73 magazine

for radio amateurs

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June 1973
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*Measured over a ¼ wavelength whip

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73 magazine
for radio amateurs

#153 JUNE 1973

FEATURES

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Amateur Radio

JUNE MCMLXXIII Monthly Ham

ATLANTA EMERGENCY

WB4CPL

In the late afternoon of March 31st a tornado struck just east of Atlanta, Georgia, and on into South Carolina. Hardest hit was Conyers, Georgia. Within an hour of learning the extent of the damage, the Alford Memorial Radio Club declared their Stone Mountain Repeater W4BOC (16–76) closed to all but emergency traffic.

A walkie-talkie was used in the Conyers City Hall to provide communications from the police, fire and city officials. Many emergency generators were available due to a recent ice storm, but the need was for someone to keep the large fixed units operating. The Rockdale County Hospital lost its power plant 10 minutes after it was started. A ham in north Georgia heard K4YGI's report from the hospital and drove down, as his business is motor-generators. Wire to operate remote functions (water, etc.) at the hospital was found by other hams; as was gas when they ran out about 2:00 a.m.

A new control was rotated among base units near Stone Mountain to keep order in the repeater operations. The Atlanta Radio Club used its autopatch machine, W4DOX, in downtown Atlanta to relieve the load on the Conyers phone system. They also manned their W4DOC base station in the Red Cross building on the 3975 emergency net relaying messages from the Stone Mountain repeater. A pair of 30 kW, 400V, 3 phase generators was obtained via the relay to W4DOX 80 meter station from the Army near Atlanta. It arrived about 14 hours after the tornado struck, to power the city water system.

By the next afternoon most power was restored and the hams pulled out after a very successful operation. That night a thunderstorm blew the Stone Mountain machine off the air for a much deserved rest.

One of the surprising occurrences was the arrival of a group from two local Citizens Band clubs with an emergency van stocked with first aid supplies and an emergency power generator but *without radios.* The non-enforcement of regulations by the FCC has turned their radios into useless junk. It was impossible to use 11 meters on a local basis. They were first-aid trained, however, and many a ham learned that all CB'ers are not brainless dolts.

FLOOD EFFORTS HONORED

Sixteen amateur radio operators were honored for providing emergency communications during tropical storm Agnes between mobile Navy units and Civil Defense Headquarters.

Left to right: Allen Mcquate K3HQC, George Gadbois W3FEY (president of SERCOM), Don House WA3OWD, John Helenthal W3DWS, Lt. Allen B. Caplan, Commanding Officer, Lancaster Naval Reserve Center, K4AVQ; Robert J. Witmer K3VAX and Barry M. Bauman WA3PTE.

The amateurs are members of SERCOM of Lancaster County, Pa., which operates the Lancaster 146.01–61 2 meter FM repeater 24 hours a day. A letter of congratulation was presented to each of the sixteen by Lt. Alan B. Caplan, Commanding Officer of the Lancaster Naval Reserve Center. Alan is also a member of SERCOM and his call is K4AVQ. Those honored were: Roy Smoker K3HLB, Robert J. Witmer K3VAX, Barry M. Bauman WA3PTE, Donald L. House WA3OWD, Robert Landis WA3JMJ, Earl E. Eshleman WA3DMH, John Helenthal W3DWS, Theodore Schriber W3KKX, Clyde Jones WA3HMJ, Ray Enders W3RLT, James P. Murray K3QAW, Allen Mcquate K3HQC, James R. Shank W5CNS, Russel E. Martin W3MFW, George S. Gadbois W3FEY and James W. Burton.

News Pages

10M BEACONS

Three 10 meter beacons have been established in Region 1 to assist in propagation studies and to establish reliable path/conditions information. They are bound to be invaluable aids to amateurs in the rest of the world for spotting band openings now that activity has lessened due to the declining sunspot cycle.

Besides the three stations presently in operation below, others are planned in the near future for Cyprus, Antartica and North America.

DLØIGI, Mt. Predigtstuhl near Salzburg (Austria) 28.195 MHz and 28.200 MHz, between 15–20 and 45–50 min. past each hour.

GB3SX, Crowborough, Sussex (UK), 28.185 MHz.

3B8MS Signal Mount (Mauritius), 28.200 MHz, will QSY to 28.190 MHz shortly.

Holding an oversized copy of their new repeater license WR3AAA are FM Association officers Robert McClain W3VRZ, club president, Beaver Falls; Richard Hanna K3VYY, treasurer, Beaver Falls; Chester Calvin WA3LJS, secretary, Patterson Heights; and Kenneth Riggle W3FCQ, chief engineer, Patterson Township. The repeater is located in Freedom PA on 146.25–85.

(Photo by K3KGX)

LAWMEN AIDED

An Associated Press technician, the pilot for a radio station traffic report, two deputy sheriffs, and lots of reinforcements combined forces March 14 to keep three prisoners in custody. Two Milwaukee county sheriffs deputies were transporting three prisoners from Waupun to Milwaukee for trial when the prisoners allegedly tried an escape. Sheriff Michael Wolke says the three – one from Central State Hospital and two from the prison at Waupun, somehow got out of their handcuffs and chains and tried to overpower the two deputies when their car was near Menomonee Falls on U.S. 41. But Associated Press techniciah Jim Taylor K9ZYS was nearby in his car, and he reported the incident on two meters (146.67) to W9PAS who notified the Washington County authorities, who in turn alerted the Milwaukee County authorities. The pilot pinpointed the location of the trouble for reinforcements. Both deputies were slightly injured, but the three prisoners were quickly rounded up.

DENVER LAWSUIT

Chuck WAØDNH in Denver is in the midst of something even worse than a tower suit. While the usual legal hassles involve large towers equipped with multi-arrays, a lawsuit is being brought against Chuck because he recently erected a Hy-Gain 4 band vertical in his back yard.

Chuck's lawyer is building a defense but is unfamiliar with cases of this sort. He is in need of a vast amount of information so he can effectively protect Chuck and, in the long run, any other amateur in the area who may run into a similar problem.

ANYONE who has had legal action taken against them and survived to transmit again can help. Chuck is desperate. You can contact him by writing: Chuck Kaufman, 3734 So. Poplar St., Denver CO 88237.

We'd like to keep track of this case and be ready when another appears. Possibly keeping an open file of legal facts that will be kept accessible is the answer. To be effective we'll need facts however, so start digging.

COLLINS RETURNS

Electronic News, 3/5/73

Collins Radio owns 57 per cent of a manufacturing and marketing subsidiary formed in Japan.

Collins Radio Co. of Japan Ltd., was formed with Kyokuto Boeki Kaisha Ltd. (Far Eastern Mercantile Co.) of Japan.

Initial plans call for production of communication products for maritime and amateur use.

W.C. Hubbard, named vice-president and general manager of Collins Far East international operations, will be based in Tokyo. Mr. Hubbard was vice-president and controller of Collins.

In Tokyo, a Kyokuto spokesman said products of the new Collins subsidiary will be sold on the domestic market and exported to the U.S.

GUATEMALA ON 3RD PARTY LIST

On April 5, 1973, Decree No. 19-73 was passed by the Guatemalian Congress and was signed by President Osorio, making 3rd party traffic legal between Guatemala and the USA.

The notice was published in the *Diario de Centro America,,* the Official Gazette of Guatemala on April 16, and the handling of traffic became legal 30 days after that date.

FUJR BUJR ZKEZK EFULQ EFWQQ RQKW LTC WKEQL US EFYWEQQV EFYWER EPU!

NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

GAO REVIEW OF THE FCC

The General Accounting Office has made an extensive investigation of the FCC's ability to enforce their regulations and found them seriously wanting. This finding will come as no surprise to any amateur who has ever listened to the citizens band or to the marine channels.

The GAO is most critical of the FCC for not taking forceful action against willful violators, particularly the citizens banders. They point out that the FCC has made it a practice of reducing or cancelling fines, with the result that enforcement of the rules is virtually impossible. During 1971 there were 502 citizens band operators fined for violations. Of this number ten handed in their licenses and paid no fines, 87 had their fines cancelled entirely, and the remainder had their fines reduced substantially. Only 30% of the fines were collected!

When you consider that there are an estimated 800,000 CBers, of which approximately 799,999 are operating in violation of the regulations – plus who knows how many right in there with them without the benefit of a license – the 502 cited seems insignificant.

The GAO suggests that the FCC might be more efficient if it got out of the business of giving license exams, inspecting shipboard radio installations, and cut way down on inspections of broadcast stations. They suggest turning over license exams to the Civil Service Commission, which is already in that business for other branches of the government. This might be better than having them given by the FCC, though I personally favor an investigation of means by which authorized amateur radio clubs might administer the exams – thereby saving the government the cost of giving the exams. Surely some means can be devised which will result in an honest system.

The GAO makes a point that the lack of enforcement of the citizens band has set up a bad psychological situation which is resulting in a spread of the contempt for regulations which characterizes CB. Certainly we see signs of this in the ham bands. The threat of many repeater groups to react to the new repeater regulations which they consider ridiculous by just ignoring them certainly would never be made if the example of chaos on CB were not there.

Amateurs feel that they have a right to reasonable regulations – and to their being enforced. Right now we have neither.

TVI BILL

The next time you find a piece of paper in hand you could do a lot worse with it than drop a note to your congressman asking him to support HR3516, a bill entered by Representative Teague of California which would make it illegal for manufacturers to put out radios and television sets which would get interference from amateur or CB rigs. How about that! You should know who your congressman is by now.

SALES AGENTS FOR 73

Just recently we've signed on some sales agents for 73 subscriptions and books. This has worked out very well for them – with incomes of $50 to $100 a weekend being reported. One agent made $80 just selling subscriptions at two auctions on one weekend.

This is a golden opportunity to let your hobby start paying for itself and bring you some extra income. There are some good territories left, so if you have the time and means to get to every ham activity within reasonable driving distance and you have a good outgoing personality – you don't sell subscriptions by sitting at a table and waiting for people to find you, you have to make sure that everyone knows you are there and what you are there for – and you have to let them know what you've got and why they should subscribe right away. This means getting some time every now and then on the public address system – going around and keeping after everyone.

U.S. AMATEUR FREQUENCY ALLOCATIONS

	CW Only	Phone & CW
Extra Class	3.500– 3.775	3.775– 4.000
	7.000– 7.150	7.150– 7.300
	14.000–14.200	14.200–14.350
	21.000–21.250	21.250–21.450
	28.000–28.500	38.500–29.700
	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
Novice Class	3.700– 3.750	
	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	

SSTV Frequencies

	Suggested
3.775– 3.890	3.845
7.150– 7.225	7.220
14.200–14.275	14.230
21.250–21.350	21.340
28.500–29.700	28.680
50.100–54.000	

LICENSE FEES

Initial License	$ 9
Renewal	$ 9
New Class	$ 9
Modification	$ 4
Special Call Sign	$25

Use FCC Form 610 and mail with appropriate fee to:

Federal Communications Commission
Gettysburg PA 17325

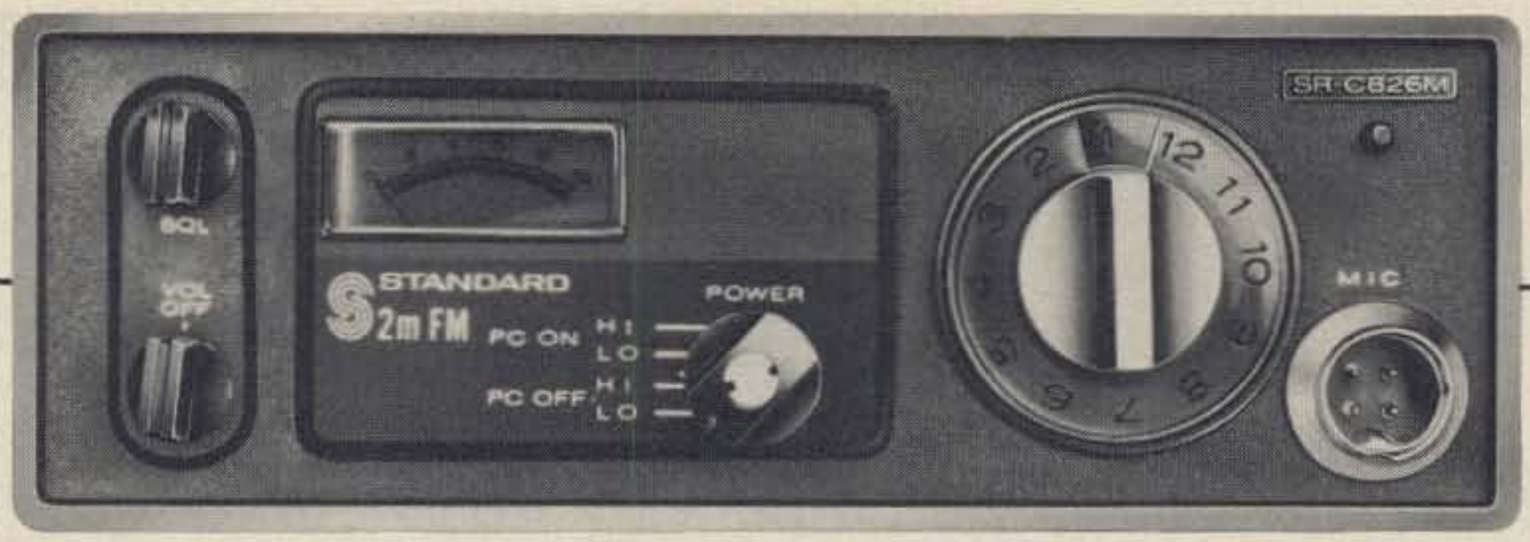
LYNCH YOUR SECRETARY

If your club secretary does not send for the special secret club 73 subscription offer and let you know about this incredible trial offer deal, then serious consideration should be given at the next club meeting to forming a lynch mob and getting someone a little more diligent for the job. Passing up this amazing opportunity might be considered by some as an offense to themselves, to the club, to the community, to the country and perhaps to all mankind.

Why take a chance?

Drop a letter to Ace Goodwin W1GRO and demand that he send you the special confidential secret club

(continued on page 104)



MAXIMIZE YOUR AMATEUR RADIO MONEY.

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SRC-14U

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- ☐ VOX
- ☐ Three Front Panel Meters
- ☐ Plus many more exciting features.

For detailed information on these; the complete Standard line and the name of your nearest dealer write:

Standard
Communications Corp.

213 / 775-6284 · 639 North Marine Avenue, Wilmington, California 90744

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

Some confusion over identification and information exchange was noted during the Slow Scan contest this year. Initially the plan was to exchange all information on SSTV; however, Franco did make an exception for those countries requiring SSB identification of SSTV transmissions. In fact, the actual Slow Scan exchange was narrowed down to merely exchanging an ID frame with the QSO number for each contact. You could identify on SSB before, during, or after Slow Scan transmissions if desired (this will probably be the situation next year also). Some problems still arose by stations using only SSB and no Slow Scan. It is my understanding these QSOs were rejected. Remember, this is not a hair, teeth and eyeball DX massacre, but rather a worldwide promotion of the SSTV mode. Yet, like any contact, it must have rules which must be followed. I hope to have the complete contest results next month, either in this column, or the preceding newspages.

We have a guest column this month written by Professor Franco Fanti, I1LCF, on Slow Scan activity in Europe. I have translated his info, thus it may not reflect an Italian accent. Franco was one of the original Slow Scan pioneers in Europe. While SMØBUO made the first European/American QSO, Franco made the first European/New Zealand QSO.

"There is a relatively large amount of homebrew Slow Scan gear in Europe, mostly of the classic MacDonald and K7YZZ design. However, the second and third Slow Scan contest results confirmed the large amount of new commercially built gear now appearing in Europe. Indeed, Slow Scan appears to be catching on heavily in Italy. A large market for SSTV gear is developing on Italy's 27 MHz "business band." In Italy, this band comes under the Postal Department and was first established for their many fishing ships to use, etc. Also (as in the U.S.) many illegal CB-type operators use this band. Now both the legal (businesses) and illegal (hobbyists) are starting to set up Slow Scan gear on this band of frequencies. The utilization of SSTV by large businesses is a trend that may expand into other European countries."

I guess you have heard that JA's can now legally operate SSTV. Judging from the number that had been watching pix on 20 meters, there should be quite a group on very soon. The VK boys say the first ones on had very good pix. No info yet on their gear, but I suspect their manufacturers will be quick to recognize the tremendous market.

Incidentally, I understand some overseas Slow Scanners (and others) are having a real problem securing parts. They send money and orders to stateside companies and that is the last of it. No reply, no parts, etc. I've helped a couple of the fellows by acting as an intermediary – they sent me their money, I bought the parts and sent them to the fellows. If other SSTVers help a DX friend like this, we will soon get even more countries on Slow Scan. Why not ask them about this during your next QSO. Further, I would like to hear what companies the DX ops are having problems with. Then we can pressure them . . . or the involved mail services.

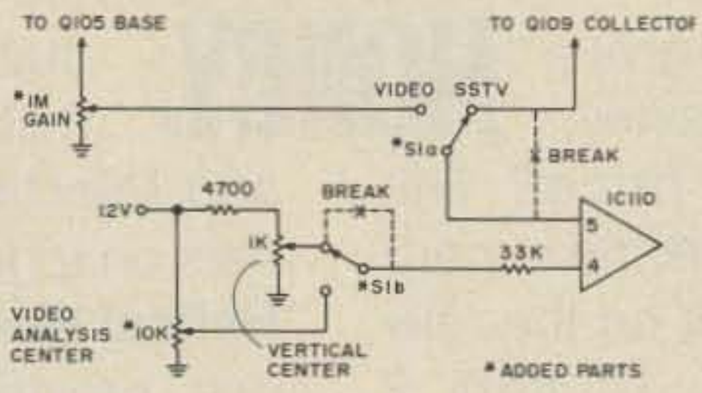


Fig. 1. Modification for the popular 'MXV monitor which enables a stair-step analysis of the received video signal to be displayed on the screen.

