARD A — 8½" x 16" Over 60 each reusable IC's. Misc. Transistors, Resistors, Diodes, Caps, Crystals, Switch, etc. **$6.95 ea.** ONLY 500 EA. AVAILABLE

DELUXE BOARD B — 11½" x 18" Over 100 each reusable IC's. Misc. Transistors, Resistors, Diodes, Caps, Crystals, Switches, LEDS, etc. **$9.95 ea.** ONLY 500 EA. AVAILABLE

NEW AY-3-8500-1 TV GAME CHIP

- Score display
- Selectable angles, speed and ball size
- Auto or manual ball service
- Realism sounds
- 6 Games — tennis, hockey/soccer, squash, pelota/practice and two rifle games

28 Lead Dual In Line

The circuit is intended to be battery powered. Minimum number of external components required for complete system.

$24.95

IC SOLDERTAIL — LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100		1-24	25-49	50-100
8 pin	$.17	.16	.15	24 pin	$.38	.37	.36
14 pin	.20	.19	.18	28 pin	.45	.44	.43
16 pin	.22	.21	.20	36 pin	.60	.59	.58
18 pin	.29	.28	.27	40 pin	.63	.62	.61
22 pin	.37	.36	.35				

SOLDERTAIL STANDARD (TIN)

14 pin	$.27	.25	.24	28 pin	$ .99	.90	.81
16 pin	.30	.27	.25	36 pin	1.39	1.26	1.15
18 pin	.35	.32	.30	40 pin	1.59	1.45	1.30
24 pin	.49	.45	.42				

SOLDERTAIL STANDARD (GOLD)

8 pin	$.30	.27	.24	24 pin	$ .70	.63	.57
14 pin	.35	.32	.29	28 pin	1.10	1.00	.90
16 pin	.38	.35	.32	36 pin	1.75	1.40	1.26
18 pin	.52	.47	.43	40 pin	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

10 pin	$.45	.41	.37	24 pin	$1.05	.95	.85
14 pin	.39	.38	.37	28 pin	1.40	1.25	1.10
16 pin	.43	.42	.41	36 pin	1.59	1.45	1.30
18 pin	.75	.68	.62	40 pin	1.75	1.55	1.40

Plastic Push Button Switch

- 18 AWG Solid Wire - 5" Long
- .50 (wide) X .60 (high) ⅜-27 Thread
- 8 AMP @ 14 Volt - 1 AMP @ 110 Volt

		1-9	10-Up
J-188-1	Push On-Push Off	.59	.49
J-188-2	Normally Open	.59	.49
J-188-3	Normally Closed	.59	.49

MINATURE TOGGLE SWITCH

JMT-221	DPDT	on/off/on	$1.95
JMT-223	DPDT	on/none/on	$1.75
JMT-121	SPDT	on/off/on	$1.50
JMT-123	SPDT	on/none/on	$1.25

CLIPLITE 8/$1.49

LED MOUNTING SYSTEM use with XC556 LEDS

Specify Colors — Red - Green - Amber - Yellow

DIP SWITCH

These switches feature 7 SPST slide switches in a molded dip. They are ideally suited for microprocessor applications. **$1.95**

50 PCS. RESISTOR ASSORTMENTS $1.75 PER ASST.

ASST. 1	5 ea.	10 OHM	12 OHM	15 OHM	18 OHM	22 OHM	1/4 WATT 5% - 50 PCS.
		27 OHM	33 OHM	39 OHM	47 OHM	56 OHM	
ASST. 2	5 ea.	68 OHM	82 OHM	100 OHM	120 OHM	150 OHM	1/4 WATT 5% - 50 PCS.
		180 OHM	220 OHM	270 OHM	330 OHM	390 OHM	
ASST. 3	5 ea.	470 OHM	560 OHM	680 OHM	820 OHM	1K	1/4 WATT 5% - 50 PCS.
		1.2K	1.5K	1.8K	2.2K	2.7K	
ASST. 4	5 ea.	3.3K	3.9K	4.7K	5.6K	6.8K	1/4 WATT 5% - 50 PCS.
		8.2K	10K	12K	15K	18K	
ASST. 5	5 ea.	22K	27K	33K	39K	47K	1/4 WATT 5% - 50 PCS.
		56K	68K	82K	100K	120K	
ASST. 6	5 ea.	150K	180K	220K	270K	330K	1/4 WATT 5% - 50 PCS.
		390K	470K	560K	680K	820K	
ASST. 7	5 ea.	1M	1.2M	1.5M	1.8M	2.2M	1/4 WATT 5% - 50 PCS.
		2.7M	3.3M	3.9M	4.7M	5.6M	

ASST. 8R Includes Resistor Assortments 1-7 (350 PCS.) **$10.95 ea.**

$5.00 Minimum Order — U.S. Funds Only
California Residents — Add 6% Sales Tax
Spec Sheets - 25¢ — Send 35¢ Stamp for 1977A Catalog
Dealer Discount Available — Request Pricing

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PHONE ORDERS WELCOME — (415) 592-8097

All Advertised Prices Good Thru April

J1

WIRE WRAP CENTER

HOBBY-WRAP TOOL-BW-630

- Battery Operated (Size C)
- Weighs ONLY 11 Ounces
- Wraps 30 AWG Wire onto Standard DIP Sockets (0.25 inch)
- Complete with built-in bit and sleeve

$34.95 (batteries not included)

WIRE-WRAP KIT — WK-2-W

WRAP • STRIP • UNWRAP

- Tool for 30 AWG Wire
- Roll of 50 Ft. White or Blue 30 AWG Wire
- 50 pcs. each 1", 2", 3" & 4" lengths — pre-stripped white wire

$11.95

WIRE WRAP TOOL WSU-30

WRAP • STRIP • UNWRAP - $5.95

WIRE WRAP WIRE — 30 AWG

25 ft. min. $1.25 50 ft. $1.95 100 ft. $2.95 1000 ft. $15.00
SPECIFY COLOR — White - Yellow - Red - Green - Blue - Black

CUTTER CRIMPER TOOL (CS-8)

- Plier Nose (serrated-jaw)
- Scissors Action Cutting
- 6 Bolt Cutters (4-40, 5-40, 6-32, 8-32, 10-32, 10-24)
- Crimp Stations (7mm Auto — 22-20 to 12-X0 elect.)
- "Up-Front" Wire Cutting
- Scissors Action Stripping (No. 22-20 to No. 10)
- Crimp Stations — insulated (2w-20 to 12-10 elect.)

Actual Size - 8¼" length **$8.50**

Permacel Electrical Tape

• ¾" (wide) X 66 ft. (long) • All weather • Not import

$1.25 per roll — $9.95 per 10 roll package

ZENERS — DIODES — RECTIFIERS

TYPE	VOLTS	W	PRICE	TYPE	VOLTS	W	PRICE
1N746	3.3	400mm	4/1.00	1N4005	600 PIV	1 AMP	10/1.00
1N751A	5.1	400m	4/1.00	1N4006	800 PIV	1 AMP	10/1.00
1N752	5.6	400m	4/1.00	1N4007	1000 PIV	1 AMP	10/1.00
1N753	6.2	400m	4/1.00	1N3600	50	200m	6/1.00
1N754	6.8	400m	4/1.00	1N4148	75	10m	15/1.00
1N959	8.2	400m	8/1.00	1N4154	35	10m	12/1.00
1N965B	15	400m	4/1.00	1N4305	75	25m	20/1.00
1N5232	5.6	500m	28	1N4734	5.6	1w	28
1N5234	6.2	500m	28	1N4735	6.2	1w	28
1N5235	6.8	500m	28	1N4736	6.8	1w	28
1N5236	7.5	500m	28	1N4738	8.2	1w	28
1N456	25	40m	6/1.00	1N4742	12	1w	28
1N458	150	7m	6/1.00	1N4744	15	1w	28
1N485A	180	10m	6/1.00	1N1183	50 PIV	35 AMP	1.60
1N4001	50 PIV	1 AMP	12/1.00	1N1184	100 PIV	35 AMP	1.70
1N4002	100 PIV	1 AMP	12/1.00	1N1185	150 PIV	35 AMP	1.50
1N4003	200 PIV	1 AMP	12/1.00	1N1186	200 PIV	35 AMP	1.80
1N4004	400 PIV	1 AMP	12/1.00	1N1188	400 PIV	35 AMP	3.00

SCR AND FW BRIDGE RECTIFIERS

C36D	15A @ 400V	SCR	$1.95
C38M	35A @ 200V	SCR	1.95
2N2328	1.6A @ 200V	SCR	.50
MDA 980-1	12A @ 50V	FW BRIDGE REC.	1.95
MDA 980-3	12A @ 200V	FW BRIDGE REC.	1.95

TRANSISTORS

MPS A05	5/$1.00	PN3567	3/$1.00	PN4249	4/$1.00		
MPS A06	5/$1.00	PN3568	4/$1.00	PN4250	4/$1.00		
2N2219A	3/$1.00	PN3569	4/$1.00	2N4400	4/$1.00		
2N2221	4/$1.00	2N3704	5/$1.00	2N4401	4/$1.00		
2N2222A	5/$1.00	2N3705	5/$1.00	2N4402	4/$1.00		
2N2369	5/$1.00	2N3706	5/$1.00	2N4403	4/$1.00		
2N2369A	4/$1.00	2N3707	5/$1.00	2N4409	5/$1.00		
2N2484	4/$1.00	2N3711	5/$1.00	2N5086	4/$1.00		
2N2906A	4/$1.00	2N3724	$ .65	2N5087	4/$1.00		
2N2907A	5/$1.00	2N3725	$1.00	2N5088	4/$1.00		
2N2925	5/$1.00	2N3903	5/$1.00	2N5089	4/$1.00		
2N3053	2/$1.00	2N3904	4/$1.00	2N5129	5/$1.00		
2N3055	$ .88	2N3905	4/$1.00	2N5138	5/$1.00		
MJE3055	$1.00	2N3906	4/$1.00	2N5139	5/$1.00		
MJE2955	$1.25	2N4013	3/$1.00	2N5209	5/$1.00		
2N3392	5/$1.00	2N4014	3/$1.00	2N5961	5/$1.00		
2N3398	5/$1.00	2N4123	10/$1.00	C106B1SCR	2/$1.00		
				2N6432	$2.00		

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

	1-9	10-49	50-100		1-9	10-49	50-100
10 pf	.05	.04	.03	.001μF	.05	.04	.035
22 pf	.05	.04	.03	.0047μF	.05	.04	.035
47 pf	.05	.04	.03	.01μF	.05	.04	.035
100 pf	.05	.04	.03	.022μF	.06	.05	.04
220 pf	.05	.04	.03	.047μF	.06	.05	.04
470 pf	.05	.04	.035	.1μF	.12	.09	.075

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.23	.17
.01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% DIPPED TANTALUMS (SOLID) CAPACITORS

.1/35V	.28	.23	.17	1.5/35V	.30	.26	.21
.15/35V	.28	.23	.17	2.2/25V	.31	.27	.22
.22/35V	.28	.23	.17	3.3/25V	.31	.27	.22
.33/35V	.28	.23	.17	4.7/25V	.32	.28	.23
.47/35V	.28	.23	.17	6.8/25V	.36	.31	.25
.68/35V	.28	.23	.17	10/25V	.40	.35	.29
1.0/35V	.28	.23	.17	15/25V	.63	.50	.40

MINIATURE ALUMINUM ELECTROLYTIC CAPACITORS

	Axial Lead				Radial Lead		
.47/50V	.15	.13	.10	.47/25V	.15	.13	.10
1.0/50V	.16	.14	.11	.47/50V	.16	.14	.11
3.3/50V	.15	.13	.10	1.0/16V	.15	.13	.10
4.7/25V	.16	.14	.12	1.0/25V	.16	.14	.11
10/25V	.15	.13	.10	1.0/50V	.16	.14	.11
10/50V	.16	.14	.12	4.7/16V	.15	.13	.10
22/25V	.17	.15	.12	4.7/25V	.15	.13	.10
22/50V	.24	.20	.18	4.7/50V	.16	.14	.11
47/25V	.19	.17	.15	10/16V	.14	.12	.09
47/50V	.25	.21	.19	10/25V	.15	.13	.10
100/25V	.24	.20	.18	10/50V	.16	.14	.12
100/50V	.35	.30	.28	47/50V	.24	.21	.19
220/25V	.32	.28	.25	100/16V	.19	.15	.14
220/50V	.45	.41	.38	100/25V	.24	.20	.18
470/25V	.33	.29	.27	100/50V	.35	.30	.28
1000/16V	.55	.50	.45	220/16V	.23	.17	.15
2200/16V	.70	.62	.55	470/25V	.31	.28	.26

REGULATED C.B. POWER SUPPLY KIT

13.8 Volts D.C. @ 2 Amps or 10 to 24 VDC @ 2 Amps

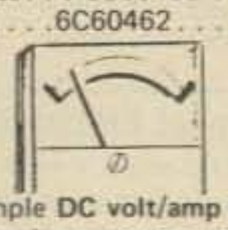
Here's an easy to build kit, designed to give maximum RF output to your CB. Can be built to deliver 13.8 volts DC regulated (2A) for mobile CB's, or switched over to give 10 to 24 volts DC (2A) regulated, to be used as a lab bench supply. Kit includes all parts and instructions to put together this versatile power supply, case not included.

Quality ≠ expensive! $14.88
Sh. Wt. 10 Lbs. . . . 6C60498 . . . $14.88
3 for 38.98. . . . 6C60498 . . . $39.98/3

0 to 24 VDC, 5 A POWER SUPPLY KIT

This power supply or battery charger kit should be useful to have around the house or shop. Easy to build, complete kit includes a 0 to 40 volt autotransformer (Variac[r]), 24 volt 5 amp transformer, bridge rectifier, filter cap., and everything else you need to build this hefty power supply (case not supplied). Complete with instructions.

Sh. Wt. 12 Lbs. . . . 6C60462 . . . $14.50
3 for $38.88. . . . 6C60462 . . . $38.88/3



ALSO: A simple **DC volt/amp meter kit** to go with the above power supplies. Includes movement, resistors and instructions. Lay out the faceplate and you have a nice meter to go with the supply.

Sh. Wt. 8 oz. . . . . 6C60463. . . . . $2.00

DRINK MIXER KIT

A real old-fashioned type like the kind at the local drug store back in the 1950's, except that these are brand new parts. Through a lucky purchase we have obtained some new parts of a drink mixer. It is complete but for the top cover, but you can make your own or operate without it. Evidently the manufacturer sold this line out to another and the tops got lost. Now you can build up a $20.00 mixer for under $5.00. Kids love 'em, order one today! Kit includes motor, mixer, screws, stand, line cord, switch, and 16 oz mixer cup. . . . . .Sh. Wt. 5 Lbs.
7M370053 . . . . . .$4.88

ALSO: Spare Mixer Cup for above,
Sh. Wt. 8 oz. . . 7M370054 . . $0.80 ea.

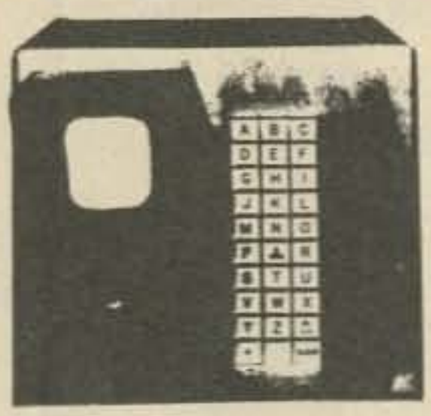
CONFERENCE CALLER KIT

Phone not included

Unique kit of parts allows you to connect up to 5 lines through switching and a special transformer. Unit will allow you to engage as many as 5 persons . . . no no matter where they are . . . in the same conversation just by dialing a number and flipping a switch. It's that simple, that quick. The "Conference Caller" can be attached to any multiple line telephone. There is no additional outside power required and no interference with normal phone service. Case not supplied. Kit includes a special transformer, switches, cable, solid state parts and you supply the case. Complete with instructions and data.

Sh. Wt. 8 Lbs. . . . 7C70043. . . . $18.88

INPUT/OUTPUT TERMINAL



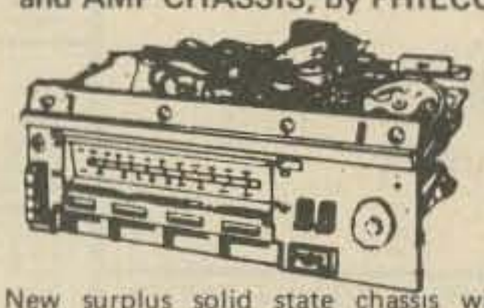
A great place to start for building a microprocessor. These units were part of a comlex computer system. The terminal contains: keyboard; CRT; drive circuits; ASC11 output; and a complete 128 page technical manual with operating and repair instructions, which makes it easy to modify the terminal for your applications. (Character generator was part of a separate control section which is not supplied. The terminal can be used when modified using character generator LSI chips, such as the 2513, 2516 or other such IC's).

The keyboard is a 50 key alpha-numeric (and others) block keyboard, with ASC11 output. Display capactiy is 768 (12 lines of 64), 384, 256, 128 and so on, depending on character size desired. The character size may be adjusted from approximately typewriter size up to ¼".

The viewing screen of the CRT utilizes a high contrast, low persistence, emerald green phosphor. Each character is composed from a 5 x 7 dot pattern, registering clearly and sharply against a dark background. Controls provided include: on/off; brightness; focus; and character height.

Great as a microprocessor input & output device. The display stations are used, removed from airline reservation systems, hotel reservation systems, stock exchanges, etc. Sh. Wt. 35 Lbs.
6NB60336 . . . . . .$49.50
2 for $95.00. . . 6NB60336 . . $95.00/2
4 for $180.00. . 6NB60336 . $180.00/4

AM-FM STEREO RECIEVER and AMP CHASSIS, by PHILCO



New surplus solid state chassis with push-pull power tab transistor power on the audio output amplifier. Has a stereo "bull's eye" on the tuning needle that lights up when a stereo station is tuned in. Has provisions for a 4 speaker system built-in, with RCA type jacks for front and rear speakers (L&R), plus cables with plugs for phono and tape inputs. Push-button switches are used to select phono, tape, AM and FM. Unit has slide controls for volume, balance, base and treble. Complete with knobs, dial face (marked and illuminated with AM & FM scales) and line cord. Looks good for custom building a stereo console, mounting in to a wall or whatever. All it needs is a case, and at our low price these Philco stereos will not last long! Size: 15½" x 5" high x 4½" deep. Just add 2 (or 4) speakers for fine stereo listening.

SPECIAL PRICE for 73 READERS!
Sh. Wt. 7 Lbs. . . . .6Z60213. . . . $29.88
3 for $80.00. . . . .6Z60213. . . $80.00/3

CCTV - COSMICAR "EE" T.V. LENSES

New surplus lenses made by Cosmicar for Mati. It's a super lens with fully automatic diaphram which opens by an electric eye control. These lenses maintain image luminance of 1001X against subject brightness EV from 11 to 17 (1500, 960001X) f/1.4, focal length = 25mm., fully automatic diaphram, EE acceptance angle = 30°, EE response time is less than 4 seconds. "C" lens mount. List price was $300.00. Sh. Wt. 4 oz.
7VL70044. Special 73 Reader Price only $150.00

COLOR TV CHASSIS

We have found some 2,000 TV chassis' that got damaged in a train derailment. These are the very same types of chassis' we have been selling: the TS-951 and the TS-953. We have sold over 2,000 of the perfect chassis and now we have a quantity that do not measure up to our high standards. They have cracked P.C. boards, bent frames, etc., but they are worth 3 times as much for the fantastic parts. See last month's ad in 73 if you need more details. Sold "AS IS". 13" and 15" include tuners and controls.

13" Chassis . . 7DZ70059 . . $22.50 ea.
Sh. Wt. 12 Lbs. ea. 10 for $198.00
15" Chassis . . 7DZ70060 . . $22.50 ea.
Sh. Wt. 12 Lbs. ea. 10 for $198.00
17" Chassis . . . 7DZ70061 . . . . $14.88
Sh. Wt. 10 Lbs. ea. 10 for $128.88
19" Chassis . . . 7DZ70061 . . . . $14.88
Sh. Wt. 10 Lbs. ea. 10 for $128.50

DIVERT-A-CALL

This unique phone device will take an incoming call, redial a new number and diverts the call to the new number. This is set into the diverter by means of thumbwheel switches. List price for this fantastic device is $400.00, yours here and now for $150.00. These are sold "AS IS", and include the mfg. shematics. They all look complete, but have not been checked out. Qty. Ltd.
Sh. Wt. 20 Lbs. . 7PH70055 . . $150.00

LOGIC AND OP AMP POWER SUPPLY

This regulated power supply has outputs of ±15 volts at 0.25 amps and +5 volts at 2.5 amps, with an input of 115 VAC. Manufactured by a computer company as part of a phone data terminal. Three (3) 723's (IC's) are used for voltage regulation. Units have barrier strip outputs, and are open frame. Size: 5" x 9" x 2". New surplus. Qty. Ltd.
Sh. Wt. 5 Lbs . . . 6MI60215 . . . $17.50
3 for $45.00. . . 6MI60215 . . $45.00/3

MODERN STANDARD TELEPHONES

A complete, factory rebuilt, modern telephone ready for instant use. Available in black, white, beige, pink, red, green and blue. Ideal as an extra phone, for use on intercoms, private systems, extensions, etc. Easy 2-wire hook-up. Phones include hand set, induction coil, and cable, but no ringers. Many types and styles to choose from. When specifying a color, please give 3 choices in order of preference. Spec sheets with wiring diagrams are included, not detectable. Phones may vary slightly from photo. Sh. Wt. 8 Lbs.
(Call Director 10 line phone = 15 Lbs.)

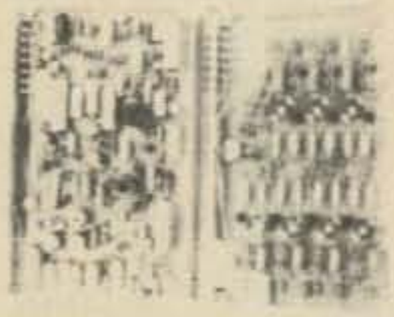
† **Standard Desk Dial Phone**
Black, Desk Dial . . 6VL60440 . . $12.50
Color, Desk Dial . . 6VL60441 . . $17.50

† **Standard Wall Dial Phone**
Black, Wall Dial. . . 6VL60442. . . $12.50
Color, Wall Dial. . . 6VL60443. . . $17.50

† **2 Line Standard Desk Dial Phone**
This phone has a twist key to switch in 2 lines over the same phone, plus a hold position. Available only in black.
Black, 2-Line . . . . 6V60448 . . . . $24.50

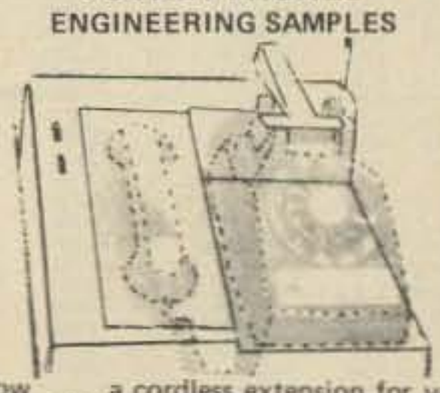
† **"Call Director" Office Desk Phone**
This dial phone handles 10 lines, and has hold and intercom buttons.
Color, Call Director . . 6V60449 . . $49.50

TOUCH-TONE RECEIVER BOARDS



Two card set of boards for detecting high group and low group in dual-tone decoding. Unit seperates the low and high frequencies comprising each tone pair and converts them into DC signals. List price on board sets is over $200.00. Yours for $29.95, because we don't have schematics at this time and board edge fingers have been cut off. When schematics become available price will reach $69.50. These boards are sold "AS IS", you decipher.
Qty. Ltd . . . . . .Sh. Wt. 10 Lbs.
7N370052 . . . . . $29.50/set

POCKET PHONES ENGINEERING SAMPLES



Phone not included

Now . . . a cordless extension for your telephone. This special unit allows you to send and recieve over your phone with a C.B. radio at a separate location, using channel 14. Have your phone always within easy reach. These basic units are engineering samples, a fore-runner to these more expensive cordless extension phones. Our units pick up the phone receiver when a call comes in and signals over your C.B. that you have a call, and then you may send and receive the call. We have not been able to have the unit hang up the phone receiver through the C.B. set, but it is probably possible to rig something up. At present, you have to return to the phone to hang up after the call is completed. Sold "AS IS", list price of $750.00, yours for only $69.88 each. Sh. Wt. 20 Lbs.
Phone not included.
7PH70063 . . . . . .$69.88

POSTAGE: Please add sufficient funds for postage and insurance. Shipping weight for merchandise is listed at the end of each product description. All shipping is from Peabody, Ma. 01960.
Mass. Residents Add 5% Sales Tax.