Here's another modification for 'MXV type monitors which should prove interesting. Our thanks to Ed Walker VE4CG, for the initial circuit. (You didn't miss the other modification which was in the February issue, did you?) Here the addition of two pots and a DPDT switch converts the screen display to a stair-step spectrum analysis of the received video signal (so called because of the various amplitude displayed for each frequency, or gray shade). The connections originally made to pin 4 and 5 of IC110, the vertical deflection op-amp, are broken and run through each side of a DPDT switch, leaving the "down" position free. The "down" positions now connect to the wipers on the two pots (see Fig.1). The 1 Meg pot adjusts the size of the video discriminator pattern, and the 10K pot is for proper centering of this display on the screen (this may drift slightly, so place it in a convenient location). The monitor now gives either a Slow Scan picture or video anaylsis, depending on the position of SW1. This same principle may be applied to practically any monitor. All that is necessary is to sample the video voltage just before it's applied to the crt (1 Meg pot) and run this small voltage to the vertical amplifier/sweep stage. The second pot (10K pot) is used rather than re-centering with existing controls.

K4TWJ

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

Good news for OSCAR 6 users – the satellite will now be on for an additional two days per week. The satellite operating schedule is as follows:

Satellite 2/10M translator ON 0000Z Thurs.–2400Z Mon.

Satellite 2/10M translator OFF 0000Z Tues.–2400Z Wed.

It should be noted at this point that it is very important that you do not try to use the satellite during the off times. If you do hear the satellite it will be the command stations either running experiments or recording the telemetry. Telemetry is very important in the operation of the satellite and it is impossible for ground command stations to receive it if the translator is jammed with calls. If you hear someone using the satellite please do not try to contact them. They may be part of an experiment or a test. Instead, log their calls and the time and send it to AMSAT. Also, if the satellite is not allowed to recharge, the batteries will become weak and eventually one will reverse, destroying the satellite for everyone. This problem of weak batteries is caused by the small dimensions of the satellite and limited area of solar cells. To make matters worse, one of the cells is malfunctioning and gives only intermittent power. Please observe these times.

From information received from AMSAT I find that only 42 of the 50 United States have amateurs communicating through OSCAR 6. Stations are badly needed in the following states:

Kentucky
Louisiana
Nebraska
New Mexico
South Dakota
Vermont
Wyoming

Why not try to gear up these states? Possibly a group could form "DXpeditions" during weekends. Field Day (June 23–24) would be more than an ideal time to try. I have heard some speculation on the possibility that Vermont does not exist! Well, I don't know about that, but if it does I feel that whoever turns that state on had better be ready for one heck of a

time. I know quite a few amateurs who need Vermont to complete a WAS.

AMSAT has asked us to continue sending signal reports as they really help in determining what OSCAR is doing. In addition, for those amateurs who copy telemetry, anyone observing an extra dot or dash on the end of transmissions from the satellite will you please send this information to AMSAT (time, date, etc., included0? This could indicate some form of degradation in one of the channels of the translator. This could be caused by the abnormally high temperature that has been observed recently and further studies would like to be made on this possibility.

I will continue to publish a list of one reference orbit per day for the month. To find orbital info for other than orbits shown, simply keep adding 115 minutes and 28.75 degrees for each succeeding orbit.

Orbit	Date (June)	Time (GMT)	Longitude of Eq. Crossing °W
2860	1	0154.0	75.9
2872	2	0053.9	60.9
2885	3	0148.8	74.6
2897	4	0048.8	59.6
2910	5	0143.7	73.4
2922	6	0043.6	58.3
2935	7	0138.6	72.1
2947	8	0038.5	57.1
2060	9	0133.4	70.8
1972	10	0033.4	55.8
2985	11	0128.3	69.5
2997	12	0028.2	54.5
3010	13	0123.1	68.2
3022	14	0023.1	53.2
3035	15	0118.0	66.9
3047	16	0017.9	51.9
3060	17	0112.9	65.6
3072	18	0012.8	50.6
3085	19	0107.7	64,4
3097	20	0007.7	49.3
3110	21	0102.6	63.1
3122	22	0002.5	48.1
3135	23	0057,4	61.8
3148	24	0152.4	75.5
3160	25	0052.3	60.5
3173	26	0147.2	74.2
3185	27	0047.2	59.2
3108	28	0142.1	73.0
3210	29	0042.0	57.9
3223	30	0137.0	71.7

It is with deep regret that I must announce the death of Clinton A. Petry W3AWN, who died of a heart attack at the age of 67, while on tour in Hong Kong, March 25, 1973. "Cap" has been very active in AMSAT and OSCAR promotion. He was scheduled to be moderator of the SpaceComm forum at the Dayton Hamvention. I am sure his loss will be felt by all.

WB8LBP

FCC NEWS

If you should need to report suspicious or improper radio activity, anomalous signals, or interference, contact the monitoring station nearest you, rather than the FCC in Washington. Address your report or complaint to "Engineer in Charge, Federal Communications Commission, (name of city) Monitoring Station,"at the various addresses given below, listed alphabetically by city or town. The telephone number for each monitoring station is also listed.

P.O. Box 89
Allegan MI 40901
(616-673-2063)

P.O. Box 1126
Denison TX 75020
(Ambrose Monitoring Station)
(214-965-7729)

P.O. Box 6303 Annex
Anchorage AK 99502
(344-1011)

P.O. Box 470
Belfast ME 04915
(207-338-4088)

P.O. Box 374
Canandaigua NY 14424
(315-394-4240)

P.O. Box 251
Chillicothe OH 45601
(614-775-6523)

P.O. Box 6
Douglas AZ 85607
(602-364-2133)

9900 West State Road 84
P.O. Box 22836
Fort Lauderdale FL 33315
(305-583-2511)

P.O. Box 1588
Grand Island NE 68801
(308-382-4296)

P.O. Box 1087
Imperial Beach CA 92032
(714-435-0048)

P.O. Box 632
Kingsville TX 78363
(512-592-2531)

P.O. Box 40
Laurel MD 20810
(301-725-3474)

P.O. Box 311
Livermore CA 94550
(415-447-3614)

3222 McLeod Road
P.O. Box 339
Bellingham WA 98225
(Marietta Monitoring Station)
(206-734-4196)

3600 Hiram-Lithia Spring Road, S.W.
P.O. Box 85
Powder Springs GA 30073
(404-943-5420)

P.O. Box 181
Sabana Seca Puerto Rico 00749
(809-784-3772)

P.O. Box 5126
Santa Ana CA 92704
(714-545-1333)

P.O. Box 191
Spokane WA 99210
(509-244-2141)

P.O. Box 1035
Waipahu HI 96797
(808-677-3954)

FCC ACTION IN RACES DOCKET CASE

In Report No. 8495, dated April 20, 1973, the Commission has ordered an inquiry into the feasibility of expanded operation of the Radio Amateur Civil Emergency Service (RACES), which provides for amateur radio operation during civil emergencies.

A request by the New York State Civil Defense Commission (NYCD), to expand emission privileges for amateur stations in the RACES program was denied.

RACES is a radiocommunication service conducted by licensed amateur radio stations for civil defense purposes only. The amateurs operate on specifically designated segments of the regularly allocated amateur frequency bands, under the direction of authorized local, regional or Federal civil defense officials, according to an approved civil defense communications plan. Amateur licensees and certain grades of commercial radio operator licensees are eligible to operate RACES stations, providing they are enrolled as radio operators in the civil defense organization.

RACES stations share the allocated frequencies with other amateur stations. Since the privileges of amateur radio operators classes (Section 97.7) do not generally apply to the operation of RACES stations, and non-amateurs may operate RACES stations, the Commission stated, safeguards are necessary to insure that non-essential RACES radiocommunication is not conducted at the expense of regular amateur radiocommunications.

The Commission explained that it was ordering the inquiry because it had received no positive response to a rulemaking proposal, adopted March 22, 1967 (Docket 17315), in response to a NYCD petition, and it lacked "any other substantive information" on the need to expand RACES.

Four additional petitions for expansion of RACES were filed later with the FCC.

The Commission invited comments on specific questions as to whether RACES is an effective means of providing needed communications during local, regional or national emergencies; if the present licensing system for RACES stations is appropriate; if RACES stations should be assigned distinctive call signs that could be used only for RACES activities. It also asked for discussion on rule abuses by RACES stations to determine whether they are "commonplace," and what possible solutions exist to end them; if additional frequencies, emissions, or operators should be authorized for RACES stations; the most needed additional privileges; the consequences to both RACES and the Amateur Radio Service generally, if RACES privileges are expended; the consequences if the privileges are not expanded; and additional safeguards, if any, which might be required to insure that non-essential RACES radiocommunication is not conducted to the detriment of non-RACES amateur radiocommunication.

Comments are requested on or before July 1, 1973.

The New York State Civil Defense Commission petition, denied by the FCC, asked for expansion of RACES to permit the use of facsimile, F4 emission, in the 1800–2000 kHz and 3500–4000 kHz amateur frequency bands. The plan called for a RACES radio link to serve as a back-up capability to the primary wireline link in a system for facilitating the collection, interpolation and dissemination of radiological fallout data from monitoring stations throughout the state.

The Commission noted that no one filed comments supporting the New York request. The American Radio Relay League (ARRL) and the New York State Phone Traffic and Emergency Net opposed it. The New York Telephone Company disputed the New York State Civil Defense Commission's contention that New York State's "post-attack wireline survival capability is an unknown," and a radio back-up link was necessary.

The four petitions for expansion of RACES still before the Commission include a request by San Diego County, Calif., to operate RACES stations by radio remote control through a control link using non-amateur frequencies; a request by the California Disaster Office for extensive rule changes, including expansion and revision of frequency allocation for RACES; a request by the Area "D" Civil Defense and Disaster Board, Pomona, Calif., for authorization of 40F2 emission for radioteleprinter operation in the frequency bands 145.17–145.71 MHz, 146.79–147.33 MHz and 220–225 MHz; and a request by a licensee to permit Technician Class licensees to operate in the 503.5–53.75 MHz, 145.17–145.71 MHz and 220–225 MHz frequency bands in RACES, and to authorize the frequencies 146–147 MHz for RACES with emissions of 0.1A1, 1.1F1, 6A2, 6A4 and 40F3.

Action by the Commission April 18, 1973, by Notice of Inquiry and Report and Order. Commissioners Burch (Chairman), Johnson, Reid, Wiley and Hooks.

The Hamburglar
STRIKES AGAIN!

List from Past Issues:

Mfr., Model, Ser. No. Coll. 62S1 No.	Owner	Issue
10728	MSU ARC E.Lansing MI	6/72
WRL Duo-Bndr 6010AT302	WA6FCY	6/72
HR-2A, 11 chan., 04-07152	WA1NVC	9/72
Collins Mic, Mod.MMs, No. 4294	K4ACJ	9/72
Heath HW-100 & AC PS	WA2JGP	10/72
Swan 270B, No. M-395430	W8HST	11/72
AF68 No. 10888 PMR8 No. 10918 M1070 pwr supply	K5LKL	1/73
Trio TR2200 No. 241969	WA2ZBV	1/73
Clegg 22er No. 1900-578	WIDHP	2/73
Standard 826M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459	WA6WOA	4/73
NPC 107m pwr supply 2, 5AJ-IPL Onan Gen., No. 327885		

The Muskegon Area Amateur Radio Council reports the theft of the following pieces of equipment from their club station sometime during the week of March 12th: Electro-Voice 641 mic on Astatic GN series stand, R.L. Drake R4B receiver SN 11578G, R.L. Drake T4XB transmitter SN 17801G, R.L. Drake W4 wattmeter SN 8390, Swan 250 six meter transceiver SN F154806, and a Swan ac power supply SN 0653556. Any information regarding this equipment may be sent to the MAARC, P.O. Box 691, Muskegon MI 49443 or WA8GVK. Area code 616 – 722-3910 or 744-1400.

Stolen from W6GSR's auto on March 10, 1973 in Berkeley CA: Regency HR-2 Ser. No. 04-C2879 and SB-34 Ser. No. 211828. Please notify Frank Inami W6GSR, 1168 Hillcrest Court, Livermore CA 94550 or the Berkeley Police Department.

Also stolen was a Standard 826, Ser. No. 011268 with an 806 front panel and a Dycomm 500D amplifier from the locked car (it was parked in the driveway!) of Martin Siegel WA2FSD, 22 Burbury Lane, Greatneck NY 11023.

A Motorola HT220, Ser. No. GJ7327 was bethefted from the SUNYA Campus, Albany, N.Y. Replies should be made to the State University of N.Y. at Albany, Washington Ave., Albany NY, c/o Mr. Williams, SUNYA P.D.

---

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

WA9FEF writes from Chicagoland that March was rather quiet until the 19th when he worked WA1EXN on E. Later the same day a very good aurora set in, providing contacts with WA2DPJ, WA1RFA, W3BWU, WB8NGD and others. The aurora lasted six to seven hours. The following day the band again prodcued aurora, this time for only a short time, but long enough to work Jim WB4YAB of NE Kentucky. Also mentioned was an E opening the 22nd during which WA2DPJ was again heard. Dave mentions too that KØAGJ (also Dave) puts a strong CW signal into the Chicago area and is interested in starting a CW net on 6 meters. Anyone interested may contact him at 3322 W. 17th St., Davenport, Iowa. I might add that Dave is often heard in the St. Louis area calling CQ on CW but seldom is there evidence of anyone answering.

Elmer KØOCN writes that he has returned to 6 meters after several years of inactivity only to find an almost complete lack of contacts on AM. The conversion to SSB is nearly as complete as it is on the lower frequencies. For some years now, and with very few exceptions, all new equipment has been basically SSB with provision in some cases to insert carrier for pseudo AM operation. While there is still some AM operation around, the amount is rather small compared to what it was even five years ago. I have been calling CQ on AM for over two weeks trying to get a signal report . . . not one signal has been heard.

WA7FLB, "Doc," of Mayer, Arizona, has recently experienced a little trouble with his five-year-old linear,

but the problem turned out to be just a bad power switch contact . . . the linear is back on the air and working as well as ever. Doc says he has heard lots of "burbles" of late but not well enough to identify them.

Bob WA5RBI, says Enid, Oklahoma had openings February 3-4-5-8-9-10-12- and 22 covering Maryland to California and Louisiana to Utah. Of the April Ist aurora, Bob says, "I called CQ's both sideband and CW but the only one I got a rise out of was a South Dakota station . . . sure wish I knew who he was . . . I don't think the many signals I heard even realized that the band was open . . . I heard many Ø's yakking back and forth but not doing any listening . . . ." Bob also mentions having worked Arizona (WA7BXK) three nights in a row with 5/9 signals.

Mike WA2DWZ would like to convert a Lafayette HA-460 to FM but can't find a commercial unit with enough deviation at 50 MHz. I have sent along some suggestions, but I am sure Mike would appreciate hearing from someone who has successfully completed such a modification. You may write Mike at 1381 Linden Blvd., Apt. 7F, Brooklyn, N.Y. 11212.

Preliminary reports from the Itchy-coo Park VHF ARC "Worldwide VHF Activity" show a 50 to 100% increase in activity over last year. Band conditions in the East provided very good ground wave and a number of stations were able to take advantage of the situation. WA1RFA (Mass.) worked several Pennsylvania stations, including K3YWY and WA3EBX; K1ZKR worked 123 stations in 8 states; WA3NLH worked 9 states with a total of 145 contacts. Congratulations are again due this group for their effort to increase VHF band occupancy.

The April 1st aurora previously mentioned was one of the best I have ever heard. I can recall only one previous opening which could be compared to this one. The first indication here was around 2000Z, the initial period lasted somewhat over 3½ hours, followed by an hour or so lull, then opened again until after the plug was pulled at 0400Z. Signals from unusually far south were heard, with Atlanta marking the southern edge as received here.

April 8th brought a strong but localized opening to Charleston, S.C. I worked the entire 6 meter SSB population of the area consisting of WA3BSZ/4, W4USW, WB4TTY and WB4MJY. No other stations were heard from this end. Several of the above worked WØCCD, Omaha. This was apparently the only other station active on the western end of this particular opening.

WAØABI

73's WORLDWIDE SALES REPRESENTATIVES

U.S. AREA REPRESENTATIVES

New Mexico/West Texas

Ambrose G. Barry, W4GHV/5
1010 Juniper Avenue
Alamogordo, New Mexico 88310

Midwestern States

Gloria M. Ligon, K8WKE
47160 Condor Street
Utica, Michigan 48087

DX REPRESENTATIVES

BCN Agencies Pty. Ltd.
178 Collins Street
Melbourne 3000, Victoria
Australia

The Wireless Institute of Australia
478 Victoria Parade
P.O. Box 36
East Melbourne, Victoria
Australia

Carlos Rohden
Caixa Posal 5004
Sao Paulo, S.P.
Brasil

Jim Coote
56, Dinsdale Avenue
Kings Estate
Wallsend
Northumberland, England

Radio Society of Great Britain
35 Doughty Street
London WC1N 2AE, England

Short Wave Magazine
55 Victoria Street
London, SW1, England

Bryan Fogerty
Irish Radio Transmitters Society
9 Wellington Street,
Dun Laioghaire, Eire

Wireless Services, P.U.Sukhadia,
1/16, Shantinath Bhuvan,
427, Sion Road
Matunga, C. Rly.,
Bombay 19, India

Orion Books
13-19 Akasaka 2-chome
Minato-ku
Tokyo 107, Japan

Tama Electronics Co., Ltd.
Towa Building 502
515 Higashi Oizumi, Nerima-Ku,
Tokyo 177, Japan

Sun Electron Corporation
15—20 Takaban-1-chome
Meguro-ku, Tokyo 152, Japan

Kushal Harvant Singh
83, Aulong Road off Stephens Road
Kampong Boyan
Taiping, Perak, Malaysia

Gordon and Gotch Ltd.
P.O. Box 584
Auckland, New Zealand

G. H. Gillman
Smarts Road
Waikuku RMD
Rangiora, North Canterbury
New Zealand

New Zealand Assn. of Radio Transmitters
P.O. Box 1459
104 Hereford Street
Christchurch, New Zealand

Harold C. Leon
P.O. Box 61141
Marshalltown, Transvaal
South Africa

South African Radio Publications
P.O. Box 2232
Johannesburg, South Africa

South African Radio Relay League
P.O. Box 3911
Cape Town, South Africa

Julio Antonio Prieto Alonso, EA4CJ
Donoso Cortes No. 58
Piso 50, Letra B
Madrid 15, Espana (Spain)

All Europe,
except Great Britain & Ireland:

Eskil Persson, SM5CJP
Frotunagrand 1
194 00 Upplands Vasby
Sweden

HAM HELP

If you need help getting your license, send *73* your name, address and phone number. Don't be bashful — remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can.