For "AS IS" items: All sales final, no returns please.

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Or, receive our catalog in an order and insure yourself of a place on our mailing list

PHONE ORDERS WELCOME!
Bank Americard, Master Charge and American Express Accepted.
Phone: **(617) 531-5774 / 532-2323**
$10.00 Minimum on Charge Orders

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01960
(617) 531-5774 / 532-2323

B&F B4

TTL SPECIALS

74H10 Dual 4 Input Buffer	$ .20
7490 Decade Counter	.49
745175 Quad Flip Flop with clear	.99
74283 4 Bit Binary Adder	.99

2½" round, 8 Ohms	1.00
2¾" round speaker, 100 Ohms	1.10
Speco miniature replacement speakers from 1" to 3¼", SASE for list.	
Brand New GE Stereo Tape Amplifier Board with all components 4 Watts 12 V ac supply limited	3.50
Mono Amplifier Board 1 control	2.25
6 foot black or brown zip cord and plug	.35
RG174 100 foot coil	6.50
2¼" round speaker, 8 Ohms	.75
VHF Ferrite Beads	15 for 1.00
Ham & CB Slide Mounts with lock and coax connectors	10.95
2 Amp Bridge Rectifier, 200 Volt	.50
2 Amp Bridge Rectifier, 600 Volt	1.25
3 Amp Bridge Rectifier, 200 Volt	.85
Ultrasonic Transducer 23 MHz	4.50
150 MFD 50 Volt Electrolytic Capacitor	.38
.047 Ceramic Radial Capacitor 400 Volt	.20

RF DEVICES

2N3375 3W 400 MHz	$5.50
2N3866 1W 400 MHz	1.15
2N5589 3W 175 MHz	4.75
2N5590 10W 175 MHz	7.80
2N5591 25W 175 MHz	10.95
2SC517	3.95
2SC1226	1.25
2N6080 4W 175 MHz	5.40
2N6081 15W 175 MHz	8.45
2N6082 25W 175 MHz	10.95
2N6083 30W 175 MHz	12.30
2N6084 40W 175 MHz	16.30
2SC1306	4.30
2SC1307	5.25
2N2876	special 10.95

ZENERS

1N746 to 1N759 .400 Mw	ea. .25
1N4728 to 1N4764 1 watt	.28
1N5333 to 1N5378 5 watt	2.10
1N2970 to 1N3005 10 watt	2.40
1N3305 to 1N3340 50 watt	4.75

8080A National CPU	$19.95
MPSA14	.90
2N3055	.99
MPF102 FET	.55
2N3904 or 2N3906	.25
2N5496 or 2N6108	.70
MJE340 (2N5655)	1.10
40673 RCA FET	1.55
741 or 709 14 Pin DIP	.25
555 Timer	.75
556 Dual 555	1.75
200 Volt 25 Amp Bridge	1.50
1N914-1N4148	15 for .99
1N34-1N60-1N64	10 for .99
CA 3028 Dif. Amp	1.50
4060 CMOS	2.00
LM309K Volt Reg	1.10
MJ3055	2.20
5313 Clock Chip	3.95
5314 Clock Chip	4.50
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2N6103	.89
LM309 or 741 Min DIP Op Amp	.45
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14 or 16 Pin IC Sockets	.30

.001 Pacer Cap. 192P10292 200 WVDC	.18
12.8 kHz Crystal in TO 5 Can	4.95
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Egg Insulators	.45

2N918	.95
2N2218	.45
2N2219A	.40
2N2222A	.30
2N2369	.20
2N2483	.34
2N2484	.45
2N2905	.35
2N2907	.25
2N2926G	.24
2N2926Y	.24
2N3053	.50
2N3390	.75
2N3439	1.59
2N3440	.60
2N3512	1.15
2N3553	1.40
2N3565	.22
2N3584	.30
2N3638A	.37
2N3646	.27
2N3713	1.35
2N3725A	1.80
2N3771	2.50

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We quote on any device at any quantity. Add 5% for shipping. Minimum order $6.00. Out of USA send certified check or money order, include shipping costs.

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2N3903	.20
2N3905	.25
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2N4041	7.80
2N4249	.25
2N4401	.25
2N4402	.25
2N4403	.25
2N4409	.19
2N4427	1.35
2N4429	7.65
2N4888	.50
2N5016	17.60
2N5090	7.50
2N5129	.40
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2N5641	5.40
2N5642	10.25
2N5643	14.35
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200 Volt 100 Amp D08	$8.50
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1000 Volt 2 Amp Silicon Rectifier RCA	10 for .99
10,000 Volt Silicon Rectifier Erie 65 mA	2.95
600 Volt 3 Amp Rectifier	.35

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Jumbo Reds, long or short bulb	6 for $1.00
Jumbo Orange, Green; Clear Red or Green	5 for $1.00
209 Series, Green, Orange, Yellow or Red	5 for $1.00
RL2 or Micro Red	5 for $1.00
Holding Clip for Jumbo LEDs	.10

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FND 359 Common Cathode	.3	$1.35
FND 503 Common Cathode	.5	1.75
FND 500 Common Cathode	.5	1.75
FND 507 Common Anode	.5	1.75
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PC Board for above 3.95
Stopwatch Hand Case 3.95

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SIX DIGIT AUTO OR BOAT CLOCK KIT. Has a beautiful charcoal grey molded high temperature plastic case with chrome rim. Dimensions are 1¾" high by 4" wide by 4½" deep. 0.4 LEDs display hours, minutes and seconds. Works on 12 Volts AC and DC *Plus* automatic switching to 9 Volt battery for power failures. Battery (not supplied) fits in case. Provision for blanking display LEDs for out of car or boat use. Adjustable Crystal Time Base included, as well as mobile mounting bracket. Kit only – $29.95. Wired and tested – $39.95. Power Pak for 110 Volt AC – $2.95.

NOW NEW IMPROVED DIGITAL ALARM CLOCK KIT Hours • Minutes • Seconds displayed on six BIG 0.5 Fairchild 7 Segment Display LEDS 12-hour format 24-hour alarm with snooze feature, plus elasped time indicator and freeze feature. Eight pages of pictorials and instructions. NEW on-board power transformer and circuitry for optional time base $19.99
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12 OR 24 HOUR CLOCK KIT. Comes with Big 0.5 Seven Segment LEDs. Uses National 5314 Clock Chip. Fits our Walnut Grain or Plexiglas Cabinets. ONLY $18.95

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A2

S.D. SALES CO.

P.O. BOX 28810 – Ⓐ DALLAS, TEXAS 75228

JUMBO LED CAR CLOCK

$16.95

KIT

Alarm Option – $1.50
AC XFMR – $1.50

THE HOTTEST SELLING KIT WE EVER PRODUCED!

You requested it! Our first D.C. operated clock kit. Professionally engineered from scratch. Not a makeshift kluge as sold by others. Features:

A. Bowmar Jumbo –.5 inch LED array.
B. MOSTEK – 50250 – Super Clock Chip.
C. On board precision crystal time base.
D. 12 or 24 Hr. Real Time Format.
E. Perfect for cars, boats, vans, etc.
F. P.C. Board and all parts (less case) included.

50,000 SATISFIED CLOCK KIT CUSTOMERS CANNOT BE WRONG!

THIS MONTH'S SPECIALS

AMD – 8080A	$14.95
Z-80 CPU	49.95
82S129 1K PROM	2.50

1702A 2K EPROM

We tell it like it is. We could have said these were factory new, but here is the straight scoop. We bought a load of new computer gear that contained a quantity of 1702 A's in sockets. We carefully removed the parts, verified their quality, and are offering them on one heck of a deal. First come, first served. Satisfaction guaranteed! U.V. Eraseable. $6.95 ea. 4/$25

UP YOUR COMPUTER!

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And so is power. Not only are our RAM's faster than a speeding bullet but they are now very low power. We are pleased to offer prime new 21L02–1 low power and super fast RAM's. Allows you to STRETCH your power supply farther and at the same time keep the wait light off.

8 for $12.95

60 HZ CRYSTAL TIME BASE
S.D. SALES EXCLUSIVE!

$5.95 ea. 2/$10.00

KIT FEATURES:

A. 60HZ output with accuracy comparable to a digital watch.
B. Directly interfaces with all MOS clock chips.
C. Super low power consumption (1.5 MA typ.)
D. Uses latest MOS 17 stage divider IC.
E. Eliminates forever the problem of AC line glitches.
F. Perfect for cars, boats, campers, or even for portable clocks at ham field days.
G. Small size; can be used in existing enclosures.

Kit includes Crystal, Driver IC, PC board, plus all necessary parts and specs. At last count – over 20,000 sold!

S.D. SALES EXCLUSIVE

$12.95 MOS 6 DIGIT UP–DOWN COUNTER $12.95

40 PIN DIP. Everything you ever wanted in a counter chip. Features: Direct LED segment drive, single power supply (12 VDC TYPE.), six decades up/down, pre-loadable counter, separate pre-loadable compare register with compare output, BCD and seven segment outputs, internal scan oscillator, CMOS compatible, leading zero blanking. 1MHZ. count input frequency. Very limited quantity! WITH DATA SHEET

7400–19c	7411–29c	7451–19c	7490–65c	74153–75c
74LS00–49c	7413–50c	7453–19c	74LS90–95c	74154-1.00
7402–19c	7416–69c	7473–39c	7492–75c	74157–75c
74LS02–49c	7420–19c	7474–35c	7493–69c	74161–95c
7404–19c	7430–19c	74LS74-59c	7495–75c	74164-1.10
74L04–29c	7432–34c	7475–69c	7496–89c	74165-1.10
74S04–44c	7437–39c	7476–35c	74121-38c	74174–95c
74LS04-49c	7438–39c	7480–49c	74123-65c	74181-2.50
7406–29c	7440–19c	7483–95c	74132-1.70	74191-1.25
7408–19c	7447–85c	7485–95c	74S138-1.95	74192-1.25
7410–19c	7448–85c	7486–45c	74141-75c	74193-1.00

TTL INTEGRATED CIRCUITS 74195–69c

1000 MFD Filter Caps

Rated 35 WVDC Upright style with PC leads. Most popular value for hobbyists. Compare at up to $1.19 ea. from franchise type electronic parts stores. S.D. Special 4/$1.

Slide Switch Assortment

Our best seller. Includes miniature and standard sizes; single and multiposition units. All new, first name brand. Try one package and you'll reorder more! Special **12/$1.00**

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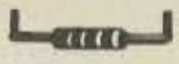
¼W 5% & 10% PC leads. A good mix of values. **200/$2.**



P.C. LEAD DIODES

1N4148/1N914
100/$2.00
1N4002-1A.
100 PIV 40/$1.

HEAVY DUTY

Full Wave Bridge
25 AMP 50 PIV
$1.25

Disc Cap Assortment

PC leads. At least 10 different values. Includes .001, .01, .05, plus other standard values.
60/$1.00

$9.95 KIT

P.C. Board – 3.00
AC XFMR – 1.50

Do not confuse with Non-Alarm kits sold by our competition! Eliminate the hassle – avoid the 5314!

SIX DIGIT ALARM CLOCK KIT

We made a fantastic kit even better. Redesigned to take advantage of the latest advances in I.C. clock technology. Features: Litronix Dual ½" displays, Mostek 50250 super clock chip, single I.C. segment driver, SCR digit drivers. Greatly simplified construction. More reliable and easier to build. Kit includes all necessary parts (except case). P.C.B. or XFMR optional.

NEW! WITH JUMBO LED READOUTS!

Motorola SCR

2N4443. 8 AMP 400 PIV. P.C. Leads 3/$1.

FAIRCHILD - TBA 641

4W. Audio power Amp. Just out! In special heat sink DIP. One super audio IC.
$1.50 with data

FND-359 -Led Readout

.4 IN. Common Cathode. High effeciency. Has FND-70 PIN OUT. 59c

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- Speed, Volume, tone & weight controls.
- Grid-block or direct keying.
- Use with external paddle such as HK-1.

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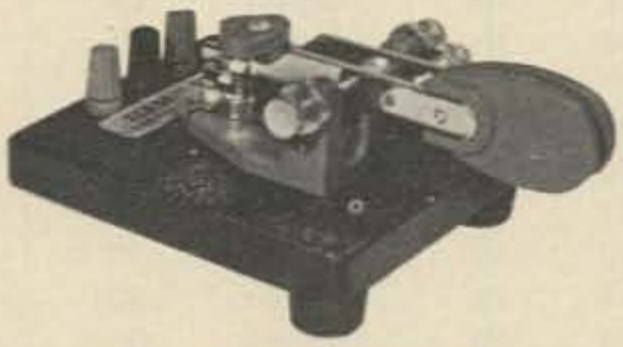
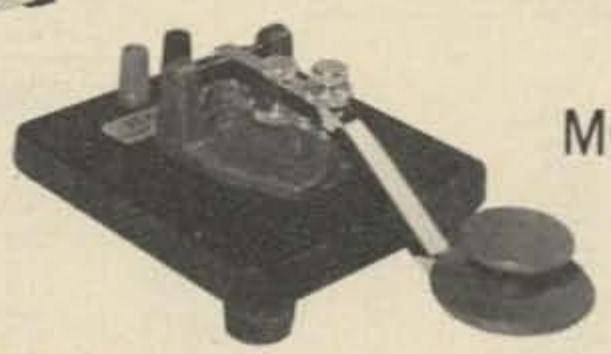
MODEL HK-5
ELECTRONIC KEYER
$69.95



MODEL HK-1
$29.95

- Dual lever squeeze paddle.
- Use with HK-5 or any electronic keyer.
- Heavy base with non-slip rubber feet.
- Paddles reversible for wide or close finger spacing.



MODEL HK-3
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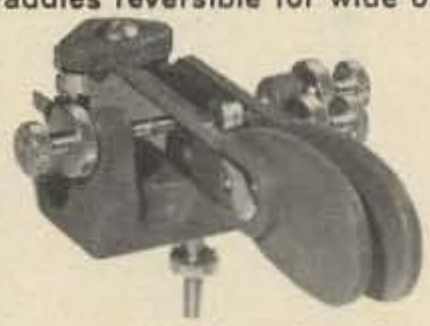
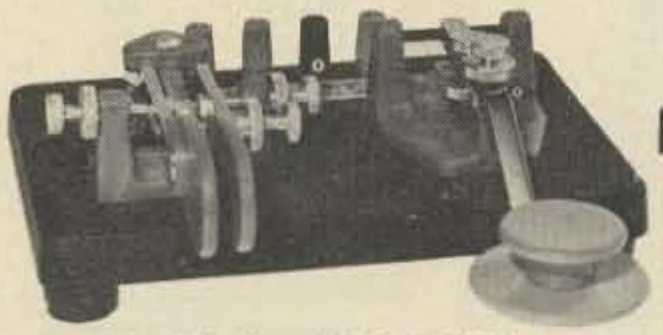
- Deluxe straight key.
- Heavy base, no need to attach to desk.
- Velvet smooth action.



MODEL HK-2
$19.95

- Same as HK-1, less base for those who wish to incorporate in their own Keyer.



MODEL HK-4
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- Combination HK-1 & HK-3 on same base.

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LM340-6	LM340-15
LM340-8	LM340-18
LM340-12	LM340-24

To 220 case. Your choice .85 ea.

NEGATIVE REGULATORS

7905 7912 7915

To 220 case. Your choice .85 ea.

FINNED HEATSINK
for above regulators

2-3/4" High 2-1/2" Wide
1" Depth ONLY ' .40 each

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*FND70	.4"	C.C.	.59
FND800	.8"	C.C.	2.50
FCS8000	.8"	3½ digits	4.95

*TI 6 digit array 3 for 1.00

*LIMITED QUANTITY

REPEAT OF SALE

12 Hour Basic Clock Kit Includes:
- *FCS8000 3½ digit .8" characters
- *FCM7010 Direct Drive Radio Alarm Clock Chip
- *1 Case (Punched for readout)

ALL THIS ONLY $9.50. Specs included

Drilled PC Board for above	$2.50
Transformer for above	$1.00

TTL BOARDS

Memorex computer boards with IC's, diodes transistor, etc. 5 boards containing 100—200 IC's. ONLY $ 4.25.

PLASMA DISCHARGE DISPLAY

12 digit display .4" character
Specs. included .79 each

POWER SUPPLY for above display

Complete with instructions $3.25 each

POWER SUPPLY KIT

Input voltage: 25V max. Output current: 1 amp max. Load regulation 50mV. Uses 220 case regulators. Does not include the transformer. Specify either +6V, +8V, +12V, —5V or —12V regulator. ONLY $ 3.50 ea.

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LM324	.40	NE556	.95
LM380 (8 pin)	.75	NE565	.95
LM380 (14 pin)	1.00	NE566	.95
LM3900	.35	NE567	1.10
LM710	.25	1458	.49
LM711	.25	RCA 3043	.95
LM723	.40	75491	.30
LM748	.25	75492	.40

TRANSISTORS – DIODES

2N2222	6/1.00
2N2369	6/1.00
2N2905	4/1.00
* 2N2907	15/1.00
2N3055	.75
2N3707	6/1.00
2N3904	6/1.00
2N3906	6/1.00
2N4400	6/1.00
2N4443 SCR	.59
RCA 200 V 115W NPN	.95
1N4004	15/1.00
1N4007	10/1.00
1N4148	20/1.00

*House numbered and P.C. Lead

TTL

7400	.17	7473	.21
7401	.17	7474	.35
7402	.17	7475	.55
7403	.17	7476	.35
74H04	.25	7480	.45
7404	.17	7483	.76
7406	.25	7485	.89
7408	.17	7486	.35
7409	.17	7490	.71
7410	.17	7491	.71
7411	.25	7492	.71
7413	.45	7493	.67
7420	.17	7494	.90
7421	.17	7495	.71
7423	.35	7496	.85
7425	.27	74100	.96
7426	.25	74121	.31
7427	.17	74123	.61
7430	.25	74125	.44
7432	.30	74141	.71
7437	.35	74145	.97
7438	.35	74151	.71
7440	.17	74153	.81
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7443	.60	74161	.91
7444	.65	74163	1.05
7446	.85	74164	1.05
7447	.81	74174	.91
7448	.81	74175	1.40
7450	.20	74180	.76
7451	.17	74181	2.25
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7470	.35	74193	.95
7472	.21	74195	.65

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60 watt color organ. Completely self contained unit with 120V power cord included.

$ 2.00 each

MK 5005

4 digit counter/latch decoder; 7 segment output only.

24 pin dip with specs.

$ 9.50 each

WATERGATE SPECIAL: Telephone relay automatically starts and stops tape recorder. No batteries required. KIT COMPLETE with all parts—drilled PC board and case..... **$10.95**

5V POWER SUPPLY—5 volt, 1 amp regulated power supply kit for all your TTL supply requirements.
FEATURES: line regulation .005% Load regulation 50mV Kit includes all components, PC Board, Transformer, Fuse and Pilot Light.
Nothing else to buy!..... **$ 6.50**

60 HZ CRYSTAL TIME BASE—This 60 Hz crystal time-base enables MOS Clock circuit to operate from a DC power source ideal for car, camper, van, boat, etc.

- •60 Hz output with an accuracy of .005% (typ.)
- •Low power consumption 2.5mA (typ.)
- •Small size will fit most any enclosure
- •Single MOS IC oscillator/divider chip
- •5-15 volts DC operation

only $5.95
2 for $10.00

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74LS00	.25	74LS74	.49
74LS02	.25	74LS90	.85
74LS04	.30	74LS132	.90
74LS08	.25	74LS138	.89
74LS10	.25	74LS139	.89
74LS11	.32	74LS155	.90
74LS20	.31	74LS157	1.00
74LS21	.33	74LS162	1.39
74LS22	.33	74LS163	1.39
74LS27	.30	74LS175	1.09
74LS30	.31	74LS193	1.09
74LS32	.33	74LS258	1.09
74LS37	.40	74LS367	.70
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- *Continously variable from 5V to 20V
- *Excellent regulation up to 300 mil.
- *4400 Mfd of filtering
- *Drilled Fiberglass PC Board
- *One hour assembly
- *Kit includes all components
- *Case included

ONLY $ 9.95

VARIABLE POWER SUPPLY KIT #2

Same as above but with 1 amp output also with case. ONLY $12.95

PC BOARDS

4 digit PC Board for FND800 or 807	2.50
6 digit PC Board for FND800 or 807	3.50
4 digit PC Board for DL707	1.50
6 digit PC Board for DL707	2.00
4 digit PC Board for FND503 or 510	2.00
6 digit PC Board for FND503 or 510	3.00
4 digit PC Board for DL747	2.50
6 digit PC Board for DL747	3.00
4 digit PC Board for DL727 or 728	2.00
6 digit PC Board for DL727 or 728	3.00
4 digit PC Board for FND359 or 70	1.75

NOTE: All PC Boards are multiplexed for adding additional digits.

CMOS SALE

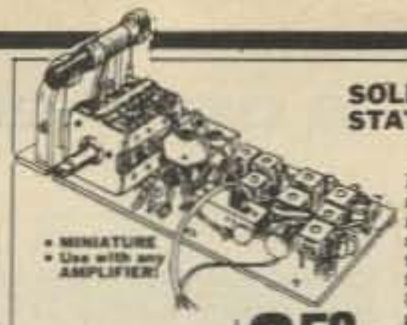
CD4000	.16	CD4040	1.00
CD4001	.16	CD4041	.69
CD4002	.16	CD4042	.59
CD4007	.16	CD4043	.60
CD4009	.45	CD4044	.59
CD4010	.45	CD4047	.59
CD4011	.16	CD4049	.35
CD4012	.16	CD4050	.35
CD4013	.29	CD4051	.90
CD4014	.75	CD4053	.90
CD4015	.75	CD4056	1.00
CD4016	.29	CD4058	.90
CD4017	.80	CD4060	1.00
CD4018	.80	CD4066	.69
CD4019	.39	CD4069	.30
CD4021	.90	CD4071	.16
CD4022	.90	CD4076	.99
CD4024	.70	CD4077	.39
CD4025	.19	CD4102	.68
CD4027	.39	CD4116	.39
CD4028	.75	CD4507	.40
CD4029	.99	CD4512	.50
CD4030	.16	CD4516	.85
CD4034	2.30	CD4518	.85
CD4035	.99	CD4520	.85

DIP Switch

Your Choice $1.69 3 for $4

Cat. No.	Switches
4A3668	2
4A3669	3
4A3021	4
4A3670	5
4A3671	6
4A2677	7
4A3022	8

We bought a factory's complete inventory of 100,000 pieces. We've sold 'em as high as $2.98 each. Now at prices anyone can afford. You can mix 'em when you buy 'em. All SPST, fits 14-pin DIP socket. Wt. 1-oz.



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3 for $18. $6.50

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OP AMP SPECIALS

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LM301V	5 for	1.19	
LM307V	4 for	1.19	
LM308V	2 for	1.19	
LM309H	3 for	1.19	
LM322N	3 for	3.00	
LM324N	3 for	3.00	
LM339N	4 for	1.19	
LM370N	3 for	2.50	
LM373N	3 for	5.00	
LM377N	3 for	4.00	
LM380V	2 for	1.19	
LM381N	3 for	4.00	
LM555H	3 for	1.19	
LM558V	3 for	1.19	
LM565N	3 for	2.50	
LM703H	4 for	1.19	
LM709H	5 for	1.19	
LM710N	2 for	1.19	
LM723N	2 for	1.19	
LM741V	4 for	1.19	
LM747H	2 for	1.19	
LM748V	5 for	1.19	
LM1800N	3 for	2.50	
LM3900N	4 for	1.19	
CM4250H	3 for	2.50	

Code H=TO5 case. V=Mini Dip, N=DIP.

100'S OF BARRELS PURCHASED!

For the first time anywhere, Poly Pak merchandisers introduce a new way in buying the economical way. Raw stock from the "barrel". Remember the "good ole days"? They're back again. The same way merchandisers throughout the United States buy from various factories . . . their overruns in barrels. Poly Pak has done the same. Therefore you are getting the same type of material as the RE-TESTERS DO!

TEST 'EM YOURSELF 'N SAVE!

Poly Pak's EXCLUSIVE BARREL KITS®

Avg. Ship. Wt. 6 ozs.

$1.98 YOUR CHOICE OF ANY KIT

Every kit carries a money back guarantee!

INCLUDES "100%" MATERIAL TOO!!!!