Gary L. Weseman
4170 52nd St, Apt #12
San Diego CA 92105

Mike Noar
9940 Belfair St.
Bellflower CA 90706

Donald A. Cook
R.R. 1
Centerville IN 47330

Richard Groot
Rt #1
Washington WV 26187

73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP
		Hz			
		Hz			
		Hz			
		Hz			
		Hz			

USEFUL RANGE (RADIUS)

EQUIPMENT

ANTENNAS & HEIGHT ☐ SPLIT SITE ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID–TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.		
DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS

AZ	W7DAY	Phoenix	52.576–52.525
CA	WR6AAA ex-WA6ZZE	Catalina Island	147.69–147.09
CT	W1EOR	Glastonbury	147.69–147.09
GA		Athens	13–73
IN	WR9AAC ex-W9JBD	Ft. Wayne	34–94
IN	WA9EAU		16–76
MA	K1UZR	Bellingham	146.46–147.06
MA	WA1HDS	Agawam	146.40–147.00
MA	WA1UIZ	Boston	01–61
MI	WB8CSQ	Jackson	28–88
MI	W8IIE	Grand Rapids T2250 or PL100	16–76
NH	K1VWJ	Londonderry	147.66–147.06
OH	WB8NON	Cincinnati	115–70
OH	K8SCH	Cincinnati	07–67
OK	K5CFM	Oklahoma City	22–82
	Delete K5CEM		
PA	WR3AAA	Freedom	25–85
RI	WA1OMS	Providence	28–88
SD	WA0VWH	Rapid City	34–94
TN	K4LSP	Kingsport	16–76
TX	W5AW	Big Spring	22–82

REPEATER DXing

Several repeater groups have asked that some sort of confidential record of telephone call up numbers be kept. Every now and then someone is able to get hold of a Wats line – or has a friend on a test board – or something which makes long distance lines available for a reasonable or less cost – and the thought comes to mind – how about connecting our repeater to another one somewhere?

One local group has been working toward making such contacts in all states. The limiting factor is getting the telephone numbers of different repeaters so they can call in over the autopatch systems.

If your repeater has a call up feature and your group would be interested in getting calls from other repeater groups please send the call up number to *73 Magazine*. We'll keep it reasonably confidential – that is we won't publish it in *73* – and who knows, you might have some extra fun.

UPDATES NEEDED

If you know of a new repeater or of an established machine that has received its WR call, mail in the above form completed with as much information as possible. We would prefer having duplicate – triplicate – even megaplicate information rather than none at all.

TOUCHTONE FOLLIES

HERE COMES THE BRIDE

1 3 3 3
Here comes the bride
1 9 6 6
All dressed in white

TWINKLE, TWINKLE, LITTLE STAR

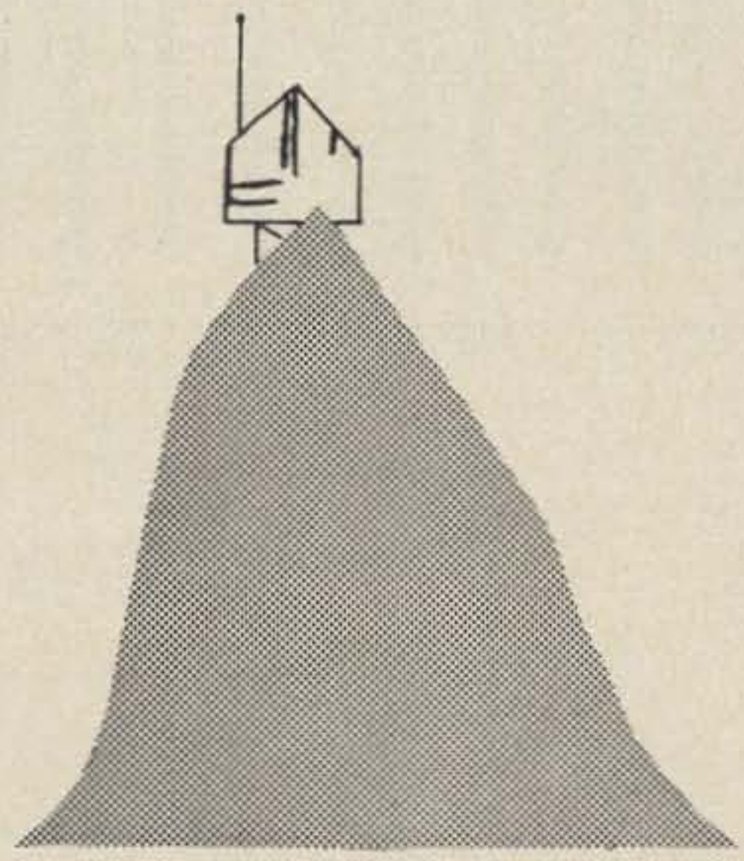
1 1 9 9
Twin-kle, Twin-kle,
0 0 9
Lit-tle Star

OLD MACDONALD HAD A FARM

6 6 6 7 8 8 7
Old Mac-Donald had a farm
9 9 0 0 4
EE-II-EE-II-OHH!
4 6 6 6 7 8
And on this farm he had
8 7
some chicks
9 9 0 0 4
EE-I-EE-I-OHH!
4 4 4 4 4
With a chick chick here
4 4 4 4 4
And a chick chick there
4 4 4 4 4 4
Here a chick there a chick
4 4 4 4 4 4
Ev-ry-where a chick chick

REPEATER OWNERS

Don't Take Chances. SENTRY offers custom made crystals made exactly to your specifications. When it comes to crystals for your repeater, BUY THE BEST – SENTRY.



REPEATER USERS

If you want reliable access to the repeaters in your area, you want and need SENTRY CRYSTALS. SENTRY CRYSTALS are custom made for your rig. We don't stock a large quantity of crystals for a certain frequency and hope you can tweak them to frequency in your rig. We do offer FAST service on crystals made especially for you and your rig. If you want reliable, on-frequency operation, INSIST ON SENTRY.

SENTRY MANUFACTURING COMPANY
Crystal Park, Chickasha, Oklahoma 73018

PHONE: (405) 224-6780

TWX-910-830-6425

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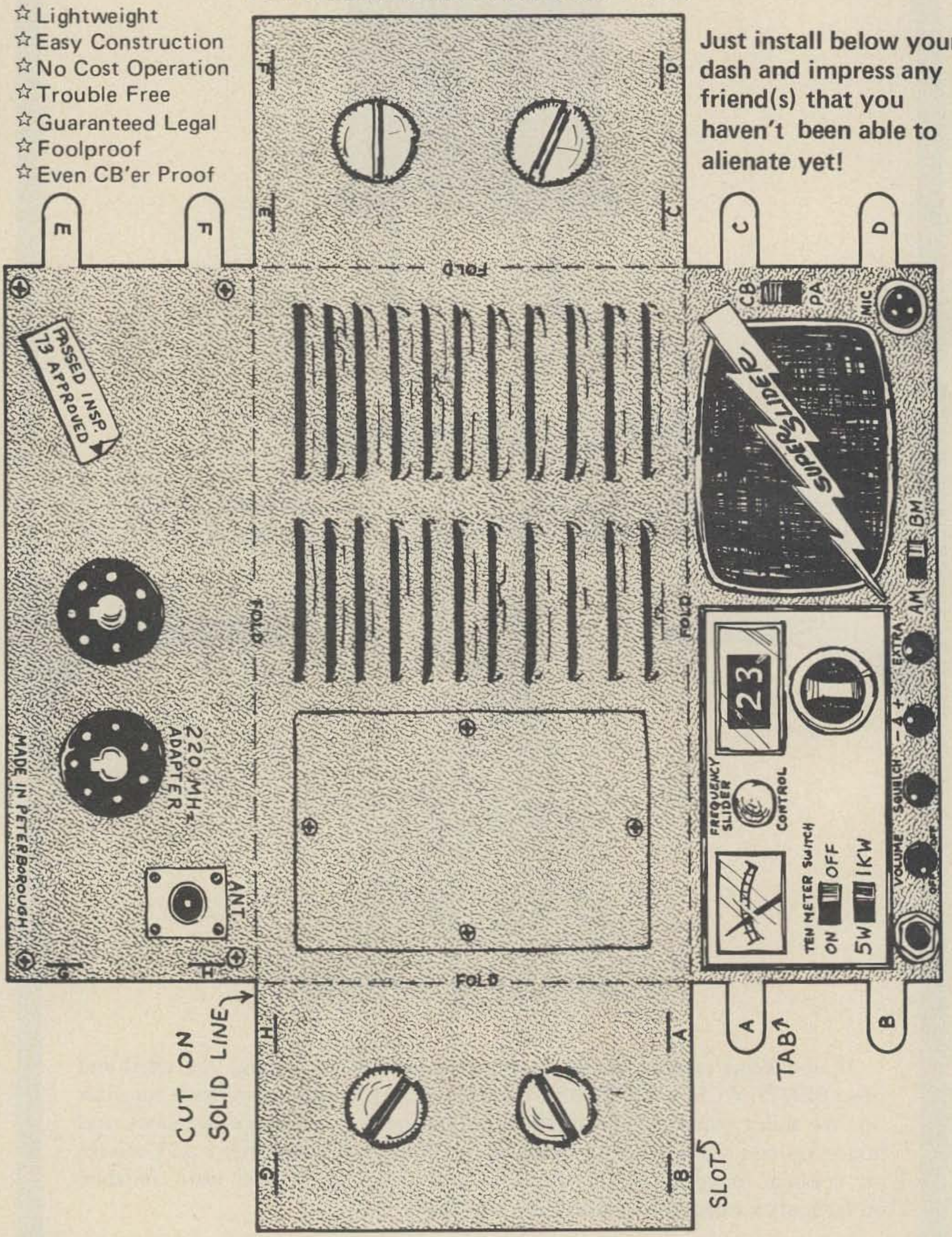

Just install below your dash and impress any friend(s) that you haven't been able to alienate yet!

NOTE: Although at first glance this construction project may seem to be simple enough for even the most inept CB'er, it is recommended that only CB'ers that have achieved a rating of "Yogi Bear," or above, attempt to build a rig of this complexity.

BY, Gus Browning, W4BPD

Setting here each month, thinking of various items to write about DX and looking over a heck of a lot of notes etc. you come to the conclusion that it is impossible to tell you all about everything, this means I am sure to leave out something that quite a few of you would have liked to know or read about, but I have just a certain amount of space for these "footnotes". I try to do what I can in the space available.

It would be interesting to do a real "tracking-down" job on just how certain "rumors" or at times just plain "lies" get started, its easy to see how they get circulated after the first blabber-mouth gets the story. What I would like to track down to the originator, is the rumor that Jack—W2CTN was dead ! I got the info myself from a short letter from K4AEB, Tava who lives over in Huntsville, Alabama. Then I went ahead and published it in my little magazine. When the magazine was delivered a few days later the telephone began to ring, each caller telling me that this was not true. W2GHK, Stu Meyer even phoned Jacks home and was told that this was not true. Of course I retracted the story, mentioning that I got the info from K4EAB. Tava then phoned me telling me that he got the info in the form of a "bulletin" thats published and delivered from the West Coast — Now it would be interesting to find out WHO TOLD THEM ! Just what was accomplished by anyone circulating such a rumor is beyond me to grasp. I know there are "sick people" in the world and it sure would be fine if they stayed out of ham radio, wouldn't it ?

I have found out from a number of letters that NO ONE likes to be referred to as a "garden variety" DX'er ! I mentioned something in a previous article about a "garden variety" DX'er. I suppose my choice of words was wrong or something. I suppose they should be referred to as, "casual DX'ers" or something like that. I wonder what "word " is best to describe a "non-serious" DX'er ?

I see that now the VE6 group of fellows who have plans to put on a lot of the "most needed" countries of the world have delayed their trip somewhat because they are now building a boat of their own to use for some of their island hopping, I suppose. I can tell you this is definitely the cheapest way to "go", but I warn them, look out for that one (or maybe more) land-lubber that may be in the crew, they can cause you a lot of trouble when those seas get a little rough and they begin to get "pink around the gills" ! And, another item of importance is those fellows sure had better be "compatable" since its rough going when 5 or 6 fellows are together 24 hours each day, crammed up in a small boat. I know all about this because I have been in the same situation a number of times and each time I will say to myself, "never again" ! So I am just warning you fellows, be very careful of the "crew" you take along ! If you are a little suspicious now, it will get worse as the trip progresses.

Remember fellows, its wintertime on the other side of the equator, the summertime QRM is nil down there. Since some fellows don't like to do battle from "down under" this may be the only time of the year that you can work certain of them. Of course it may be a little hard on your ears ! (especially if you are on 80 or 160 meters), but it will be worth it if you can snag a good one from down there.

All you fellows who have sent in your WTW applications please be a little patient with me because the printer (NOT ME) was slow in delivering the stickers to me. We issue the basic certificate for the first 100 countries and then when you qualify for more countries later on and send us the info we will issue you a sticker to put on your WTW certificate. When we first started the WTW we had a different certificate printed for each band and mode, this involved a lot of printing and printers bills, so to sort of streamline and cut costs we now use the same basic certificate. We have had a delay in delivery of the 73-73-73 certificates also and I hope by the time you are reading this you will have yours in your hand. In case you haven't heard about the 73-73-73 Certificate let me explain. If you have worked 73 countries in the first 73 days of 1973, you have qualified for the certificate and all you have to do is either send us your cards or just get three licensed ham friends to certify the copy of the list of the stations you contacted in the first 73 days of 1973 and we will send you your certificate. This is 73's year, and NO OTHER MAGAZINE can say that ! And, this certificate is being issued for this momentous occasion and this will never happen again until the year of 2073 and YOU wont be around then to help 73 magazine celebrate.

Plenty of places around the Mid East that are gradually becoming rare DX again. Such an ex-common place as VS9A-Aden is one of them and then there is Kamaran Island that was always more or less rare, now very rare. There is a group of islands right near Aden, but in the Red Sea called the Hanish group, the larger one of them Great Hanish is claimed by Yemen leaving about 10 smaller islands, un-officially unclaimed. Here is a good possible "new country" for some "daring," adventuresome DX'er to go to and operate from. I feel that I should warn you though that you may have to dodge bullets from two directions - The Yemenis and I have heard that Israel just might have someone on some or one of them and they may not like, uninvited visitors coming there, looking around, and maybe "talking" after they depart. If they are anything like Kamaran Island they can have the place as far as I am concerned (Kamaran Island is near-by so I would assume they are all alike more or less.) Very hot, humid, sandy with very little breeze, and when that blows its very hot - sort of like a blow torch. From a DX viewpoint, its very FB, from ANY OTHER viewpoint its "unhealthy". I wonder when that part of the world will really open-up again - if ever ?

Looks like good old ten is gone for some years, and if things go like they did some years back fifteen will be the next one to be almost gone except a very short time each day and some days it never did open up for any worthwhile DX to speak of. Better get your "needed" countries on fifteen right now fellows, because you might not have that DX in there too much longer. Get 'em NOW !

I wonder what ever happened to the plans of Martin, OH2BH going to that "new one" somewhere up around the Baltic Sea area ? It was supposed to be a Brand New One, or so I understood. How about it Martin Ole Buddy ? Lets get "hopping" and put it on the DX map, and just exactly where is it anyhow ?

Then there is a little small piece of land (actually mountain) at the Kyber Pass thats a Neutral Zone, looked like a good possibility for a new one when I went through Kyber Pass some years ago IF you could TRUST those guards with those Long Barreled guns who act as border guards there - They looked MAD and MEAN to me ! I didn't even SLOW DOWN after being checked by their Passport control.

We are still looking for a good Ham Club in some USA call areas to be our WTW check points, no "pay" but we will publish the name of the various clubs a few times each year thus they will get a little "free" publicity, which is not bad for them.

de, Gus BPD

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

By the time you read this, the first WR6 repeater will be in operation. The prize WR6AAA call has been issued to the Catalina Island Repeater which will be going on the air shortly. This will also to my knowledge be the first amateur repeater to operate from an island, and coverage up and down the Pacific coastline should be very good. I know everyone congratulates Catalina on their two firsts.

As I mentioned last month, my pet project has been to try and set up a transcontinental repeater link between one of the local L.A. repeaters and a machine on the east coast via telephone. I already have this end set, but need some help from the other side. If your group is interested, please get in touch with me. This will not be a cheap project (unless your club or repeater has access to a wats line; we don't). Aside from the fun aspect of the project, it will enable FMers here and back east to exchange ideas on a one-to-one basis.

For a long time we have wondered when repeaters would settle the question of what type of break meant what. Get on one machine and say, "Break;" you are welcome. Get on another, do the same, and 25 fellow hams jump to tell you that you are committing a cardinal sin. About a week ago I received in the mail what I think may be one good way to go and present it here for your consideration. It comes from George K1TKJ, who owns and operates WR2AAA (ex WA2SUR) and WA1KGK.

"Use the word BREAK if your traffic is URGENT (NOT emergency). Use Break-Break Emergency only when life is at stake. Traffic reports are not emergencies and should not be broadcast to the world at large. Call a station on frequency and tell him – everyone else will hear at the same time."

Basically, what George says, is to use your call (i.e., WA2HVK/6 or WA2HVK/6 on frequency) to enter a QSO already in process, and reserve the Break, and Break-Break Emergency for times only when they are necessary. Having operated WA2SUR almost from the time it went on the air, I know the validity of this system first hand, and it works. It's a good step in the right direction, and well worth consideration as a national standard.

All repeaters have jammers. They come in all styles from the ones who like to wipe out a QSO in progress with an unidentified carrier, to the music players, to the type who have to prove their lack of manhood by uttering obscene language atop another QSO. To put it bluntly, there are sick people found in every facet of life, and we here in ham radio are unfortunate enough to have our share. It is beyond my comprehension why someone would spend the time and money necessary to join this "un-elite club" that gets its kicks by making life miserable for everyone else on the channel, when the real enjoyment is in belonging.

The best method I know of to date in handling one of these problems is to simply ignore it. It's not easy, especially if the jammer is aiming his attacks at you personally. Give a jammer an audience and you will have him with you for a long, long time. Ignore him, and he will eventually crawl back into the woodwork. To again quote the WR2AAA group,

"To acknowledge a nut is to encourage a nut."

If he insists on staying around long enough, he will eventually get caught, his toys taken away and he may even get sent to bed without his supper.

Heathkit has come through as we all hoped they would. By the time the March issue hit the stands, their VHF Scanner was already on the market, and now they have announced their HW202 Two Meter Transceiver, designed for those of us who like to roll our own. It's sure a neat little package with that built-in tone burst encoder. Now who will be first with a 220 MHz transceiver kit?

That of course gets us to the subject of 220 and some good news. The WB6ALV and W6FNO two meter groups are in the process of assembling 220 machines, and two others are in the works. One belongs to the four guys who record meetings for me when I can't make it. The other, tentatively dubbed "The Icom Amateur Radio Club" is the brainchild of Bill WA6NTW, Max K6GLG and Warren WA6JMM. It will be completely solid state and located on a hill 1300 feet above the L.A. basin. It seems that a number of years ago Bill had a 220 AM repeater on the air out here (probably the first anywhere) but took it off the air due to lack of users. We hope his present effort meets with greater success.

Going down by about 150 MHz or so, a quick note on 6 meters. While activity there is in no way overwhelming, there are quite a few stations that seem to be dedicated to keeping the band alive. Such a group worth noting is the Los Angeles Metropolitan Traffic Net. They meet every evening except Sunday at 50.40 MHz AM. I happened across the net one evening last week, checked in, and originated some traffic to Lou K2VMR in New York. Lou received the message in less than 24 hours and confirmed receipt! Now that's what I consider traffic handling.

WA2HVK/6

Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

At this time of the year most of us are about to take a well-deserved vacation. Those of you coming to Washington D.C. might be interested in reading about amateur radio in the Washington area.

Two meter FM is very active. There are repeaters on 01–61, 07–67, 28–88, 31–91, and 37–97 (whistle-on) in the area. Both the 01–61 and 31–91 repeaters have autopatch facilities. There is no repeater on 34–94, but 94 is a well-used simplex channel. By the time this article gets into print there should also be repeaters on 22–82 and 25–85. The 25–85 repeater is being assembled by AMSAT, so if you wish to talk to the active AMSAT personnel, carry 25–85. 85 simplex is being used at present as an AMSAT intercom channel, and the 25–85 repeater is planned to improve the coverage. If you are driving into Washington, there are also repeaters located near Washington. 04–64 is in Damascus, Maryland (north of Washington on I-70s), 16–76 is in Baltimore, 13–73 is in Frederick, Maryland and 146.46–147.06 is in Annapolis. Although these repeaters are some distance from Washington, anyone with a handy-talkie in a tall hotel will have no trouble in communicating through them.

Talking of handy-talkies, do you own a TR-22? Well, this month's column was written with you in mind.

TR-22 Modifications

Have you ever waited for a call (on the TR-22) in vain, only to find that the rig was switched off, or have you ever put the rig away for the night and

HAM & EGGS YAESU

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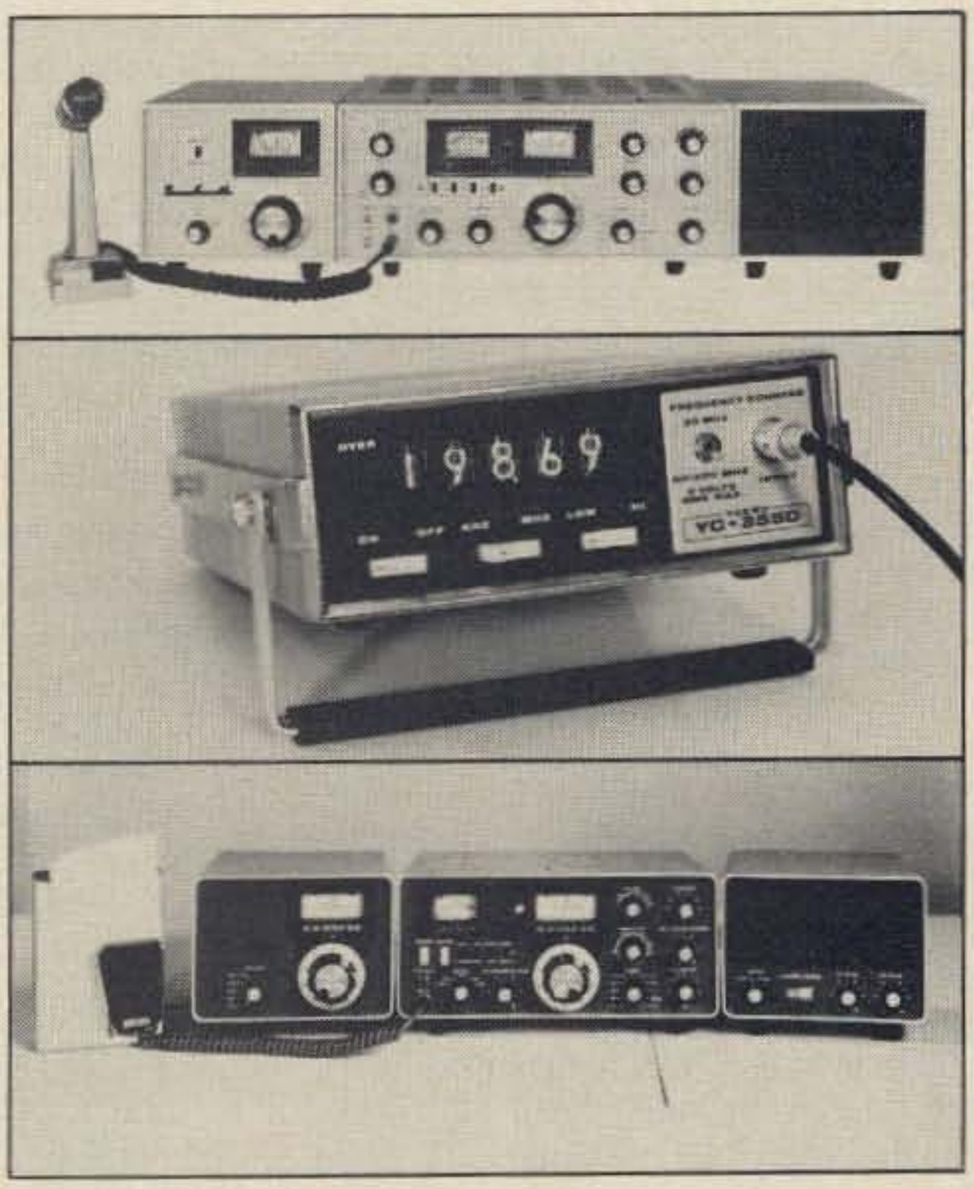
Yaesu products are a natural for American hams because of their strict standard of high quality. And because Yaesu now has its own factory in the U.S. to provide direct service and to back up its dealers throughout the country.

Another American favorite. Ham and Yaesu.



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7625 East Rosecrans Ave., Unit #29,
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Phone: (213) 633-4007

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Farmingdale, New York, Valley Stream, N.Y.

come back the next morning to find that your batteries are discharged because you left the rig on overnight? For about $1 and a little effort you can insure that such things will never happen again. The magic cure is known as an LED (a light emitting diode). This is a solid state lamp that will put out a good visible light for about 10 mA of current. It is even detectable in bright sunlight.

The modification is simple: just connect the LED in series with a 1 KΩ resistor and put it across the 12V supply line. There is plenty of space to put the resistor inside the rig. The LED can be a Fairchild FLV-110 or other manufacturer's equivalent. I used a HP device because it came with a handy mounting bushing. The LED (and/or bushing) is pushed into the hole already drilled in the panel and a dab of epoxy cement put on it to hold it in place.

This modification gives the rig a power-on indicator, improves the appearance of the TR-22 and should be equally applicable to other FM rigs.

Have you ever wondered what is under that "stuck on" label on the front panel of the TR-22 (in older models), but have been unwilling to find out for fear of defacing the rig? Well, wonder no more — for under the label is the original panel logo that says Trio TR-2200. The panel comes off easily and does not leave any marks on the panel. Tell someone you are running a TR-2200 and they will say, "What kind of a rig is that?"

Have you ever had any difficulty in remembering what crystals are in which switch position? You have? Well, W3ATE has come up with an instant modification that will end that problem forever. The TR-22 switch knob has a see-through section that indicates the selected channel.

The modification works like this: First, determine the crystal positions. Set the knob to position #1, then loosen the two screws in the knob and remove it. You will then see the channel numbers. Prepare some stick-on labels as follows: Type on the sticky labels the numbers to correspond to the crystals — for example, 91 would be 146.91 MHz and 94, 146.94 MHz — then stick these labels over the switch position numbers. You might even make simplex channel labels of a different color than the repeater ones. Then replace the knobs and tighten the screws. Make sure the knob goes into its original position (position #1) when you tighten it up.

The channel number modification is the most painless and should be tackled first. When you have done that you might develop the courage to drill a hole in the panel, but take care.

G3ZCZ/W3

MASS. AMATEUR RADIO WEEK!

The Amateur Radio Operators of Massachusetts invite all amateur radio operators to participate in the Fifth Annual Massachusetts Amateur Radio Week. Certificates of Recognition will be issued to all amateurs who take part in the Operations program for the week. Operating times are from 0001 GMT June 10th to 2400 GMT on June 16th. Massachusetts amateurs must work 16 other Mass. amateurs. The rest of New England, work 8 Mass. amateurs. All other U.S. amateurs must work 5 Mass. amateurs. DX, including KL and KH, must work 2 Mass. amateurs. Any band and mode may be used.

Applicants must include a No. 10 size stamped, self-addressed envelope (DX enclose 1 IRC) with their application, which must be received no later than July 31, 1973. Submit applications to William C. Holliday WA1EZA, 22 Trudy Terrace, Canton MA 02021.

ORLANDO HAMFEST

The Orlando Hamfest/Southeastern FM Convention will be held in Orlando, Florida June 2nd and 3rd, 1973. Location: Fairgrounds Exposition Hall in downtown Orlando. Further info may be obtained from Clair E. "Buzz" Showalter, W4UFL, 1810 Lorena Lane, Orlando FL 32806.

RTTY PICTURE — Courtesy K2AGI

DES MOINES HAWKEYE HAMFEST

The Des Moines Radio Amateur Association will hold a Hamfest Sunday, June 17, 1973, from 8 a.m. to 6 p.m. in the Teen Town Arena of the Iowa State Fairgrounds. Give Pop a present for Father's Day and bring him to the Hawkeye Hamfest. Lots of free parking — refreshments — lots of room for Flea Market. Limited number of covered booths and extra tables available at small charge. Open area inside the arena at no extra charge. Dealer displays, valuable prizes and XYL activities. Auto races and camping on Saturday night, extra. Registration $1.50 advance, $2.00 at gate. Write Des Moines Radio Amateur Association, Box 88, Des Moines, Iowa 50301.

AKRON GOODYEAR PICNIC

The Goodyear Amateur Radio Club (Akron) will hold its 6th Annual Hamfest Picnic on June 17 at Goodyear Wingfoot Lake Park east of Akron, 1 mile west of Suffield, Ohio on County Rd. 87 near Ohio Rte 43. Join us for an enjoyable day of entertainment, swap-and-shop, prize awards, and good fellowship. Refreshments, displays, huge flea market. Hours: 10 a.m. to 6:00 p.m. Family admission $2 prepaid, $2.50 at gate. For details, tickets, and map, write to Floyd Gilbert, 1976 Newdale Avenue, Akron, Ohio 44320.

CENTRAL KANSAS ARC

The annual hamfest is scheduled for Sunday, June 3, 1973, at the 4-H Complex, Kenwood Park, Salina. For early arrivals there will be a dinner Saturday evening. Registration starts Sunday morning at 9:00 a.m., with a program of interest to OM, YL, XYL, and harmonic. Covered-dish lunch with beverages supplied by the club. Talk-in on 146.34—94, and 3920 kHz. For more information write WNØDEQ, William Peck, 1028 W. Ash, Salina, Kansas 67401.

PENN-CENTRAL HAMFEST

The tenth annual Penn-Central hamfest will be held by the Williamsport and Milton clubs on Sunday, June 3, 1973, at the Union Township Volunteer Fire Co. grounds on Route 15 in Winfield PA. This informal hamfest with indoor and outdoor facilities for contests, auction, and flea market, will start at 12 noon. Gate registration $3.00, XYL and children free, free parking. Talk-in on 3940 and 146.52/146.94 MHz. More info from Clair Yeagle WA3QXI, 714 N. Main, Watsontown PA or call 717-53809292.

ARMED FORCES CONVENTION

On-the-air amateur radio facilities will be provideo by K4NAA during the Armed Forces Communications and Electronics Association convention in June. K4NAA is the official AFCEA amateur radio station, providing attendees with amateur facilities to contact friends during the convention on June 5, 6 and 7, 1973. The K4NAA portable station will be operational from 1000 to 1800 EDST with two available positions for CW and SSB on the 10, 15, 20, 40 and 80 meter bands. A specially designed QSL card has been prepared. Please bring your original FCC license if you plan to operate. The convention will be held at the Sheraton-Park Hotel in Washington, D.C.

WORKED ALL MASS. CITIES & TOWNS CONTEST

In celebration of Massachusetts' Radio Week, a contest will be held from 0001 GMT June 10th to 0004 June 14th. One point is scored for each station worked, regardless of band or mode utilized. There are a total of 351 Mass. cities and towns and the final score is the no. of different Mass. stations worked times the no. of different cities and towns worked. Entries must be recieved no later than July 31, 1973, and submitted to Nina Robbins, 30 Prospect St., Bridgewater, Mass., 02324. For complete contest rules write to Steven Rich WA1DFL, Publicity Chairman, Massachusetts Chapter National Awards Hunters Club, 31 Arlington Ave., Revere MA 02141.

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The Egyptian Radio Club Inc. will hold its annual Ham-Picnic Sunday June 24, 1973 at the Club grounds, 700 Chouteau Slough Rd., Granite City, Illinois. Something for everyone – prizes, games for the children, food at the club house, parking for swaps – etc. For further info write Andy Anderson K9KXP, 1712 No. Keebler St., Collinsville, Illinois 62234.

ROMAN HOLIDAY

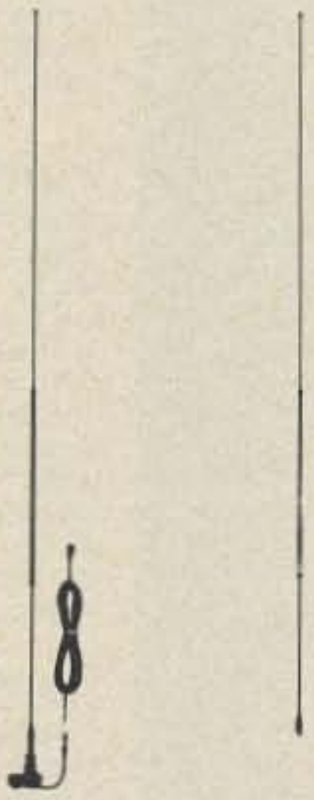
The Rome Radio Club sponsors its 21st consecutive Ham Family Day on Sunday, June 3, 1973, at Beck's Grove, 10 miles west of Rome. Technical talks, contests, equipment displays, ladies' and children's fun programs. Meetings: The Post Office Traffic Net, Air Force MARS, and Repeater Council. Flea market with plenty of display space. Registration starts at 11:00 a.m. and ends with that famous (all you can eat) steak and chicken dinner served at 5:00 p.m. Advance reservations: Adults $5.75, children under 12, $2.00 – under 6, FREE. Tickets at the gate: add 50¢. Tickets w/o dinner at gate: Adults $2.00, children, FREE. Send your reservation ASAP to Rome RC, P.O. Box 721, Rome, N.Y. 13440.

ATLANTA 45th ANNUAL HAMFEST

This event will be held June 9 and 10, 1973, at Lenox Square, Atlanta, Georgia. Approximately 2,500 amateurs attended last year's hamfest, and with the expected continued growth it is sure to become one of the biggest in the U.S. For information write Philip R. Cass W4BTW, VP Atlanta Radio Club and Hamfest Committee Chairman, 175 West Wieuca Road, N.E., Atlanta GA 30342.

NEW PRODUCTS

2m MOBILE COLLINEARS



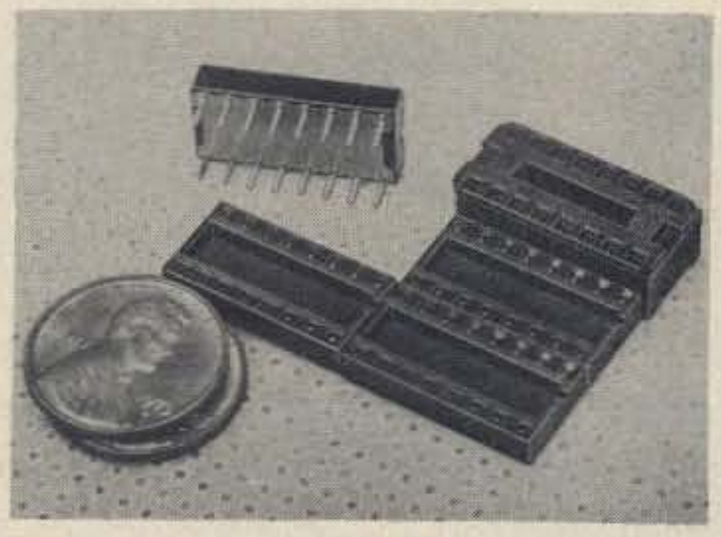
Extremely low radiation angle, 5.2 dB gain over a 1/4 wave ground plane, low SWR and wide bandwidth are features of Hustler CG-Series Super Gain two meter collinear mobile antennas from New-Tronics Corporation.