Buy 10 BARREL KITS AND CHOOSE THE 11TH KIT Free

BARREL KIT #210 GLOWIN' PANELS
3 for $1.98
4" x 1" panels that glow blue-green with 110VAC. Use for nite lites, indicators, etc. Cat. No. 4A3550

BARREL KIT #203 CALCULATOR KEYBOARDS
10 for $1.98
It's true! 20-key, 4 function keyboards at ridiculous give-away. Wt. 12 ozs. Cat. No. 4A3524

BARREL KIT #205 MINI BLOCK CAPACITORS
100 for $1.98
Unbelievable! Worth $50. High precision submini caps for all applications. Wt. 3 ozs. Cat. 4A3528

BARREL KIT #202 PLUGS, SOCKETS, RECEPTACLES
100 for $1.98
Includes AC, DC, RF, audio, 8-9 pin, all kinds. Wt. 1 lb. Cat No. 4A3527

BARREL KIT #201 6V INDICATORS w/leads
15 for $1.98
Test lamp manufacturer dumps inventory! Worth 69¢ ea. Like grain-o-wheat. Cat. No. 4A3526

BARREL KIT #200 9 DIGIT READOUT MODULES
5 for $1.98
with calculator & driver chips beneath epoxy Cat. No. 4A3515

BARREL KIT #188 400 Parts $1.98
Includes resistors, caps, transformers, rectifiers, diodes, etc. for p.c. work. Preformed, dumped into barrels by factories. 100%. Cat. No. 4A3401

BARREL KIT #184 ¼-WATT METAL FILM
150 for $1.98
100% metal film resistors. Long leads. 4A3413

BARREL KIT #182 JUMBO RED LEDS
15 for $1.98
100% material, user cancellation from factory dumps, 3V 10 mils. For 100's of projects, red lens. Cat. No. 4A3369

BARREL KIT #167 ROMS-RAMS-REGISTERS
1-lb. $1.98
with approx count of 80 pcs. You get more. Mostly marked, mostly National. Some 40 pins. 4A3064

BARREL KIT #166 LONG LEAD DISCS
4 ozs. $1.98
No counting makes it so you get 150-pc. kit (approx). All marked, 100%. Cat. No. 4A3089

BARREL KIT #163 MINI TRIM POTS
30 for 1 oz. $1.98
Asst. values 100 to 1 meg. What a buy. Single turn, ¼ W, Wt. 6 oz. 4A3345

BARREL KIT #5 SCRS, TRIACS QUADRACS
40 for $1.98
Raw factory stock! All the 10 amp types. Cat.No. 4A2419 Untested

BARREL KIT #159 MODULAR SWITCHES
25 for $1.98
Centralab switches. TV-makers excess. Dpdt, 6pdt, etc. Brand new. Cat. No. 4A3150

BARREL KIT #158 MAGNIFIED MAN-3's
12 for $1.98
MAN-3, 7-seg readout, with built-on magnifier. Factory discontinued line. 100% material. Cat. No. 4A3325 1 oz.

BARREL KIT #157 MOLEX CONNECTORS
75 for $1.98
12 ozs.
Nylon, white cable connectors, asst. factory over-run, NO PICKEE! Mixed in barrels. Cat. No. 4A3324

BARREL KIT #144 RCA PHONO PLUGS
40 for $1.98
1,000,000 RCA phono plugs for this one. You hi-fi-ers know wut they are . . . 100% material. 4A3293

BARREL KIT #154 CLOCK CHIPS
20 for $1.98
We gathered an assortment of clock chip, alarm, calendar, beepers, who knows, all mixed. Cat. No. 4A3308

Back By Popular Demand

BARREL KIT #143 75-PC TRANSISTORS
$1.98
100% material, TO-92, factory discontinued lines, pnp's mixed with npns, 2N4400-1-2-3-4. 4A3290

BARREL KIT #138 PANEL SWITCHES
30 for $1.98
Did you hear of OAK? Another eqpt maker barrelled all types of rotaries, electric, slides, etc. 4A3268

BARREL KIT #135 MICRO MINI LAMPS
20 for $1.98
1 oz.
Imagine! Micro size (¼ x ¼) with wire leads. 3 to 5 VDC, 40 mils. Worth 60¢ ea. Cat. No. 4A3259

BARREL KIT #134 CALCULATOR CHIPS
15 for $1.98
National type. Can be MM5736, 38, etc. Untested. Cat. No. 4A3258

HONEST ABE PENNY SALE

Order by Cat. No. 4A1981 & Type No.

SALE

Type	Sale	2 For
SN7400N	$0.16	$0.17
SN7401N	.16	.17
SN7402N	.16	.17
SN7403N	.16	.17
SN7404N	.16	.17
SN7405N	.18	.19
SN7406N	.20	.21
SN7407N	.25	.26
SN7409N	.18	.19
SN7410N	.16	.17
SN7411N	.25	.26
SN7413N	.45	.46
SN7417N	.32	.33
SN7420N	.16	.17
SN7421N	.29	.30
SN7423N	.35	.36
SN7425N	.27	.28
SN7430N	.16	.17
SN7437N	.26	.27
SN7438N	.26	.27
SN7440N	.16	.17
SN7441N	.84	.85
SN7442N	.53	.54
SN7445N	.69	.70
SN7446N	.79	.80
SN7447N	.79	.80
SN7448N	.76	.77
SN7450N	.16	.17
SN7451N	.16	.17
SN7454N	.16	.17
SN7464N	.16	.17
SN7470N	.45	.46
SN7472N	.34	.35
SN7473N	.36	.37
SN3474N	.31	.32
SN7475N	.49	.50
SN7476N	.31	.32
SN7478N	.79	.80
SN7483N	.69	.70
SN7489N	1.95	1.96
SN7490N	.44	.45
SN7491N	.73	.74
SN7492N	.47	.48
SN7493N	.47	.48
SN7494N	.78	.79
SN7495N	.78	.79
SN7496N	.72	.73
SN74100N	.98	.99
SN74106N	.65	.66
SN74107N	.33	.34
SN74112N	.65	.66
SN74113N	.65	.66
SN74114N	.65	.66
SN74121N	.38	.39
SN74123N	.59	.60
SN74125N	.59	.60
SN74126N	1.00	1.01
SN74132N	.59	.60
SN74141N	.88	.89
SN74145N	.69	.70
SN74148N	1.29	1.30
SN74150N	.99	1.00
SN74151N	.70	.71
SN74153N	.65	.66
SN74154N	1.03	1.04
SN74155N	.70	.71
SN74157N	.70	.71
SN74158N	.85	.86
SN74160N	.88	.89
SN74161N	.88	.89
SN74164N	.79	.80
SN74165N	.99	1.00
SN74173N	1.39	1.40
SN74174N	.97	.98
SN74175N	.89	.90
SN74176N	.79	.80
SN74177N	.79	.80
SN74181N	2.05	2.06
SN74184N	1.75	1.76
SN74185N	1.75	1.76
SN74190N	1.15	1.16
SN74191N	1.05	1.06
SN74192N	.87	.88
SN74193N	.83	.84
SN74195N	.73	.74
SN74196N	.88	.89
SN74198N	1.49	1.50
SN74199N	1.49	1.50
SN74200N	3.95	3.96
SN74251N	1.09	1.10
SN74284N	5.95	5.96
SN74285N	5.95	5.96

BARREL KIT #131 TANTALUM ELECTROS
30 for $1.98
Mixed, marked prime, top grade asst. values, voltages. Cat. No. 4A3255

BARREL KIT #128 MINI DIP ICS
75 for $1.98
Large mfgr dumped 100's of lbs into barrels. Includes 741s, LM-380-8, 703, 567, 555, 558—but who knows? Wt. 1 lb. 4A3245

BARREL KIT #127 AXIAL ELECTROS
40 for $1.98
Asst. capacities and voltages. Cat. No. 4A3227

BARREL KIT #126 UPRIGHT ELECTROS
40 for $1.98
1mf to 300mf in mixture of voltages. 100% marked 'n good. 4A3226

BARREL KIT #115 MOLEX SOCKETS
100% good
200 for $1.98 Cat.No. 4A3145
Calculator maker dump! We got a zillion of 'em. Used for IC sockets, etc.

BARREL KIT #112 MICRO MINI LEDS
40 for $1.98
All the tiny leds, axial, upright of Monsanto, Litronix, variety of colors. Yield 50% or better. 4A3139

BARREL KIT #109 TERMINAL STRIPS
100 for $1.98
Wide asst. of terminal strip connectors, from 1 contact up. Strip manufacturers barrel dump is your gain. Wt. 1 lb. Cat.No 4A3136

BARREL KIT #104 SLIDE VOLUME CONTROLS
10 for $1.98
Cat.No. 4A3057

BARREL KIT #101 RESISTOR SPECIAL
200 for $1.98
Includes: ⅛, ¼, ½, 1, 2-watters, carbon, 8 oz. 100% good. 4A3054

BARREL KIT #99 PHOTO ELECTRIC CELLS
10 for $1.98
Asst. GE types, CDS types. Mixed by factory. Big job for us to separate. 100% good. Cat.No. 4A3052

BARREL KIT #93 HALF WATTERS
200 for $1.98
Resistor factory tried to fool us by mixing 100% color-coded resistors in barrel. But value is there. 4 oz. 4A3046 Untested

BARREL KIT #92 3 AMP EPOXY RECTIFIERS Untested
100 for $1.98
Cosmetic rejects, electrically fine business! You check 'em, it's not for us. Asst. voltages. 4A3204

BARREL #91 SILVER MICAS
100 for $1.98
Axial, red case, variety of physical sizes & values. Cat.No. 4A3018

BARREL KIT #88 LITRONICS LED READOUTS
10 for $1.98
747's, 727's, singles, triples, etc. .33 to 0.6. Bot from factory, all mixed; have fun! No. 4A2861

BARREL KIT #87 NATIONAL IC BONANZA
100 for $1.98
Types 8000, 7400 series, DTLs, ROMs, registers, clock & calc. chips, linears, etc. Cat.No. 4A2860 Untested.

BARREL KIT #86 HOBBY LEDS
40 for $1.98
Untested
747's, 727's, singles, triples, etc. .33 to 0.6. Bot from factory, all mixed; have fun! 4A2855

BARREL KIT #83
15 for $1.98
LM-340T VOLT REG
Factory rejected them for length of leads. May include 5, 6, 8, 12, 15, 18, 24 volts. Power tab Cat. 4A2635

BARREL KIT #81 SUBMINI RESISTORS
200 for $1.98
PC, upright type, color coded, ⅛ watt. Asst values. Came to us in a barrel. Cat.No 4A2746 100% good.

BARREL KIT #76 1-WATT ZENERS
100 for $1.98
Factory same as 400-mw's. Never-to-see-again offer. 6, 8, 10, 12, 15V. under glass. Double plug. Cat.No 4A2741 Untested.

BARREL KIT #73 TRANSISTOR ELECTROS
50 for $1.98
We don't wish to separate wide asst voltages & values up to 300 mf. Cat. 4A2747

BARREL KIT #71 CAPACITOR SPECIAL
100 pcs. $1.98
micas, moldeds, plastics, ceramics, discs, etc. Nifty 100% good Cat.No 4A2738

BARREL KIT #68 2 WATTERS
100 for $1.98
100% good.
Suppliers throw 'em in the barrel. It's a li'l gold mine. All marked. Cat.No. 4A2735

BARREL KIT #65 MIXED READOUTS
10 for $1.98
Factory returns — such numbers as MAN-4's, MAN-7's, MAN-8's, 11 barrels & no time to separate. Cat.No. 4A2733 Untested.

BARREL KIT #61 POLYSTYRENE CAPS
100 for $1.98
Finest caps made. As a gamble we bought 10 barrels from factory, mixed values; all good. Cat.No. 4A2729

BARREL KIT #58 SLIDE SWITCHES
30 for $1.98
All shapes, sizes, spst, dpdt, momentaries, etc. Tremendous shop pak for 100's of switching projects. Cat.No. 4A2726 100% good

BARREL KIT #56 POWERS! POWERS!
$1.98
100 for
Large distributor cleaned house. Barrels of power resistors 3 to 7 watts. Cat No 4A2724

BARREL KIT #54 8 DIGIT READOUTS
10 for $1.98
Bargain of a lifetime! All we got was 1 barrel — the "blisdor digit" types. Multiplexed. Cat. No. 4A2722

BARREL KIT #40 PNP HIGH-POWER TRANSISTORS
20 for $1.98
Popular germanium TO-3 case 4A2618 100% good

BARREL KIT #39 2N3055 HOBBY TRANSISTORS
15 for $1.98
Fallouts of the famous 2N3055. 4A2617 100%

BARREL KIT #37 1 AMP "BULLETT" RECTIFIERS Untested
100 for $1.98
Famous style, asstd. voltages, silicon, axial includes all types of voltages to 1KV. Cat.No. 4A2615

BARREL KIT #36 GERMANIUM DIODES
200 for $1.98
Untested
Famous maker, popular item. Never grows old. But this is the way the RE-TESTERS buy 'em from the factories. Cat.No. 4A2614

BARREL KIT #35 NEON LAMPS
30 for $1.98 100% good.
Famous NE-2's. All prime, but factory made millions and barrel'ed 'em. Your advantage Cat.No 4A2613

BARREL KIT #31 METALLIC RESISTORS
100 for $1.98
Made mostly by Corning, the finest resistor made. Mostly ½ watters, 1% to 5% tol. & a barrel of values. Cat. No. 4A2609

BARREL KIT #30 PREFORMED RESISTORS
200 for $1.98
We got barrels of ¼ and ½" watters for pc use., 100: ¼, 100 ½" watters. No. 4A2608 100% good

BARREL KIT #27 PREFORMED DISCS
100 for $1.98
Hi-Fi mfr's shelf inventory but he dumped 'em in barrels. Preformed, for PC use. Mixed values too! 4A2605

BARREL KIT #26 PLASTIC TRANSISTORS
100 for $1.98 Untested.
Type TO-92 (TO-18), all manufacturers, variety of 2N #'s. Cat.No 4A2604

BARREL KIT #25 METAL CAN TRANSISTORS
100 for $1.98
Includes TO-5, TO-1, TO-18, etc., assorted 2N numbers, unmarked etc. Cat.No. 4A2603 Untested.

BARREL KIT #20 LONG LEAD DISCS
100 for $1.98
"auction sale". Prime, marked only. Long leads. Cat. 4A2598 100% good

BARREL KIT #19 DIPPED MYLARS
60 for $1.98
Finest capacitors made, shiny finish. Imagine factory dumping 'em in barrels. Cat.No. 4A2597 100% good

BARREL KIT #3 1N4148/914 SWITCHING DIODES
100 for $1.98
Imagine famous switching diodes at these prices! Cat.No. 4A2418 Untested.

BARREL KIT #2 LINEAR OR AMPS, DIPS
75 for $1.98
Untested
May include 709's, 741's, 703's, 560 series, 555 includes 4A2416

BARREL KIT #1 SN7400 DIP IC'S.
75 for $1.98
Marked 14 and/or with 16 pin dips, may include gates, registers, flip flops, counters. 4A2415 Untest

BARREL KIT #14 PRECISION RESISTORS
200 for $1.98
Marked and unmarked ¼ ½, 2 watts. No. 4A2428

BARREL KIT #11 POWER TAB TRANSISTORS
40 for $1.98
NPN, plastic TO220 type. Assorted 2N numbers. No. 4A2425 Untested.

BARREL KIT #7 VOLUME CONTROL BONANZA!
30 for $1.98
100% good
Singles, duals, variety of values, styles, big ones — small ones. Cat.No. 4A2421

BARREL KIT #4 "4000" RECTIFIERS
100 for $1.98
Untested.
1N4000 series. May include 25, 50, 100, 200, 400, 600, 800 and 1000 volters. 4A2417

Terms: Add postage Rated: net 30
Phone: Wakefield, Mass. (617) 245-3829
Retail: 16-18 Del Carmine St., Wakefield.
MINIMUM ORDER — $6.00

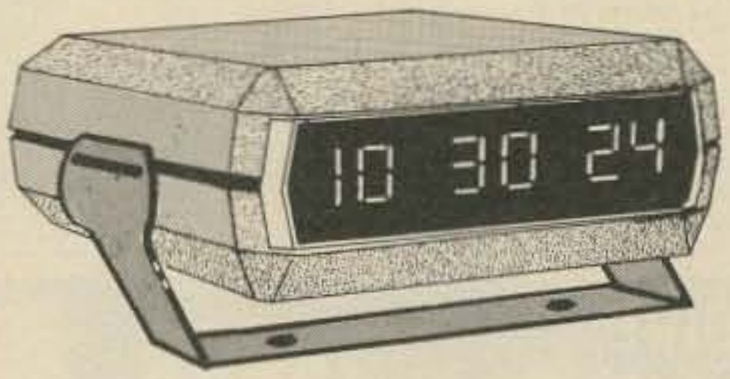
POLY PAKS

P.O. BOX 942A LYNNFIELD, MA. USA 01940

SALE ☐ Send for FREE SPRING CATALOG

C.O.D.'s MAY BE PHONED

DIGITAL AUTO CLOCK



The heart of this chronometer is a high frequency crystal oscillator which provides an accuracy of ± 1 minute per month even in changing temperature or electrical "noise" conditions. Easy to assemble kit with complete step-by-step instructions. Or, for those who would rather not, a ready-built and tested unit is also available.

FEATURES INCLUDE:

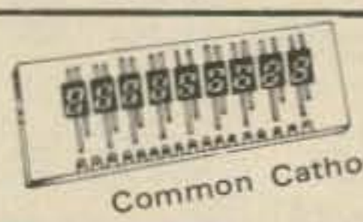
12 or 24 hour time format — Displays time in hours, minutes, and seconds on 6 large, .4" red LED digits — Operates from 9–14 volts AC or DC power — Simple, non-polarized power input — Display blanks when ignition off — Internal 9 V battery assures timekeeping (without display) when external power is removed — Special circuitry surpresses voltage spikes — Recessed switches in front of case for quick and easy time setting.

Complete kit: Includes all components, etched and drilled epoxy boards, case, mounting bracket and comprehensive assembly instructions. (Less 9 V Battery).

Kit #SI-204 $27.95 **Assembled #SI-204W $37.95** **110-V AC Adapter $2.50**

CLOCK CHIPS

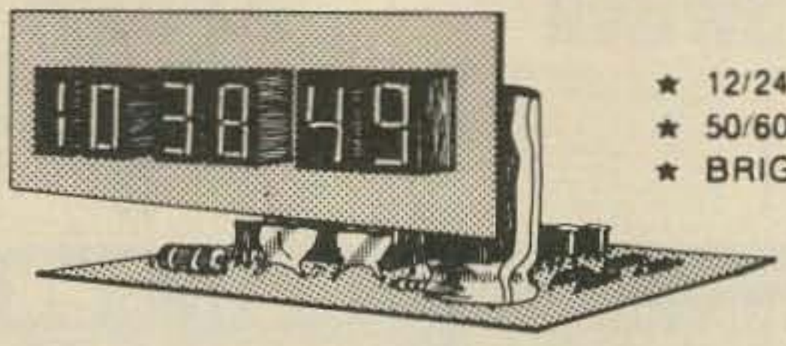
MM5314 - 6-digit, 12/24 Hr, 50/60 Hz Multiplexed, 24-pin	$3.75
MM5316 - 4-digit, 12/24 Hr, 50/60 Hz, Alarm, Snz, Timer, 40-pin	$4.50
50252 - 6-digit, 12Hr/60Hz, 24Hr/50Hz, Alarm, Snz, Mpx., 28-pin	$4.95
CT7001 - 6-digit, Clock, calendar, Radio Timer, 12/24 Hr, 28-pin	$6.95
MK50381 - 4-digit direct drive LED, 12Hr, 50Hz, Radio Timer, 40-pin	$6.95



9-DIGIT DISPLAY

Ideal for a mini clock, calculator or stopwatch. .11" digit height.
Special – $0.99 ea. . . 3/$2.50

6 DIGIT LED CLOCK KIT



- ★ 12/24 HOUR
- ★ 50/60HZ
- ★ BRIGHT LEDS

This kit uses the MM5314 clock chip and is available with a choice of display sizes. Features 12 or 24 hour time format, 50 or 60 Hz input, fast and slow time setting with a hold function for precise time syncronizing. Kit includes all components, etched and drilled epoxy boards and complete step-by-step assembly instructions. (Case and transformer not included).

Kit #SI-10 with .27" Red LED's	$11.50
Kit #SI-14 with .4" Red LED's	$13.95
Kit #SI-15 with .5" Red LED's	$16.95
Transformer to suit. (pc lug mount type)	$ 1.25
Transformer to suit. (molded with line cord)	$ 2.50

60 HZ CRYSTAL TIME BASE

This kit enables any AC powered clock to be operated on DC. Compact size — only 1" x 2". Power requirement: 5-15 VDC @ 3 mA. Kit includes all components, PC Board and easy to follow hookup instructions for interfacing with MOS clock chips.

Kit #SI-62 . . . . . $4.95

FM WIRELESS MIKE KIT

Kit #SI-36A $3.95

Kit SI-36 is completely new design in FM wireless transmitters. Unique PC layout eliminates the need for wire-wound coils which other units use. Can be used with any dynamic type microphone to broadcast on the FM band. Frequency range 88–108 MHz. Output: 100 mW with a 9 V battery, Size: 1.8" x 1.8". Kit includes all components, PC board and assembly instructions. (Less battery and mic.)

LED DISPLAYS

FND-359	.38"CC	$0.95
FND-503	.50"CC	$1.29
FND-510	.50"CA	$1.29
MAN-74	.30"CC	$1.39
DL747	.60"CA	$1.89
XAN-664*	.60"CC red	$1.99
XAN-654*	.60"CC grn	$1.99

*Denotes no decimal point.

LED DRIVERS

Quad segment driver.	$0.49
Hex digit driver	$0.59

DISCRETE LED

Submini red	8/$1.00
Submini green	6/$1.00
Mini red	7/$1.00
Mini green	6/$1.00
Jumbo red	6/$1.00
Jumbo green	5/$1.00

VOLTAGE REGULATORS

LM309K 5v, 1 amp, TO-3	1.10
7805 5v, 1 amp, TO-220	0.95
7812 12v, 1 amp, TO-220	0.95
7815 15v, 1 amp, TO-3	1.25
7818 18v, 1 amp, TO-3.	1.25
7824 24v, 1 amp, TO-3	1.25

LINEAR IC's

308 Precision Op Amp	0.99
380 2 Watt Audio Amp	0.99
555 Timer	0.55
565 Phase Locked Loop	1.19
567 Tone Decoder	1.75
709 Op Amp	0.25
741 Op Amp	0.25
748 Op Amp	0.29

MEMORY

2102-1 1K Static RAM	1.49
21L02B Low pwr. version	1.79

TRANSISTORS

2N2222 NPN	8/$1.00
2N3906 PNP House #	.10/$1.00
2N4400 NPN	8/$1.00
2N4403 PNP.	6/$1.00
2N3055 NPN	$0.69 ea.

MJE 3055

90 Watt NPN Pwr. transistor mounted on heatsink plate.
Special – $0.69 . . . 3/$1.95

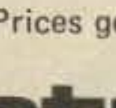
SPEAKER / MIC.

40 ohms impedance – 1-1/8" dia.
Special – $0.79 ea. . . 3/$2.00

SWITCHES

SPDT Heavy duty Rocker	6/$1.00
SPST Momentary Push Button	3/$1.00
SPDT Miniature slide	6/$1.00

IC SOCKETS



16-pin Lo-profile	0.25
18-pin Lo-profile	0.29
24-pin Std. profile	0.49

DIODES

1N4148	switch	20/$1.00
1N4001	1 A/50 V	20/$1.00
1N4005	1A/400V	15/$1.00
1N4007	1A/1000V	10/$1.00

ELECTROLYTIC CAPS.

2000 uF/15V	Axial	3/$1.00
1000 uF/25V	PC leads	4/$1.00
220 uF/25V	PC leads	5/$1.00
100 uF/25V	PC leads	6/$1.00
10 uF/25V	PC leads	8/$1.00

RESISTORS

100 assorted, mostly 5% & 10% some 20%. Full leads

100/$1.29 200/$2.10

TERMS

Satisfaction guaranteed. We pay shipping in Continental USA. Others add 5%. Overseas add 10% (20% for Airmail). U.S. Funds only. Orders under $15.00 add 75¢ handling. Texas residents add 5% Sales Tax. Sorry – No COD or charge cards. Check or Money orders only.