Model CGT-144 is a complete system including collinear antenna with stainless steel radiating sections, 180° swivel ball, heavy duty trunk lip, and 17' Mil Spec RG-58-U coax with factory attached connectors. Power rated at 200W FM, the completely operational CGT-144 has a SWR of 1.1:1 (typical) at resonance and a SWR within 1.5:1 over its 6 MHz bandwidth of 143–149 MHz. Overall length is 86 inches.

The Hustler Model CG-144 consists of the 84" collinear antenna with 3/8'-24 threaded base to fit standard mobile ball mounts. It has the same outstanding electrical characteristics as the Model CGT-144.

For complete specifications contact *New-Tronics Corporation, 15800 Commerce Park Drive, Brook Park OH 44142.*

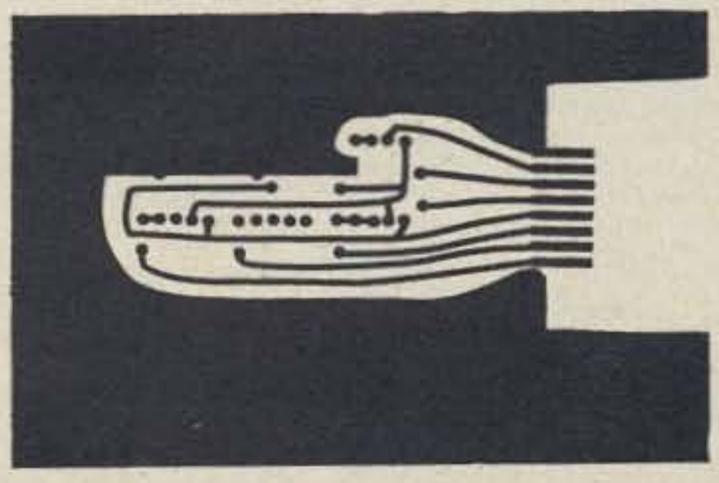
DIP SOCKETS



A new line of 14- and 16-pin dual-in-line sockets incorporates a tapered entry way for easy automatic or manual insertion. The wide, chamfered entry accommodates slightly bent or misaligned component pins and guides them to strong gold plated beryllium-copper contacts. The compact R714-2 and 716-2 sockets reduce the height of DIP components by nearly 50 percent over conventional sockets. The individual contacts are precision spaced for insertion in perforated circuit boards and they may be placed immediately end-to-end or side-by-side for maximum packaging density.

The sockets are available in 1000 unit packages and also in five unit packages for smaller users. Contact *Vector Electronic Company, 12460 Gladstone Avenue, Sylmar CA 91342.*

POSITIVE PC PROCESS



Vector has introduced a pc board that is factory coated with + positive photo resist that does away with the usual artwork reversing step required with negative resist. After using their pre-printed pads, contact tabs and tape interconnections to lay out the full size pc pattern on a piece of clear mylar film, the completed master is placed on the photo sensitized board and a contact print is made under photo-floods or in strong sunlight. The board is then dipped in developer

From the World's Number One Manufacturer of Amplifiers

The biggest, broadest, finest line of amateur power amplifiers

2K-4 . . . THE "WORKHORSE"

The 2K-4 linear amplifier offers engineering, construction and features second to none, and at a price that makes it the best amplifier value ever offered to the amateur. Constructed with a ruggedness guaranteed to provide a long life of reliable service, its heavy duty components allow it to loaf along even at full legal power. If you want to put that strong clear signal on the air that you've probably heard from other 2K users, now is the time. Move up to the 2K-4. Floor console or desk model . . . $845.00

2K-ULTRA . . . THE "ULTIMATE"

There has never been an amateur linear amplifier like the new 2K-ULTRA. Small and lightweight, yet rugged and reliable . . . all that the name implies. The ULTRA loafs along at full legal power without even the sound of a blower. Its anode heat is silently and efficiently conducted to a heat sink through the use of a pair of Eimac 8873 tubes. In fact, all of its components are the very best obtainable. The price . . . $845.00

TEMPO/2001

Small but powerful, reliable but inexpensive, this amplifier is another top value from Henry Radio. Using two 8874 grounded grid triodes from Eimac, the Tempo 2001 offers a full kilowatt of power for SSB operation in an unbelievably compact package (total volume is .8 cu. ft.). The 2001 has a built-in solid state power supply, a built-in antenna relay, and built-in quality to match much more expensive amplifiers. This equipment is totally compatible with the Tempo One as well as most other amateur transceivers. Completely wired and ready for operation, the 2001 includes an internal blower, a relative RF power indicator, and full amateur band coverage from 80-10 meters. $545.00

TEMPO/6N2

The Tempo 6N2 combines most of the fine features of the 2001 for 6 and 2 meter amateur operation. The amplifier uses the same small cabinet, the same modern tubes, the same inherent quality for 2000 watts PEP input on SSB or 1000 watts input on FM or CW. The rig is completely wired in one small package with an internal solid-state power supply, built-in blower, and RF relative power indicator. $595.00

3K-A COMMERCIAL/MILITARY AMPLIFIER

A high quality linear amplifier designed for commercial and military uses. The 3K-A employs two rugged Eimac 3-500Z grounded grid triodes for superior linearity and provides a conservative three kilowatts PEP input on SSB with efficiencies in the range of 60%. This results in PEP output in excess of 2000 watts. In addition, the 3K-A provides a heavy duty power supply capable of furnishing 2000 watts of continuous duty input for either RTTY or CW with 1200 watts output. Price . . . $1080.00

Prices subject to change without notice.

Henry Radio

11240 W. Olympic Blvd., Los Angeles, Calif. 90064 213/477-6701
931 N. Euclid, Anaheim, Calif. 92801 714/772-9200
Butler, Missouri 64730 816/679-3127

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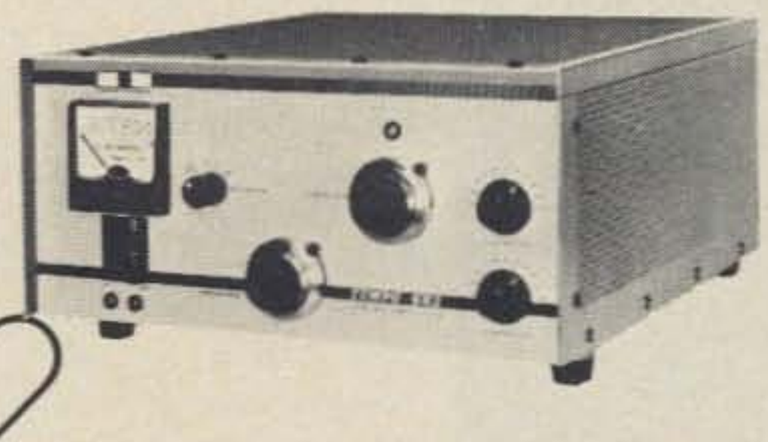
they're both Tempo... so you can't go wrong

THE TEMPO 2001 LINEAR AMPLIFIER

Small but powerful, reliable but inexpensive, this amplifier is another top value from Henry Radio. Using two 8874 grounded grid triodes from Eimac, the Tempo 2001 offers a full 2 KW PEP input for SSB operation in an unbelievably compact package (total volume is .8 cu. ft.). The 2001 has a built-in solid state power supply, a built-in antenna relay, and built-in quality to match much more expensive amplifiers. This equipment is totally compatible with the Tempo One as well as most other amateur transceivers. Completely wired and ready for operation, the 2001 includes an internal blower, a relative RF power indicator, and full amateur band coverage from 80-10 meters. PRICE: $545.00



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$595.00

Prices subject to change without notice

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HUSTLER® and HENRY RADIO have the right antenna for every situation.

THE MODEL 4-BTV FIXED STATION TRAP VERTICAL

40 through 10 meters

ONE SETTING FOR TOTAL BAND COVERAGE

• Lowest SWR—PLUS! • Bandwidth at its broadest! SWR 1.6 to 1 or better at band edges. • Hustler exclusive trap covers "Spritz" extruded to otherwise unattainable close tolerances assuring accurate and permanent trap resonance. • Solid one inch fiberglass trap forms for optimum electrical and mechanical stability. • Extra heavy duty aluminum mounting bracket with low loss—high strength insulators. • All sections 1¼" heavy wall, high strength aluminum. Length 21' 5". • Stainless steel clamps permitting adjustment without damage to the aluminum tubing. • Guaranteed to be easiest assembly of any multi-band vertical. • Antenna has ⅜"-24 stud at top to accept RM-75 or RM-75S Hustler resonator for 75 meter operation when desired. • Top loading on 75 meters for broader bandwidth and higher radiation efficiency! • Feed with any length 50 ohm coax. • Power capability—full legal limit on SSB and CW. • Weight: 15 pounds • Price: $47.95 Amateur Net

Henry Radio features the complete line of New-Tronics products. Please come in, phone or write.

Henry Radio

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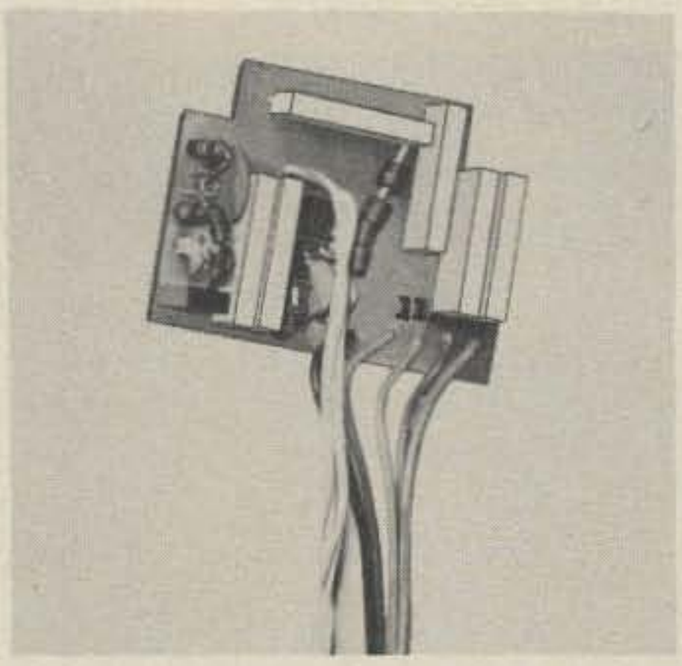
931 N. Euclid, Anaheim, Calif. 92801 714/772-9200

Butler, Missouri 64730 816/679-3127

for about three minutes and the board pattern will appear, ready for inspection and possible retouching. At this point the board is complete except for etching, drilling and trimming, which are normal operations anyway.

The big advantage with the Vector method is that no special equipment, other than a nimble set of fingers, are required to produce (and reproduce) high quality pc boards. Everything you need is supplied with one of their kits, the + positive photo sensitized board, layout tape and film, developer, the etchant and even a plastic bag for use as an etching container. One happy volunteer working in the XYL's kitchen can turn out enough boards in an evening to keep his buddies happy for a long time. Contact *Vector Electronic Corp., 12460 Gladstone Ave., Sylmar CA 91342. (212) 365-9661.*

ALPHA ENCODER



The new Alpha ST-85J-107 multi-frequency encoder makes it possible to encode up to five frequencies of sub-audible continuous tone or high frequency burst tone (20 Hz to 3000 Hz) and is ideal where multiple base station or multiple repeater tone access is required.

For rigs not equipped with the necessary pin sockets, a kit is provided that can be field installed and a five position tone selector switch is included along with complete instructions. The ST-85J-107 is comprised of miniature plug-in thick film hybrid modules, which makes changing frequencies or adding frequencies exceptionally simple. The thick film hybrid technique and the all electronic non-reed design, eliminates many of the problems generally associated with the use of reed relays. There is no falsing from vibration and a far greater degree of shock resistance from dropping.

Frequency stability is plus or minus 5% over a temperature range of -40° to +100° C. Current requirement 3.5 mA at 12.6V dc.

For more information contact *Alpha Electronic Services, Inc., 8431 Monroe Avenue, Stanton CA 90680 (714) 821-4400.*

HEP INDEX

The new 1973 Motorola HEP cross reference guide contains over 43,000 isting of transistors, diodes and SCR's with HEP replacements for each. Besides the 66 pages of listings, there is a complete catalog giving ratings, characteristics and base diagrams for each HEP device. Handy guide lines are given that will assist a beginner to select and get the most performance from HEP substitutions.

The Cross Reference sells for 50¢ at most electronics distributors or from *Motorola Semiconductor Products, Box 2953, Phoenix AZ 85036.*

TOUCH TONE PAD

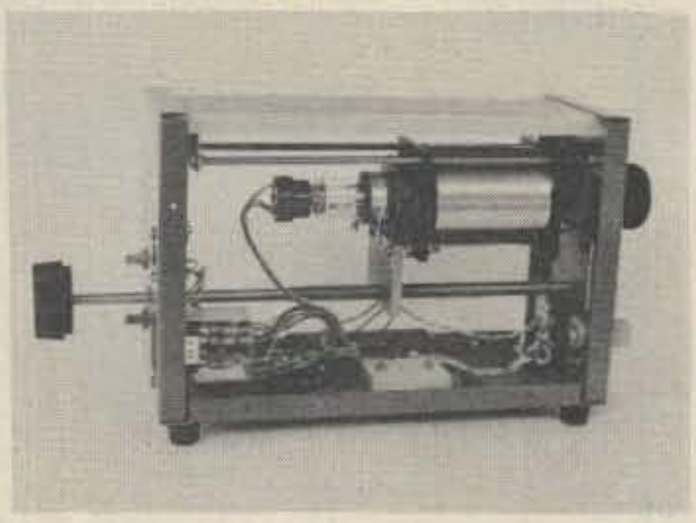
Just about everyone agrees that the ultimate in FM operation is a hand unit that can be carried everywhere. If you work through a repeater with autopatch or Touch Tone controlled functions you could be missing out on half of the available enjoyment if you can't use them. An accessory Touch Tone pad is the answer.

73 recently had a pad installed on a KP 202 hand unit (similar to the Tempo/fmh) by Waller Electronics in Chevy Chase MD. The job they did was superb. Almost looking like original equipment, the pad fits neatly under the speaker and projects from the front panel about the same distance. Practically no weight is added as the tone generator is a miniature IC (negative weight!) and the small mounting case is of a strong alloy.

The unit works great. A squeeze of the transmit bar puts 16 tones at your fingertips so you can place calls through the autopatch from the weirdest locations imaginable.

Contact *Waller Electronics, P.O. Box 9913, Chevy Chase MD 20015, 301-652-0996.*

MICRO SSTV PICTURES



An adjustable carriage kit is available that enables owners of Robot cameras to focus on objects smaller than a postage stamp! A variation of the lens extension principle, the modification lets you move the vidicon back from its original position at the rear of the lens to the proper distance required for close-up focusing.

The kit is uncomplicated and installs in a couple of hours. The carriage mounts between the lens mount bolts and the two existing chassis holes at the rear of the case. The long adjusting screw requires that only one hole be drilled for its rear mount because its front bearing plate is again secured by the lens mount bolts. Focusing is achieved by turning the adjusting screw which moves the vidicon toward or away from the lens. Normal operation of the camera is not impaired as the vidicion can be returned to its original position against the camera's hex spacers.

After the kit was installed in *73*'s Robot camera, everything was hurriedly connected up. The camera was mounted pointing down at the operating desk approximately 7 cm away from the surface. A quick look around for an object on which to focus naturally resulted in a copy of the latest issue of *73*. Positioning a small schematic under the lens and turning the focus screw resulted in a large image of two bias resistors and their

Continued on page 100.....

LETTERS

ou goons don't ever proofr
l asy m s p s f m b b
bu ch f ro ks re ng n
you ignored my comments In
I insist that you print ev

INSURANCE COVERAGE ADVICE

I am an insurance broker – in New York State you are covered for ham gear if your car is broken into. You can endorse your auto policy and pay a small premium, as I have done on my business accounts where the insurance carrier has charged $10 and added protection of theft of the entire gear. It can be obtained – ask your local broker.

Under Homeowner's policies, we have paid claims for windstorm damage, subject to the Homeowner's deductible of $50 or $100, to antenna, TV or ham. If the amateur has only a Dwelling policy, then have your local broker under the Extended Coverage endorsement, eliminate under Windstorm & Hail the exclusion to Radio or Television antennas, including their lead-in wiring, masts or towers, and coverage will be afforded at the rate of $2.81 per $100 of value. A $1,000 antenna or tower would cost $28.10 per year.

I hope this helps.

Larry Schulman WA2FVP
Flushing NY

FCC = W8KID / 2

The whole chain of events started slowly back in September 1972 when Carl K8PAX happened to mention that in his business acquaintances he had come across another ham with the call sign W8KID, but couldn't recall any name or address. I assured him that my call sign had not lapsed and I would appreciate his letting me know if he came across the fellow again. I dismissed the whole thing as a mix-up in calls.

My worst fears were suddenly confirmed just before noon December 21, 1972. W8KID/Mobile 8 gave a call on the Muskegon, Michigan Civil Defense Two Meter FM Repeater (K8WNJ 22/82). Monitoring at the time were WA8GVK, WB8HDD, WB8NHX, WA8OJI, W8QAO, W8TBP and WA8SCS, all of whom recognized the call sign but not the voice. Some comments about "bootlegging" and illegal call signs were bantered about, and then my wife, who had been listening to the strange goings on, frantically called me in from my job of shoveling snow. "Somebody else is using your call on the repeater," Jackie said.

I broke in on the frequency only to hear WA8GVK return, "W8KID meet W8KID!" Paul Hollinger, the other W8KID, was probably just as surprised as I at the happening of that day. A fellow ham riding with Paul attested to the fact, over the air, that he did indeed have the call sign W8KID assigned to him by the FCC.

About a month after writing Gettysburg on the subject, Richard C. Zeigler, Chief, Gettysburg Processing Section, sent me a cordial letter verifying the call sign was mine and an explanation of what had occurred.

When Paul moved from Area 9 (formerly K9GAI) to Area 8 in January 1971 the computer mistakenly assigned my call sign to him and removed my data from the machine. When I renewed my license in June 1972, Paul's data was in turn removed from the computer with the resultant error of both of us having been issued the same call sign.