Prices good thru April

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SLEP ELECTRONICS

SURPLUS SPECIALS

RECEIVERS – TRANSCEIVERS

- COLLINS R-388/URR RECEIVER, MILITARY VERSION OF THE 51J-3, TUNES 500 KHZ THRU 30.5 MHZ, 19" RACK MOUNT $365.00
- R-390/URR RECEIVER, TUNES 500 KHZ THRU 30.5 MHZ, DIGITAL TUNING, DUAL RF, AUDIO FILTERS, 115V/60HZ 19" RACK MOUNT, DIGITAL TUNING 495.00
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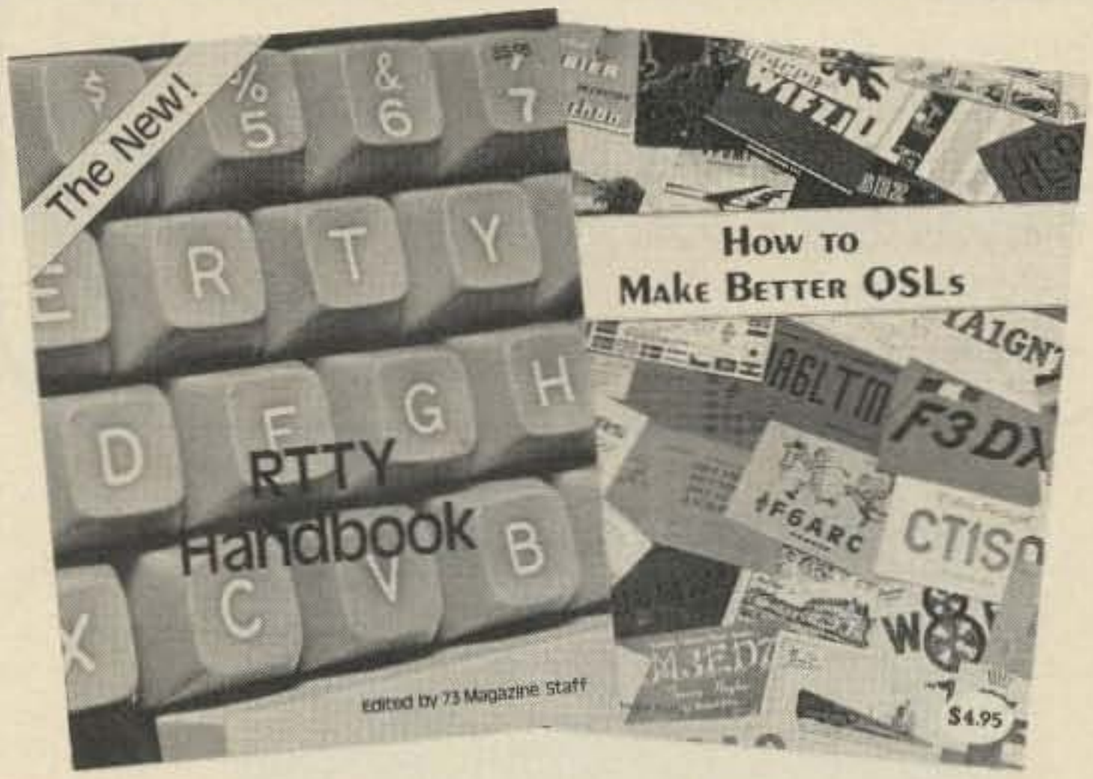

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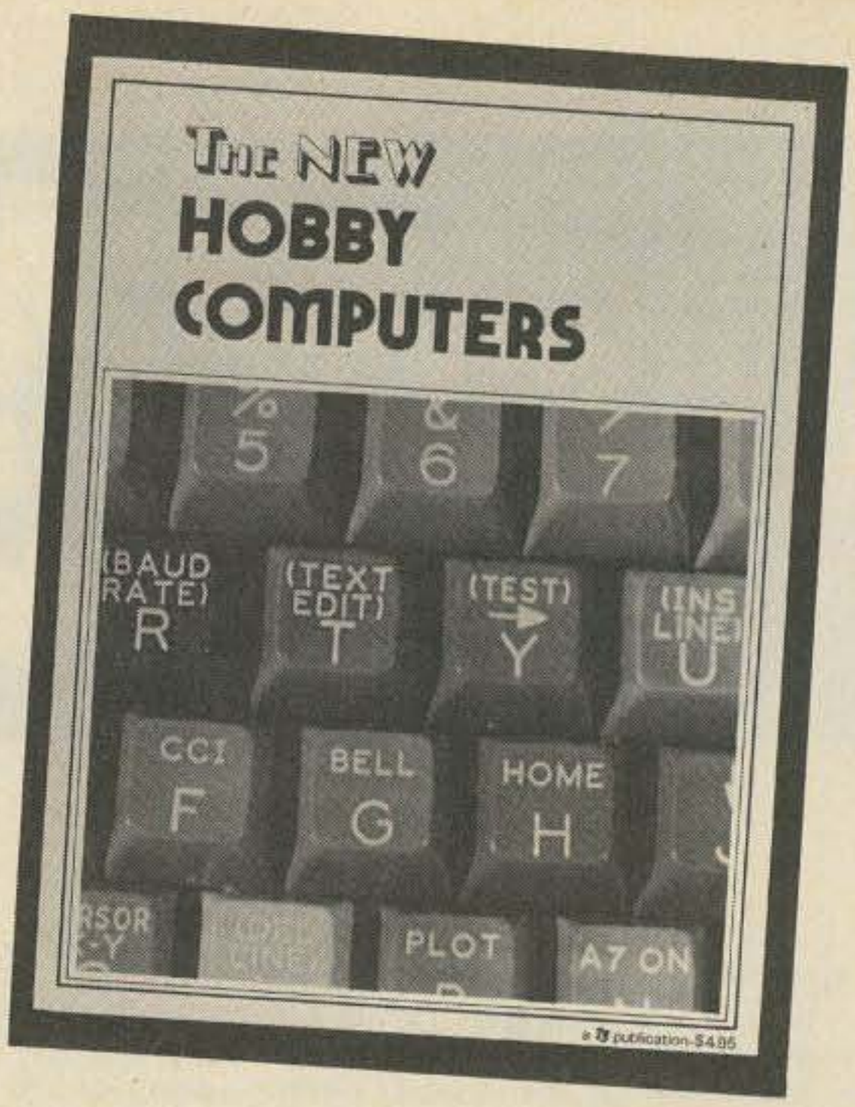

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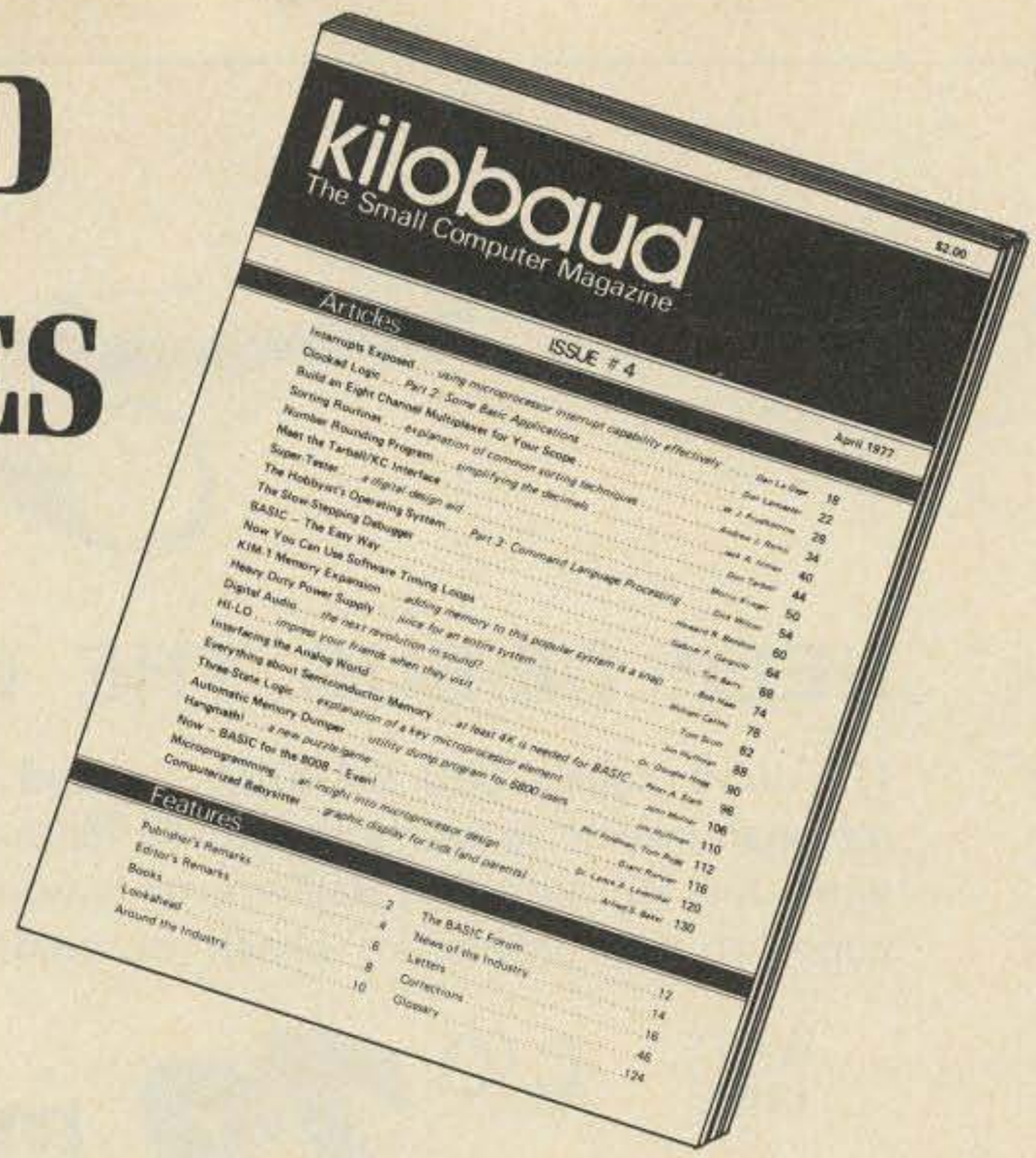

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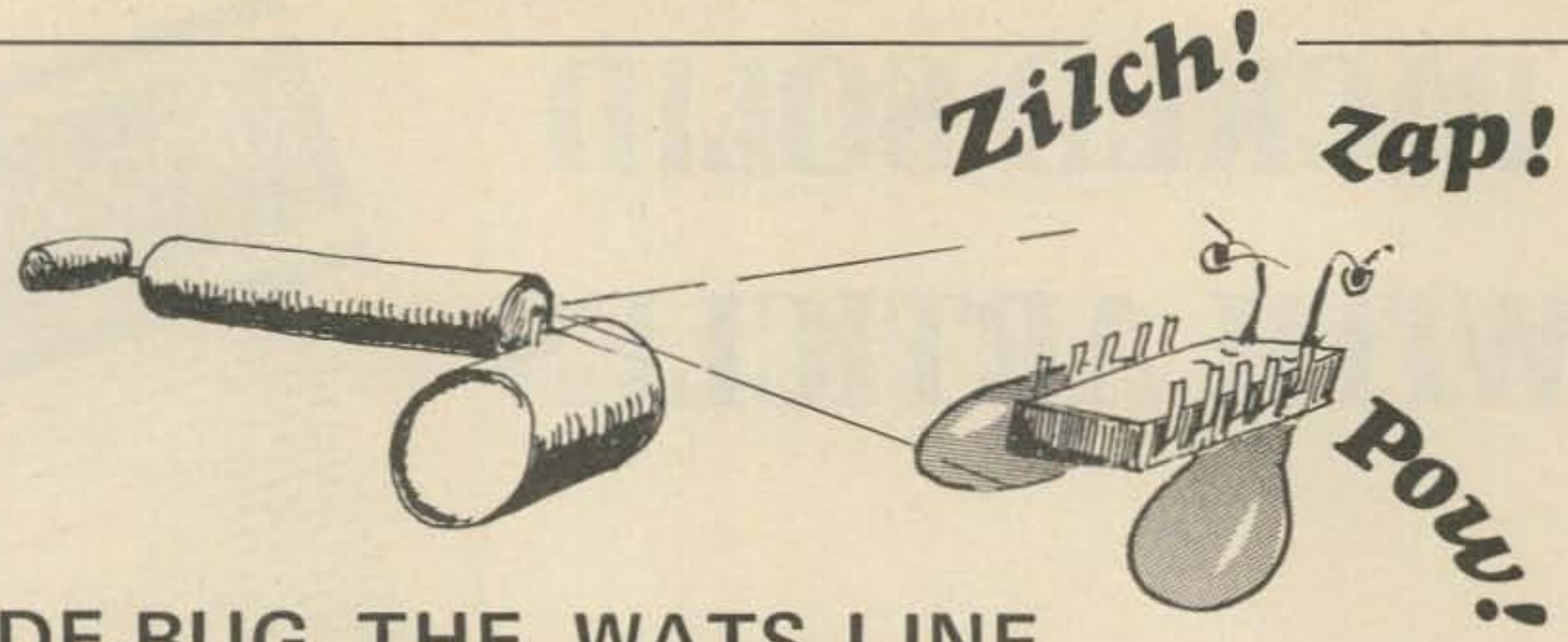