By now Paul has probably been issued another call sign and hopefully there ends the tale of two calls. There must be a moral to this whole thing, but I'm not about to probe that area.

Dick Hathaway W8KID
Whitehall MI

FCC NO JOKE

When the FCC dropped the bomb last fall (Docket 18803), commonly called the new repeater regulations, I was aghast. I wrung my hands in anguish, thinking of all the money and energy we had expended in our repeaters. I had visions of 75% of the repeaters going off the air on June 30th.

Then the idea struck me – it was so obvious, I had to laugh. It was the most ingenious April Fool's joke ever devised.

I listened as the weeks went by to the cries of outrage on 94 and 76, snickering to myself and feeling somewhat guilty for not letting them in on the big secret. With tongue in cheek, I agreed with the cries and moans I heard in the QSO's. In times of doubt I reassured myself with the fact that these were grown men at the FCC, full of respect and admiration for the amateur service. I had to be right or else the only other plausible explanation was a collective loss of sanity. Nonsense!

As April 1st neared, I could hardly contain my mirth and excitement. The big day arrived – I watched the early TV news, and there wasn't a word. The noon news and hourly radio broadcasts came and went and still there was nothing. The Sunday newspaper arrived; I searched it page for page, and not a line. It was perhaps too inconsequential for the news wires.

That evening I went downstairs and copied the MARS RTTY broadcast and there wasn't a word. W1AW was completely silent on the subject. Well, it was Sunday; maybe it was inappropriate to pull such a monumental joke on the Lord's Day.

All day Monday the ritual was repeated and still no word. But there was still hope – it was probably being held up for a first line article in *QST*. Finally, *QST* arrived, and with frantic fingers I leafed through the pages. Not one word about it. Still there was hope – if it was in print at all, it would be in *73*.

The new issue of *73* arrived and again I scanned page by page only to find that I had searched in vain. I hung my head, my shoulders sagged. It was true! The FCC had lost its collective mind! God help us all!

Bob Hileman WA8SSM
Weirton WV

HELPING HAM NEEDED

I have recently acquired a piece of Navy surplus gear which was made by Hammarlund. This particular piece of gear is a receiver, type CHC 46140, model 4BG 2, with a frequency coverage of 54 MHz to 31 MHz. The physical layout of the receiver suggests that perhaps it might be a predecessor of the present HQ series.

First, would you perhaps happen to have a schematic of this receiver in some of your back files? If not, could you tell me where I might find one? As a subscriber to *73*, I have seen many ads for surplus; perhaps some of these places could help me.

Lt. Scott Shannon WA5CVI/7
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Mountain Home AFB ID 83648

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Being a CBer myself, I can agree with the letters you receive about the unauthorized use of the 11 meter band by about 90% of licensed operators.

The only way I can see the practice of using CB as a hobby is completely close the band, or require a special license for "bootleggers." Say $50 + $10 a watt.

Keep up the good work. Who knows, I may learn enough to pass the Novice test some day.

Sp6 Paul R. Harrison
Tacoma WA

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LOW-COST 220 MHz SIGNAL GENERATOR

This article describes the design and construction of an easy to build, inexpensive, crystal controlled signal generator for the 220 MHz band, including a very low cost attenuator that goes from a quarter volt down through 1/20th of a microvolt and on to a real zero (of rf power). It is very useful for receiver front-end tuneup, low noise tests, and as a portable field generator for overall antenna tests through the receiver. For signal identification purposes, af and FM modulation are included.

If you really want to fight for a low-noise front end, this piece of equipment will be of great assistance to you, because the attenuation really is infinite and without any difficult bypassing or shielding.

Design of the attenuator.

Infinite attenuation is achieved here by the use of a 50¢ piece of aluminum tubing, as shown in Fig. 1. You cannot drive 220 MHz signals more than a few inches down inside of a piece of aluminum tubing. By putting *everything* – battery, on-off switch, circuit and all – on the movable generator strip and sliding it in and out of the tubing, you avoid all touchy, difficult and expensive bypassing, costly attentuator pots, shielding, etc., and provide a simplified means of varying the attenuation with stable, smooth, easy repeatability. Calibration is of the slide rule variety and also simple as far as writing down the microvolts on the scale is concerned.

This principle is older than radio tubes; in fact Sir Oliver Lodge used it in his 1890 microwave work.

Attenuator Construction Details

Figure 1 tells most of the story, with details in Figs. 2 through 9. An adequate rf

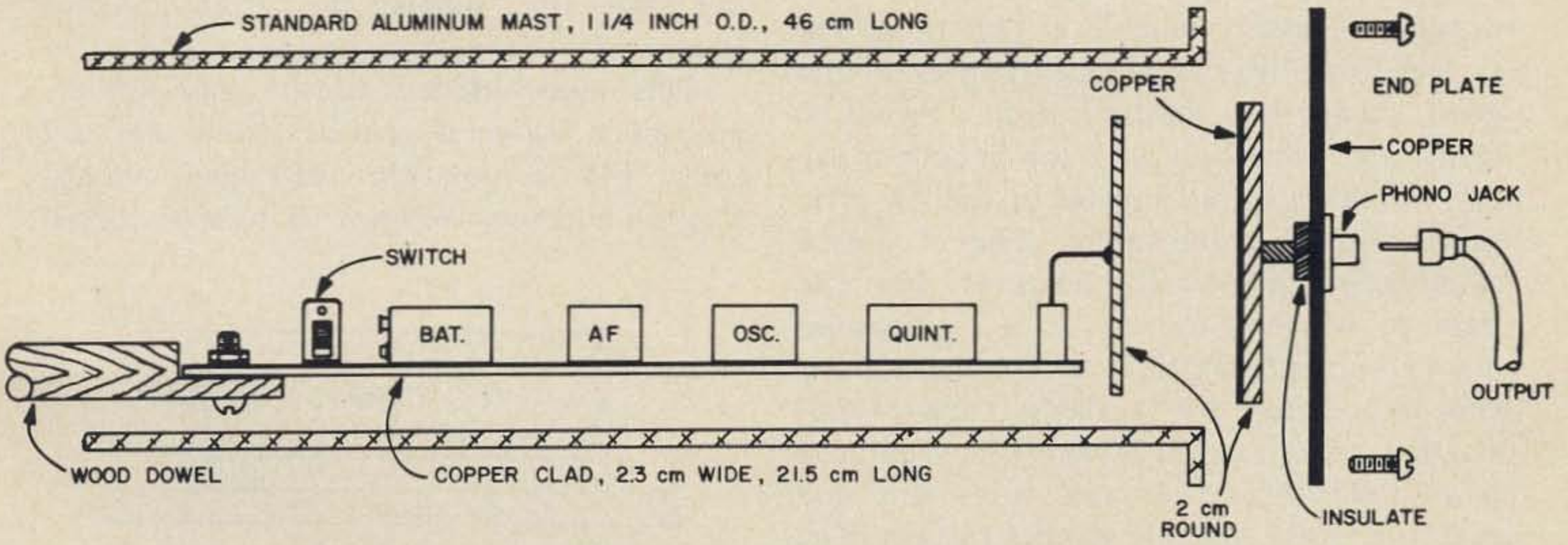

Fig. 1. Sideview, 220 signal generator and infinite attentuator.

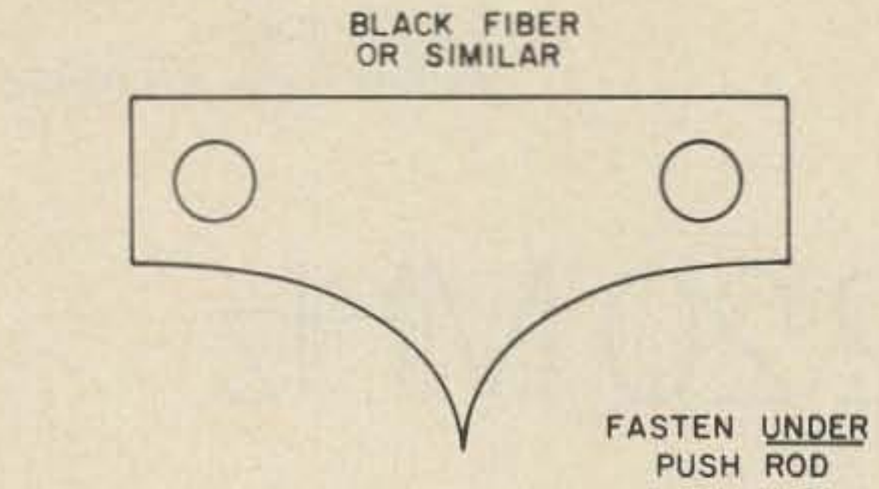

Fig. 2. Top view of the 220 signal generator and details of the calibration pointer.

seal can be made at the pickup end of the aluminum tubing, standard TV masting, 1¼ O.D., by 2 or 4 tabs in one end as in Fig. 3 and bending them back as shown, then cutting off the excess tubing. Install the pickup, plate, output jack, and end plate as shown in Fig. 1. I used time-saving external mounts for fastening it down to the wood baseboard as shown in Figs. 2 through 5. Drill a ¼ in. hole for a screwdriver as in Fig. 2, and use angles for the pickup end. Figure 2 also shows the scale in use for attenuation settings, and Fig. 3 shows pointer details. Figures 6 and 7 show pictorials of the layout, top view and side view.

The Generator

Nothing too fussy here, but attention to details will assure reliable af and rf oscillation at low power and low battery drain and good frequency multiplication. Figure 8 shows the schematic with the details of the two oscillators, the crystal in the 44 MHz range, and the quintupler. The af uses a standard circuit which, however, has one item to watch. Contrary to a transformer coupled circuit, which is seldom mentioned, this twin-T job has a nasty trick of not starting every time. However a small cap from collector to ground cures this and makes it 100% reliable in that respect. The emitter being grounded, I suppose this establishes the correct in-phase relation with the collector, in which both of these elements should be in phase. You can put a small trim pot af gain control between the modulator and the oscillator if you wish, watching out for dc voltages of course. As shown here, there is plenty of modulation for signal identification, both AM and FM.

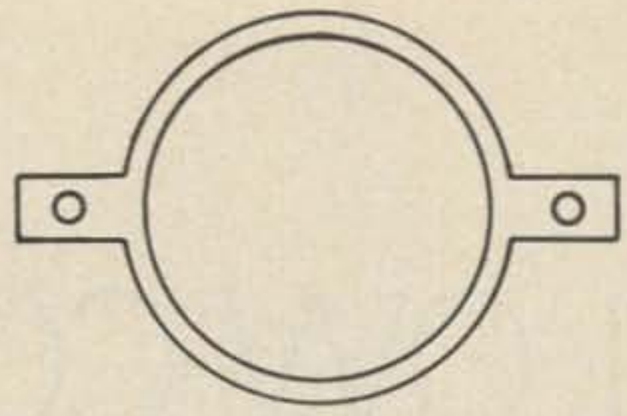

Fig. 3. Cable end view tubing.

Referring to Fig. 8, at the left is the af oscillator. It is not down symmetrically, but you can note the two 22K resistors and the two .02 frequency settling caps, along with the .05 and the 2.2K terminating the lines. All of these set the frequency, and to change the frequency you should vary all of them in at least their approximate present ratios. It is around 500 cycles as shown. Do not forget the "starting cap" from collector to ground.

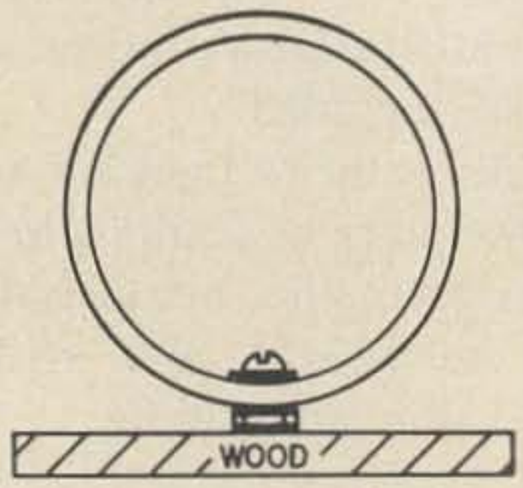

Fig. 4. Open end view.

This audio is fed to the base of the multiplier where it provides some AM and some FM modulation for signal identification purposes. When working with receiv-

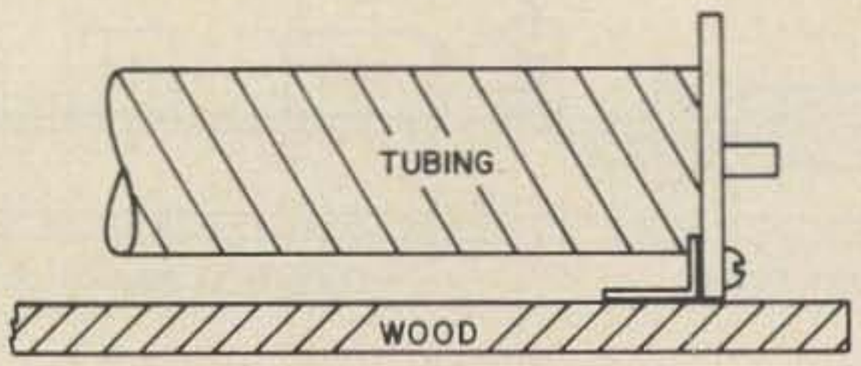

Fig. 5. Side view.

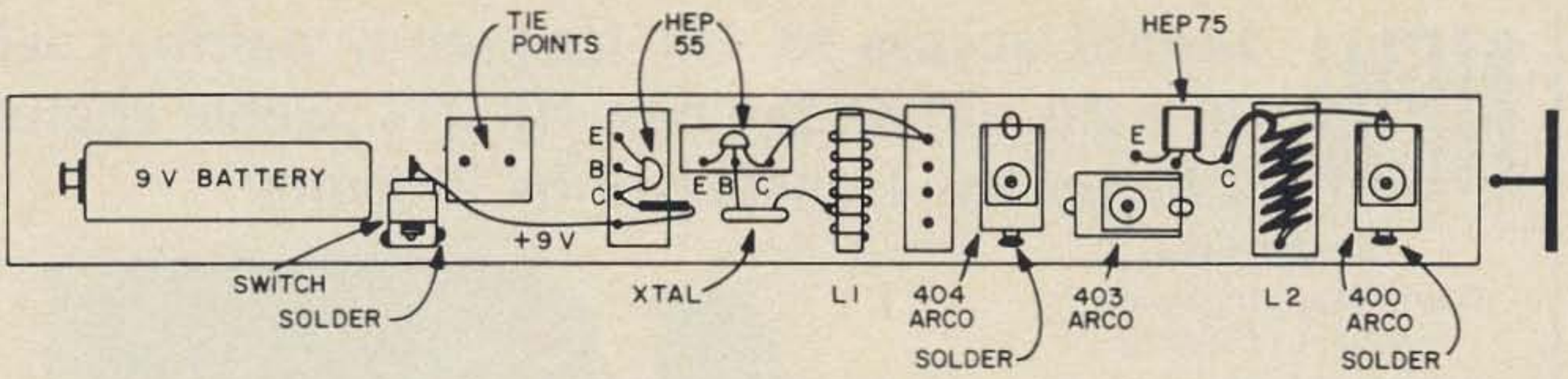

Fig. 6A. Layout, top view.

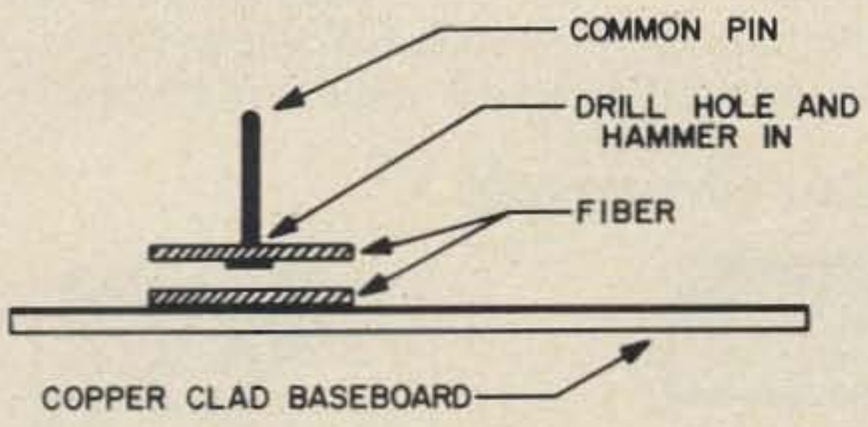

Fig. 6B. Tie-point construction.

er oscillators, and in particular with high-ratio multipliers, this is very important. It may also be locked into any old scope sync for noise figure and sensitivity comparisons. The scope sync gives a reference point where the signal to noise ratio will always be the same, without resorting to guess work. The crystal oscillator is my old tried and true crystal phase-reversing job, which uses negative feedback from the collector coil, which, after going through the crystal, reverses phase and becomes positive, thus assuring oscillation but *only* on the crystal frequency. A HEP 75 (similar to the famous 3866) is used for the quintupler. A lot more output is noted with this powerful but smooth operating old faithful, still good to 450 MHz.

The output goes to the antenna plate on the forward end of the baseboard plank. When this plate is moved all the way in so that it is only ¼ in. from the cable pickup plate in the end of the aluminum tube, a full scale reading may be obtained on a 50 microamp meter on the output of a tuned diode detector (see Fig. 9). My first model here has marks on the scale (see Fig. 2) for 1 rf stage; 2 rf stages; mixer (feeding into a good i-f strip); mixer plus 1 rf, etc. At the 1 rf plus mixer, you begin to hear all the repeaters within 100 miles or so. With 2 rf plus mixer (followed by a sensitive i-f of course) you are really getting sensitivity. This is where you put a scope in line in order to have an electronic comparison point for signal coming out of the noise purposes, and then can really get into the low-noise bit, if you have a hermit location. Just happens I have one here. When I hear the noise of a car, it's a visitor!

Output

You will see for yourself as soon as you start testing that the attenuator is smooth-working and stepless, and that true infinite attenuation is at hand. An rf input state (pre-amp) with a noise figure a fraction better than another shows right away on the

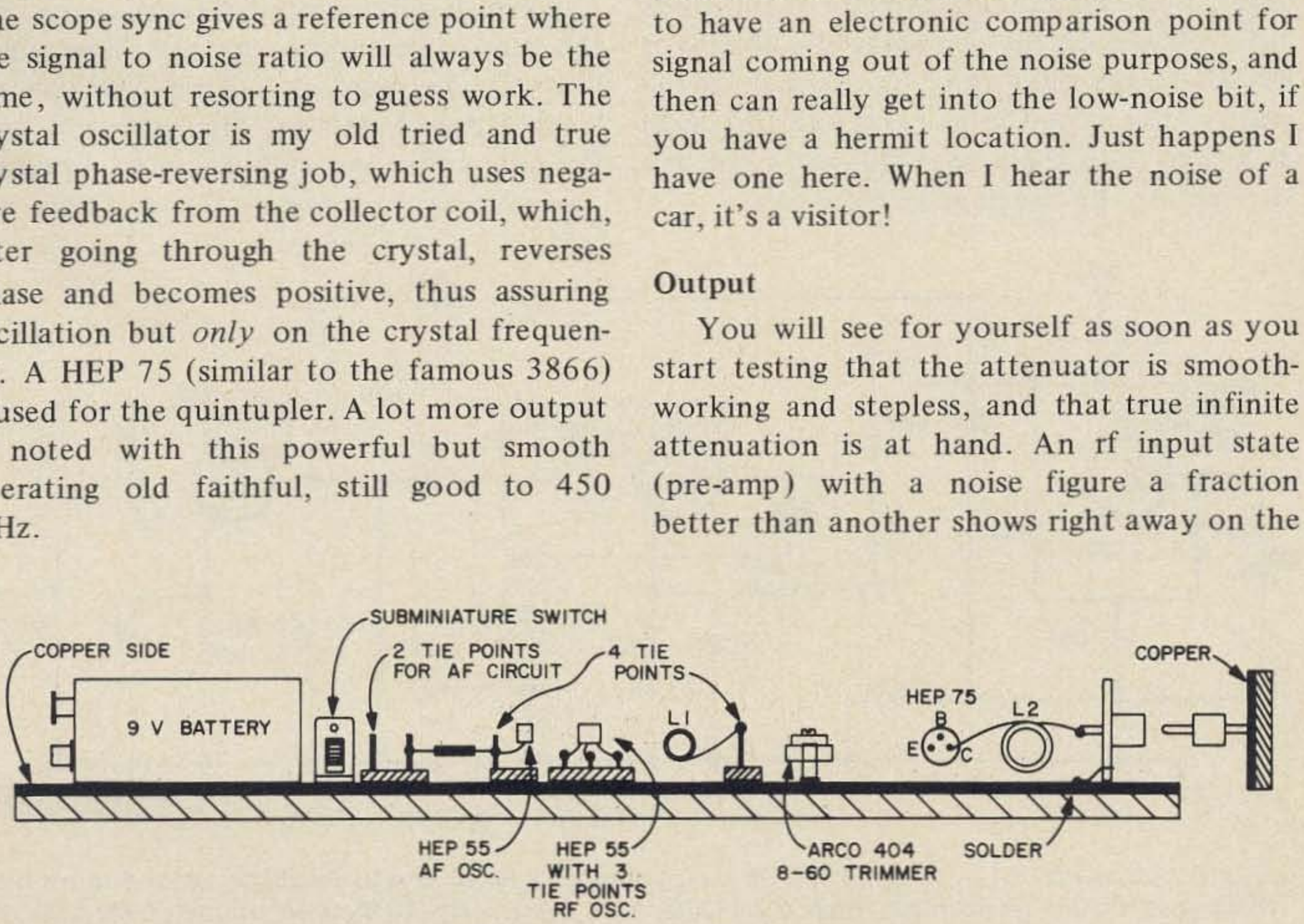

Fig. 7. Side view of the signal generator, 220 MHz.

scale. For example, adjustment of the fixed bias voltages on the two gates of a 3N200 or 3N201 shows right away on the scale as the push-rod is moved in and out and the signal is locked onto the scope. This work you can do right on the bench and at low cost.

There is quite a bit of mechanical work in the unit, depending on just how much "finish" you want it to have. You can also bring a dowel rod for "on and off" use. Do not, under any circumstances, bring out a *conductor*. You *can* do this, but only with

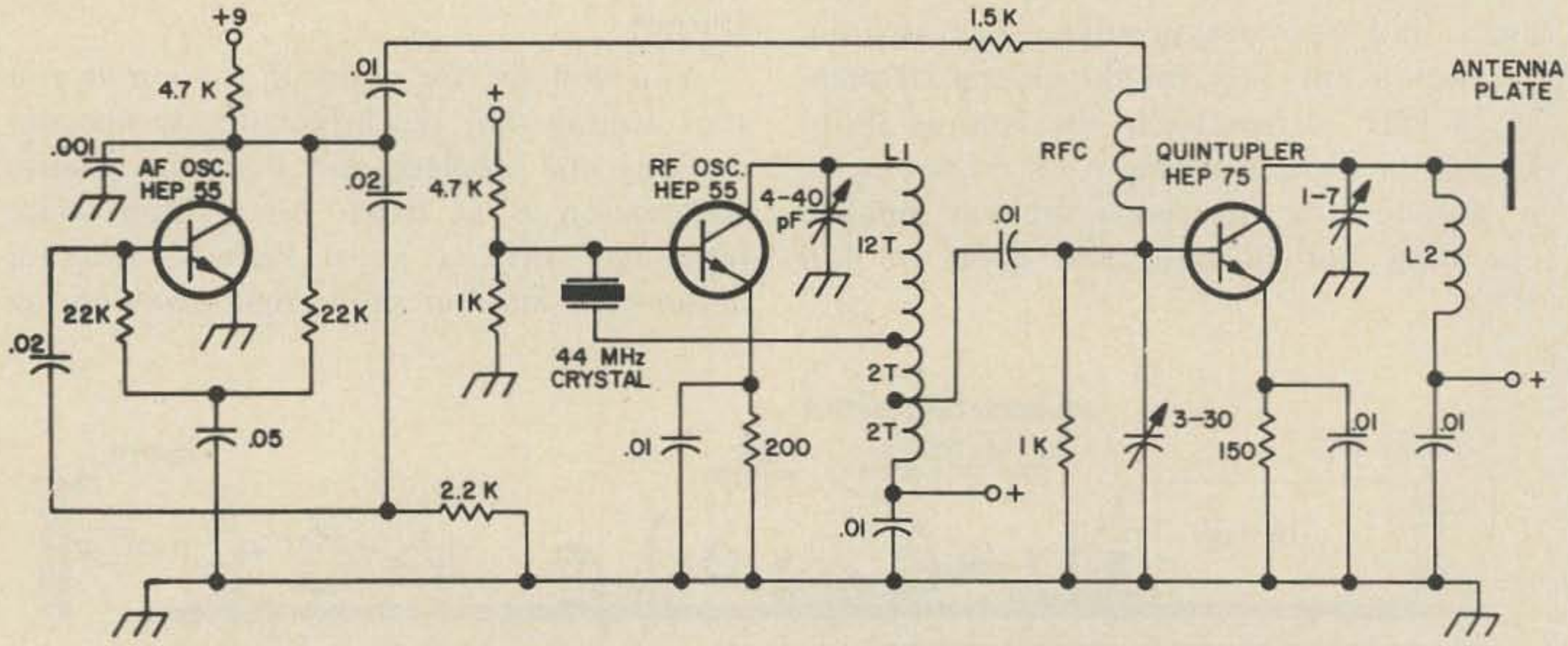

Fig. 8. Schematic. L1 = 16 turns No. 26 output tap at 2 turns, crystal feedback tap at 4 turns, from cold end. Wound on phenloic form .6 cm O.D. L2 = 6 turns No. 18 bare, air wound, .6 cm O.D., 2.3 cm long between tie points. RFC = about 40 turns No. 40, on phenolic form .3 cm O.D., 1 cm long (not critical).

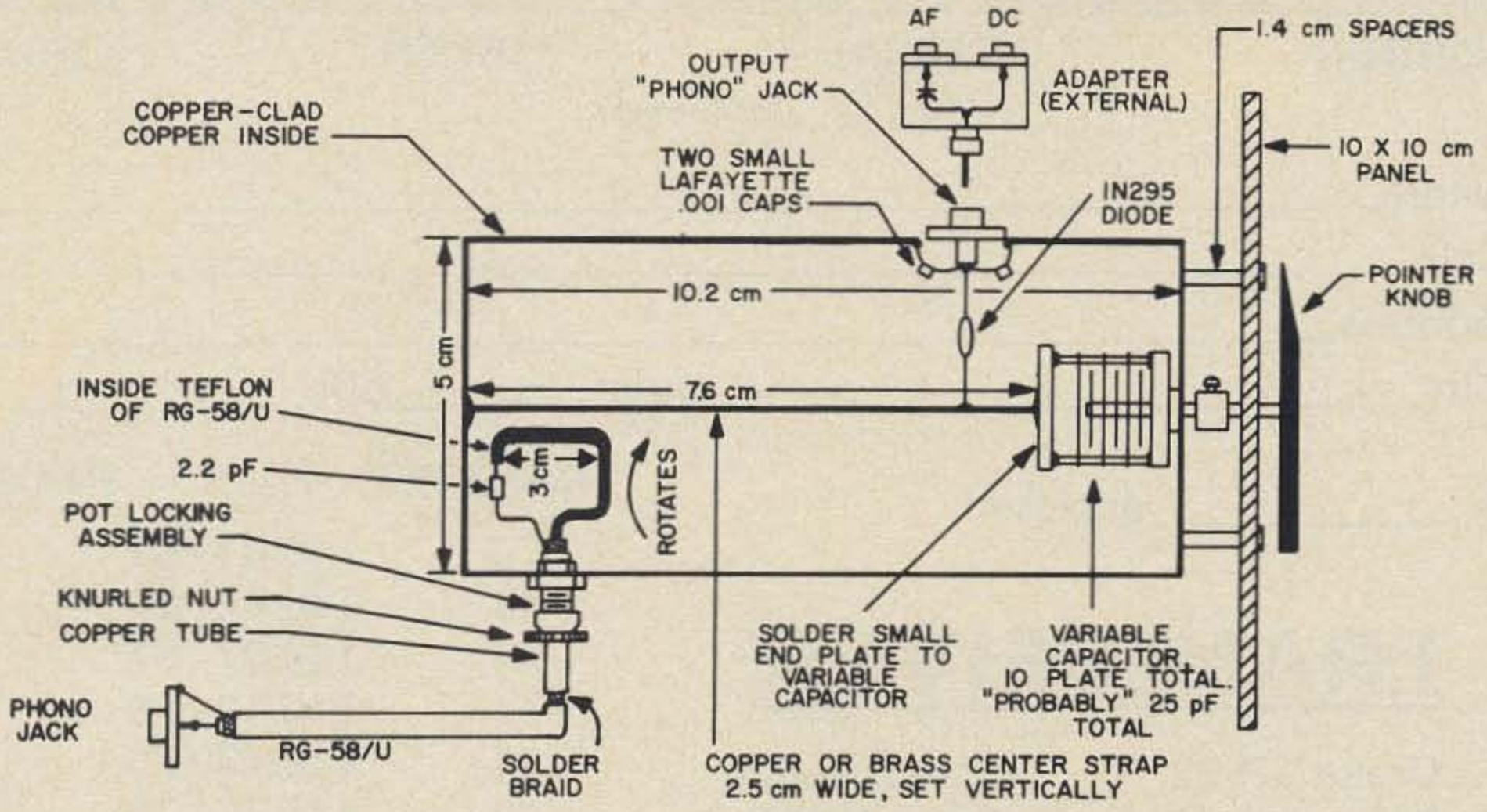

Fig. 9. Tuned diode detector, 160—460 MHz.

an extreme amount of filtering, which is not part of this article. Be sure to set up the baseboard, antenna plate and battery first, and get them working mechanically. With a drawn-out shape like this I generally start with a longer piece of copper-clad than needed, build from one end, and then cut off what is left over. Understandably, once you have made the first one you can always see, after it is done, many ways of improving it. However, someone has to make the first one, and that's generally my job.

Antenna and Field Tests

Out of the tubing, and with a small antenna connected via a one turn link around the quadrupler coil and then to ground, returning L2 for maximum output, this little rig puts out a lot of signal on 220. Especially if you reduce the oscillator emitter resistor! Up to several volts of rf can be obtained in a tuned diode receiver if you push things along, which is around 5 to 10 mW. If you place this generator out in a field several hundred yards or more away, you can then line up your antenna on the car or house, check antenna cables, antenna input alignment, and match or mismatch for lowest noise figure, etc.

Front end alignment should first be done with a relatively broadband i-f strip on 10.7 MHz. Be sure nothing metallic on the generator strip protrudes enough to touch the inner wall of the tubing, or "scratch" will occur in the high gain receiver. A piece of thin fiberglass or other insulating sheet wrapped around the whole generator movable plank is a good precaution.

Once again I include a 220 MHz tuned diode detector, which is an absolute must for frequency multiplication, especially quintupling and such, where the other unwanted harmonics are as little as 20% away from the desired frequency. Figure 9 shows this piece of test equipment in pictorial schematic form. Remember, shape is of considerable importance as you go from VHF into UHF. It is quite easy to make the square trough line out of an old piece of copper clad. Or even a new piece! And this particular one described and shown in Fig. 9 goes very well to over 450 MHz and thus is very nice for the next band also. If you make it just as I've shown it, it will do a good job for you.

Calibration will present some difficulties, so line up some other lads around who are already on these bands and get your calibration that way.

So good luck, friends, more coming — lot's more! Keep reading.

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AN EXPERIMENTAL MINIATURE ANTENNA for 40 to 80m

Active, subminiature antennas have been publicized in many technical journals recently. Here is discussed the nature of such antennas and their applicability to amateur radio usage. An experimental antenna developed by the author is also described.

The term "active antenna" has come into usage recently to describe antenna forms which use semiconductor elements as an integral part of the antenna structure. Probably every reader has seen photographs of some form of this type of antenna where an antenna a few inches long is claimed to have the same performance (for receiving purposes) as a regular antenna of 10 to 20 times the size.

Whether the performance which is claimed is really true or not is still a question debated by many scientists and engineers. It would appear to be simple enough to take such an antenna and switch a receiver back and forth between it and a regular antenna for comparison purposes. However, such tests still leave many questions unanswered because the active elements in the antenna alter the noise figure of the entire receiving system. Therefore, the question remains of whether the active elements in the antenna really act to produce a new type of antenna form or simply act as a sort of very low noise level preamplifier for the receiver.

The purpose here is not to make any definite judgment about active receiving antennas. I do not advance any claim to having solved any of the scientific questions regarding the true value of active antennas. However, such forms of antennas do present a tremendously interesting opportunity for amateurs to experiment with antenna forms since only simple materials and components are necessary. Once one has constructed an active antenna that performs as well, or nearly as well, as a full-size antenna, one can really appreciate the scientific confusion that such antenna forms can generate.

Why Build an Active Antenna?

A logical question to ask is what value an active antenna would be. Even if one

could wire together a few transistors and a few pieces of wire a few inches long that duplicated the reception results achieved with a 30–40 ft wire antenna, of what value would the antenna really be since the full-sized antenna is necessary for transmitting purposes anyway? If one were engaged only in receiving operations, the value of such an antenna is clear, but there is also a good reason for using such an antenna even when a full-size transmitting antenna is available. That reason is directivity. Often, particularly on the lower frequency amateur bands, almost any good receiver has all the sensitivity available that is useful. Contacts are lost or DX stations not heard because of QRM. Selectivity devices within the receiver can be used to eliminate QRM to a degree, but relatively few amateurs also have available rotary antenna arrays, so antenna directivity can also be used to null out QRM sources. A small active antenna gives rise to the possibility of having available a small, easily rotatable antenna for receiving purposes that can be used to improve reception by means of its directivity. Such an antenna might be used indoors or outdoors, to replace or supplement the full-size transmitting antenna for reception purposes.

Definition of an Active Antenna

When an antenna design is that of an active antenna instead of just a short antenna with a preamplifier is sort of a moot question and perhaps the question at the base of the overall discussion on the value of active antennas. As shown in Fig. 1, one can visualize the question starting with the placement of an auxiliary preamplifer stage immediately at the input to a receiver at the terminals of the antenna, or within the antenna structure.