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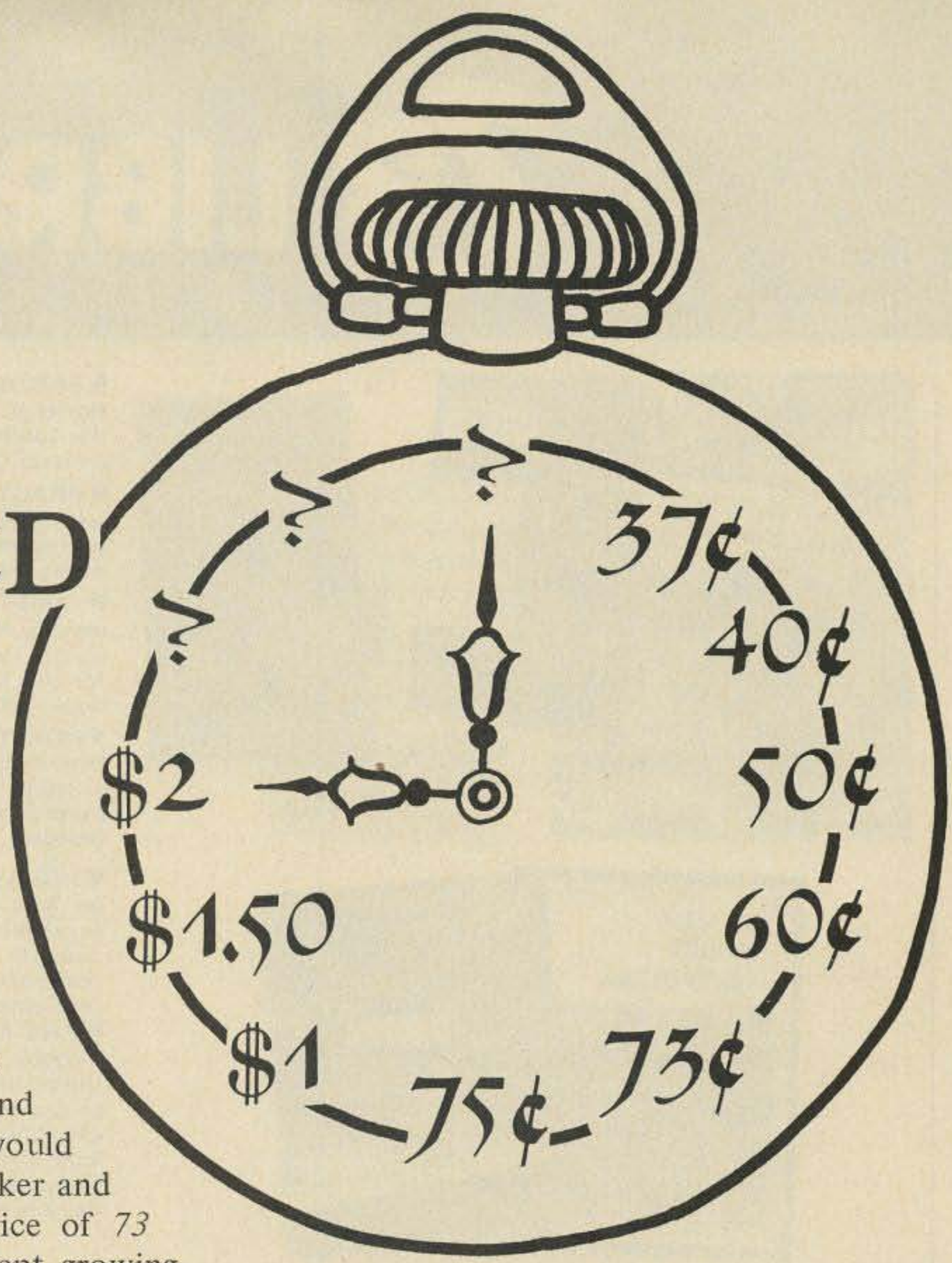

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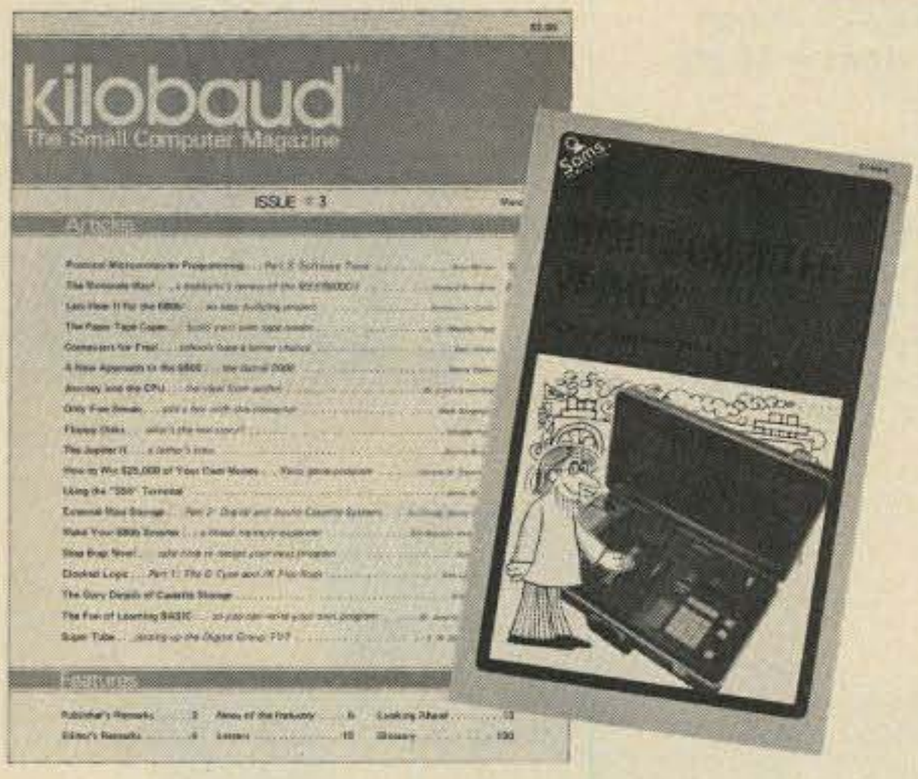

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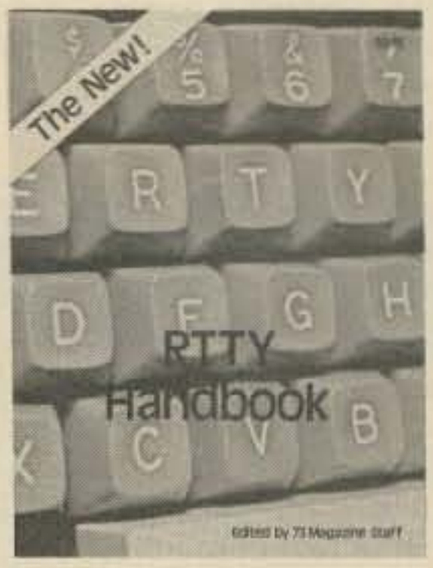

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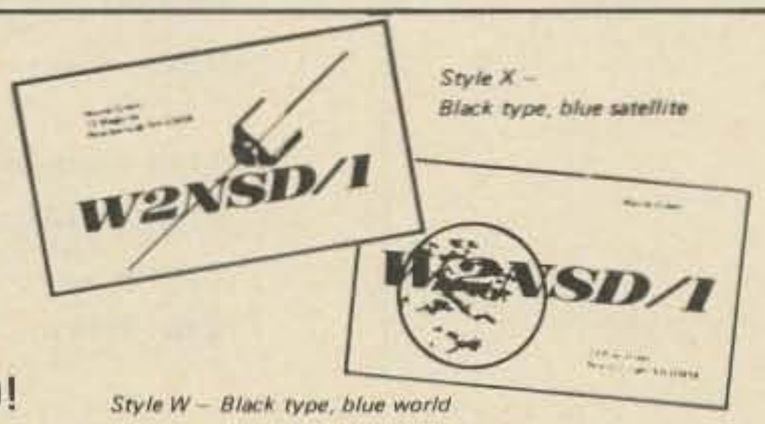

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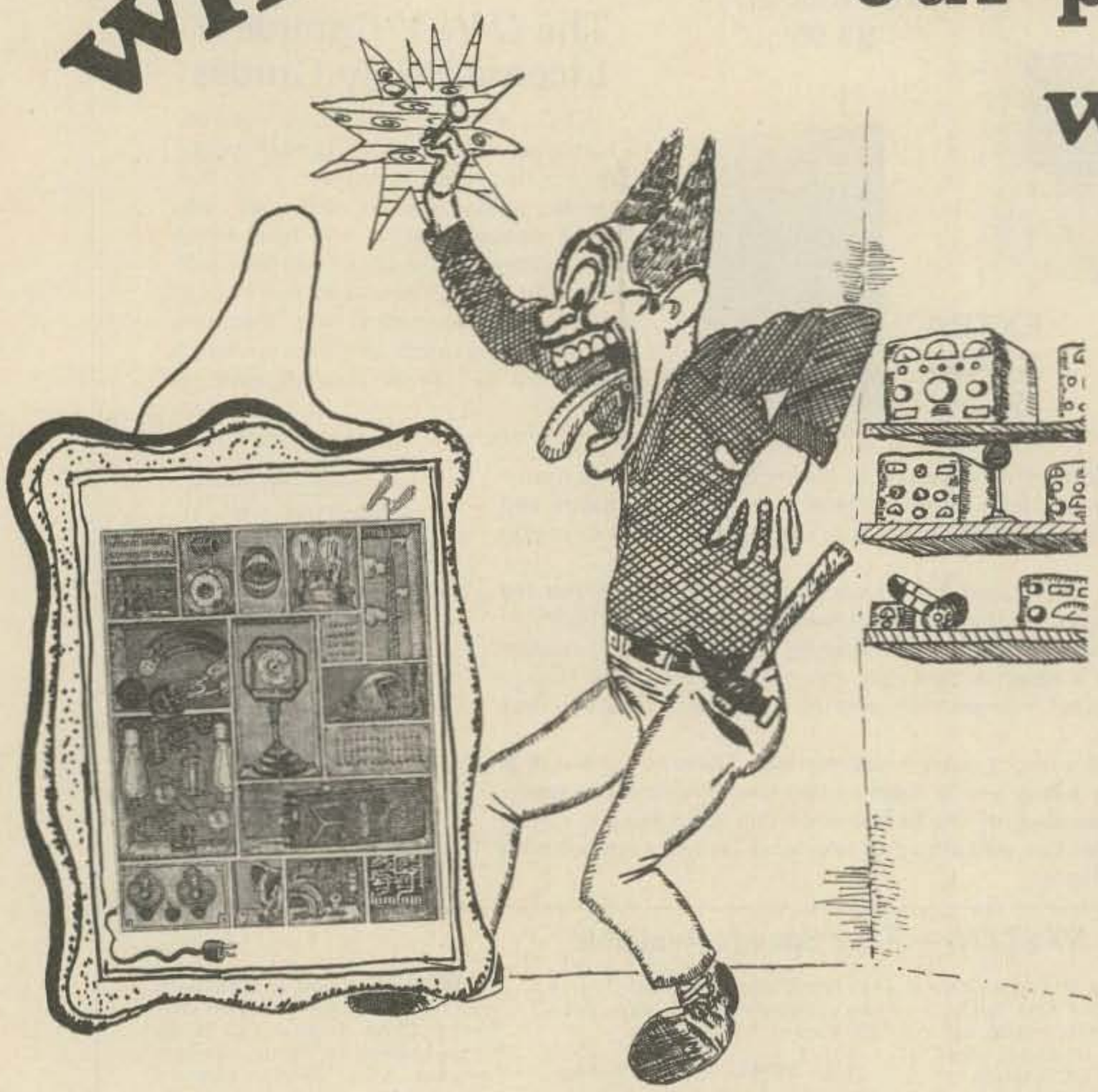

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