The role and performance of the preamplifier when placed immediately at the receiver, or at the terminals of a conventional antenna form are clear – as long as the input and output impedance levels of the preamplifier are known and are constant. Generally speaking, one converts from the conventional role of a preamplifier to an amplifier used as part of an active antenna when the amplifier also

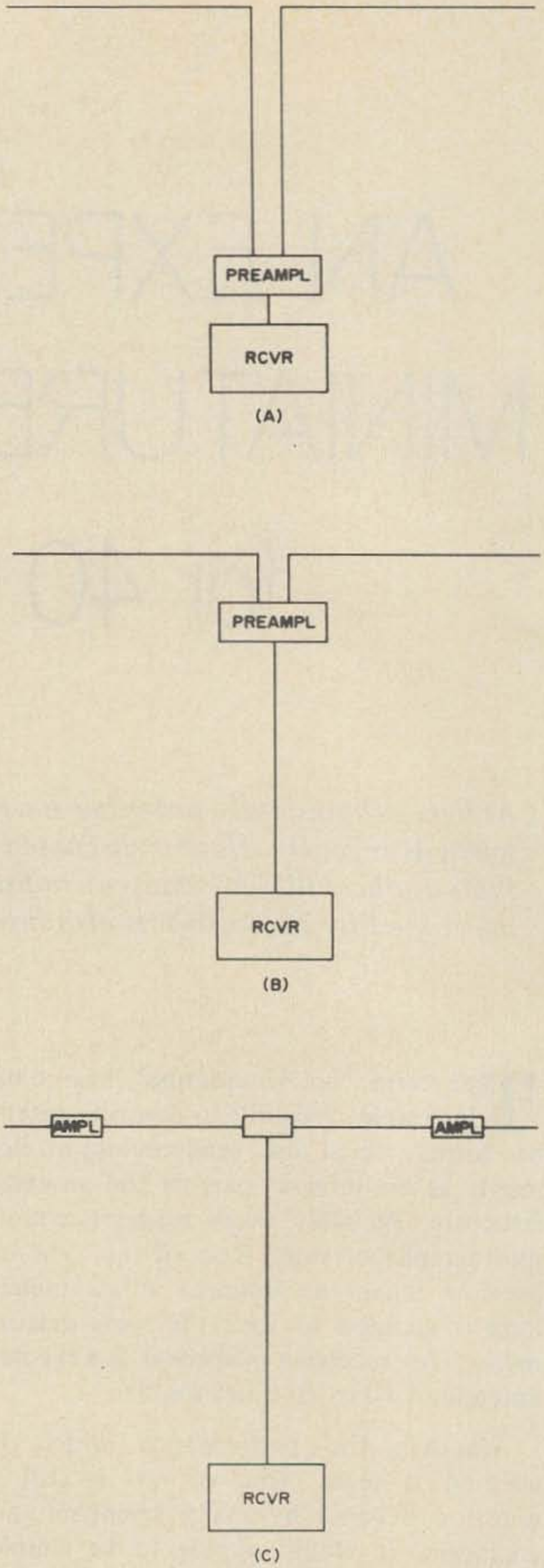

Fig. 1. The term "active" antenna does not have a rigorous definition. However, it can be visualized as a progression of the idea of using a preamp before a receiver (A) and (B). In the active antenna (C), the active device is part of the antenna structure and may act as a matching device as well as an amplifying device.

performs a matching or coupling function either at the base or internally to an antenna form. If the active device can perform this function over the impedance range necessary and in a very efficient manner, one can develop a physically small antenna that will perform the same as a full-size antenna. If one goes back and reads over basic antenna theory, it will be found that theoretically the signal pickup possible with a very short antenna, say 0.1λ, is essentially the same as that possible with a 0.5λ antenna. The reason the 0.1λ antenna does not perform as well in reality as the 0.5λ antenna is that power cannot be as efficiently extracted from it because of the loss in matching circuits. The active elements in the active antenna are supposed to perform this function in an efficient manner, not just act as a preamplifier.

Active antennas can take a variety of forms – there are few ground rules to go by. Most of the forms which have been developed have been developed on a strictly experimental basis and it often seems that the more detailed, scientific explanation of why an antenna works is developed after an experimentally derived form proves interesting. So, an amateur interested in experimenting with such antennas need not feel inhibited because of any lack of detailed knowledge of antenna theory. The antenna described next, which I developed for experimental purposes, is one example of an active antenna form.

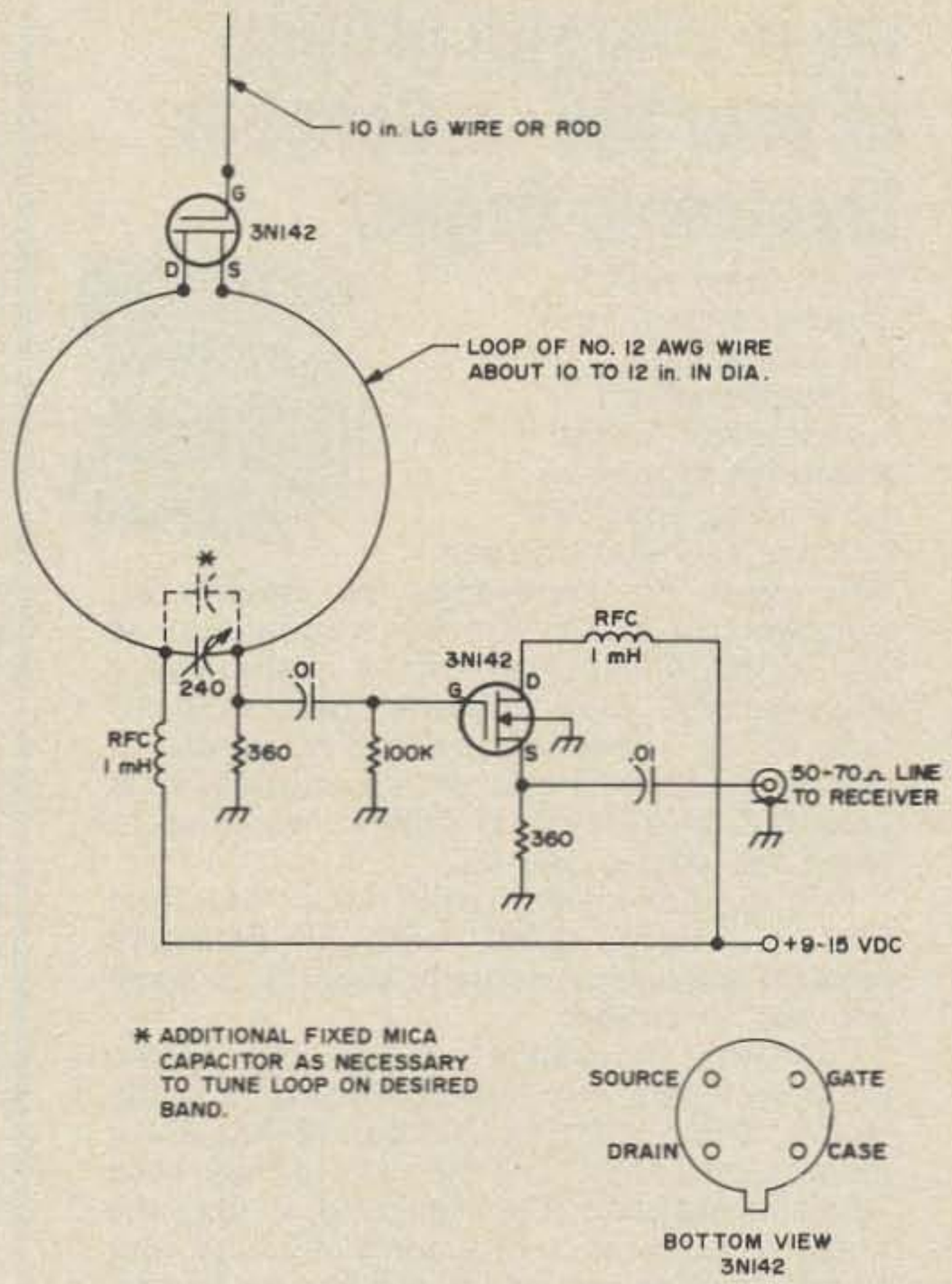

Fig. 2. Diagram of active antenna which author experimented with for use on 80 or 40 meters. The design is strictly experimental but seemed to yield very useful results.

An Experimental Active Antenna

Figure 2 shows the circuit of an experimental active antenna that I developed as a single-band antenna for use on the lower frequency amateur bands. The main features of the antenna are its relatively small size, directivity, and the use of two low-noise MOSFET stages. The basic scheme of the antenna was to use a tuned loop of relatively low Q for broadband operation over one amateur band phase coupled via a FET to a "sense" antenna for a unidirectional reception pattern.

As can be seen from Fig. 2, one 3N142 FET is used at the apex of the loop to couple the loop to a short vertical antenna. The loop is tuned to 80 or 40 meters by the trimmer capacitor at the base of the loop. The tuning is quite broad because the drain–source resistance of the FET at the apex of the loop is in series with the loop. The trimmer capacitor also serves the function of dc voltage isolation, since the drain potential is routed to the FET over one side of the loop. The other side of the loop is brought to ground via the source resistance for the FET. The signal output from the loop is therefore achieved with the FET at the apex of the loop acting as both a coupling stage and an amplifier with a source-follower output. The output of the loop is coupled to another 3N142 FET used as a source-follower stage. This stage is used to isolate the output of the loop from the heavy loading effect of the 50Ω transmission line to a receiver. The current drain of both FET stages is very low (a few

milliamps) and can be supplied from any battery source of 9–18V.

My original antenna for low frequency bands was of experimental construction. Later on, perforated board was used to mount the components and to act as a vertical support for the antenna. There is no need to shield the stage at the base of the loop. The only tuning adjustment for the loop, the trimmer capacitor at the base, can be peaked under actual reception conditions.

The actual reception results with the antenna were a mixture of interesting observations. Compared to a full-size quarter-wave vertical on 40 meters, the antenna delivered signals only about an S-unit lower! However, the "active" antenna was used directly on top of the receiver indoors while the vertical was mounted outdoors in a clear field. On 80 m, the active antenna performed about the same as compared to the 40m quarter-wave vertical base-loaded for use on 80m. The active antenna exhibited fair to good directivity. The back null, as one might expect from an antenna with a cardioid pattern, was not as sharp nor as deep as usual. The front-to-back ratio was in the order of 10–15 dB. Such a ratio certainly is useful for QRM reduction, but is usually better with a full-size antenna. By varying the length of the 10" rod at the apex of the loop it appeared possible to also optimize the directivity on any given band.

Summary

This was my first experience with the actual construction of an active antenna, although much study had been done on such antenna forms. As is perhaps usual with any instance of actual experience versus studied time, some surprises were experienced. The active antenna performed surprisingly well, even though it was crudely constructed. To see a relatively small antenna deliver almost as good reception as a full-size antenna is quite surprising. The directivity of the active antenna could certainly be better and this direction in experimentation may prove to be the most fruitful since the basic signal pickup of a small active antenna on the lower frequency bands seems to be more than adequate.

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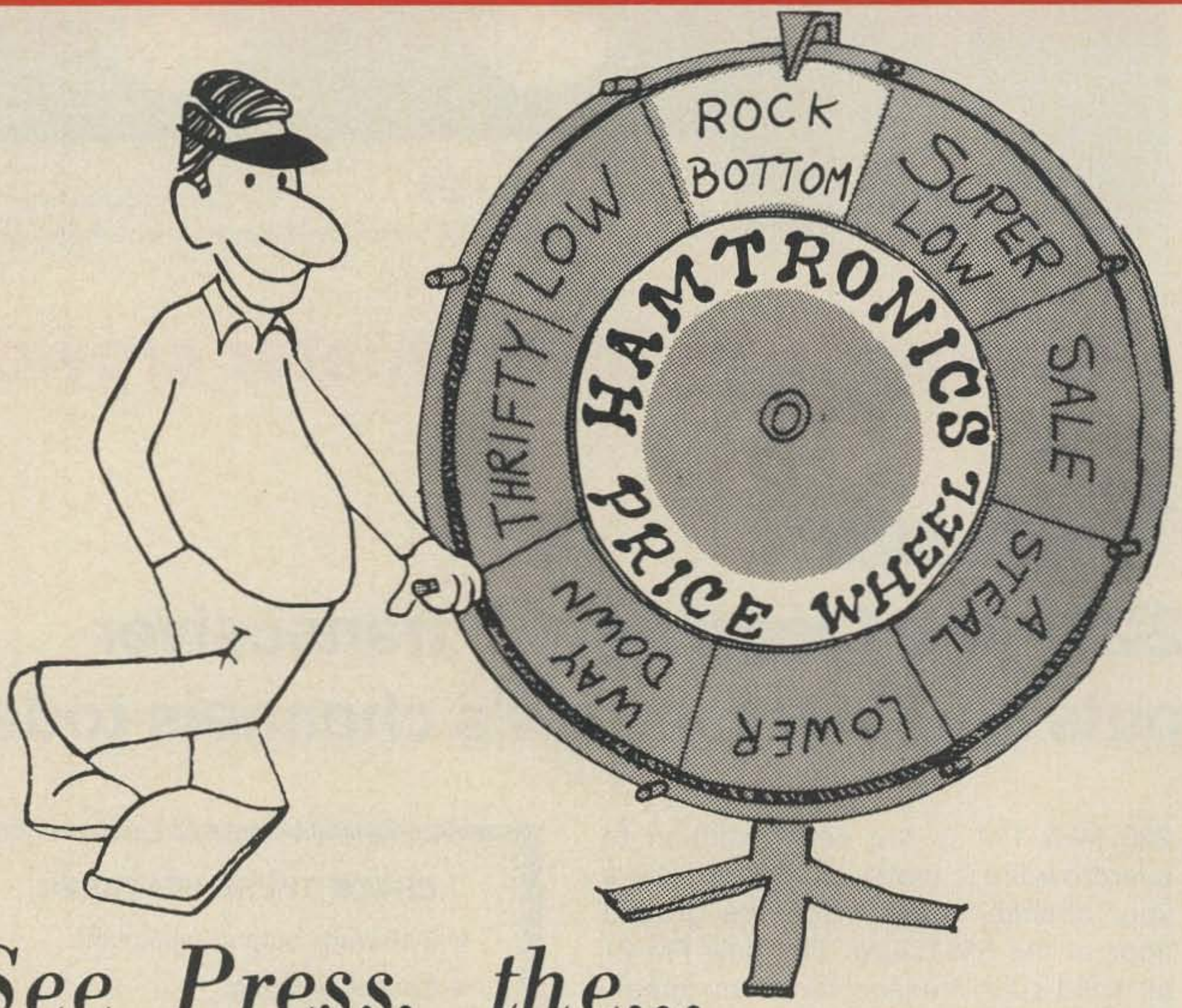

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Now—**hit** those challenging 6 meter targets—**be there**—be ready instantly for those thrilling DX breakthroughs and skip happenings. In the interim, join a select group who have discovered that mobile SSB on the low end of 6 approaches the ideal for solid, uncluttered local contacts. Here **now**—from SBE, SB-50, a very tidy package that provides all the ammo you need for 6 meter bullseyes! **Synthesized frequency selection** is an example in point: No crystals to buy, no concern about VFO stability. The band between 50.050 and 50.280 MHz is divided into 23 channels, spaced at 10kHz intervals. A clarifier control allows the master crystal frequency to be moved anywhere between two 10kHz points. SBE, SB-50, is a transceiver but switching to RIT enables a drifting signal to be zeroed without affecting transmitter frequency. A fine receiver with high sensitivity insures that the weak ones will be heard during band openings. Exclusive SBE "Super Shape" BP filters provide excellent SSB/AM response, both transmit and receive. A lighted panel meter monitors what's coming in—and going out. Squelch, noise limiter contribute to performance. Power input is 20 watts p.e.p. on SSB, 8 watts on AM. Equipment is all solid state, easy on car battery. Dynamic microphone is provided.

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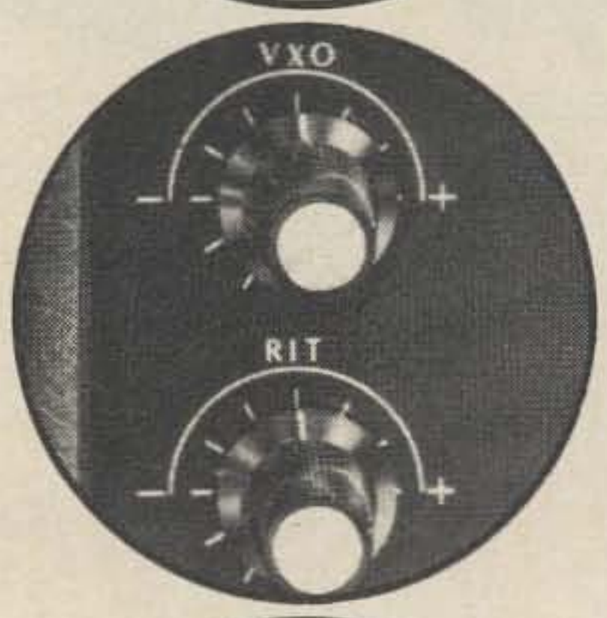

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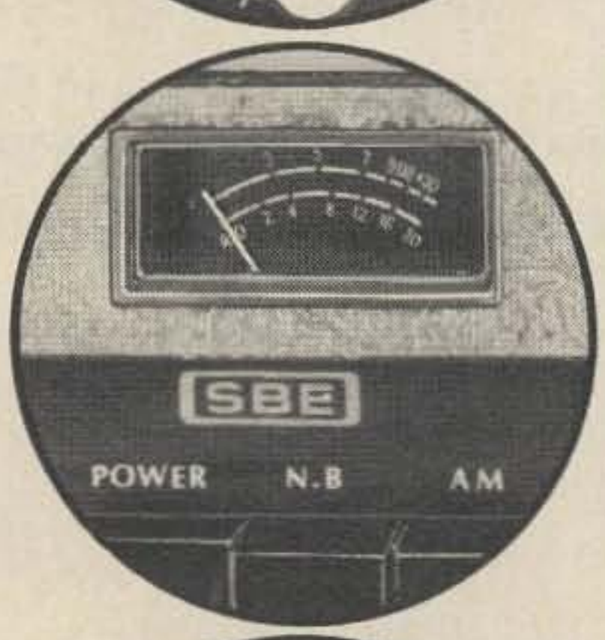

Lighted meter shows "S" units receive—power output SSB/AM

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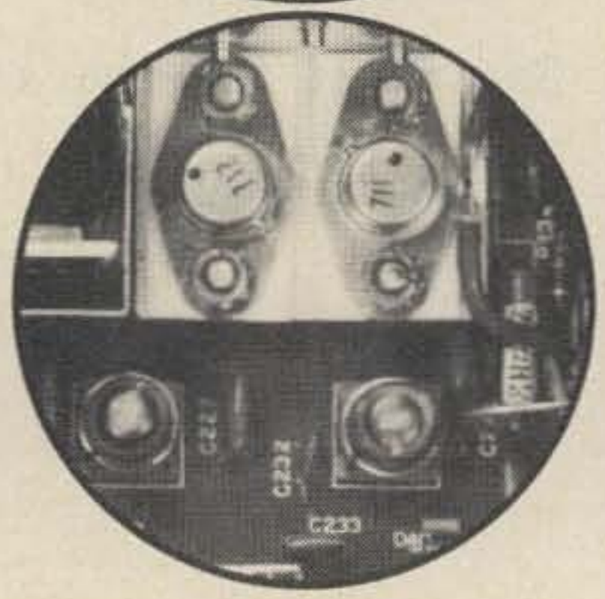

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AN IMPROVED UHF POWER OUTPUT METER

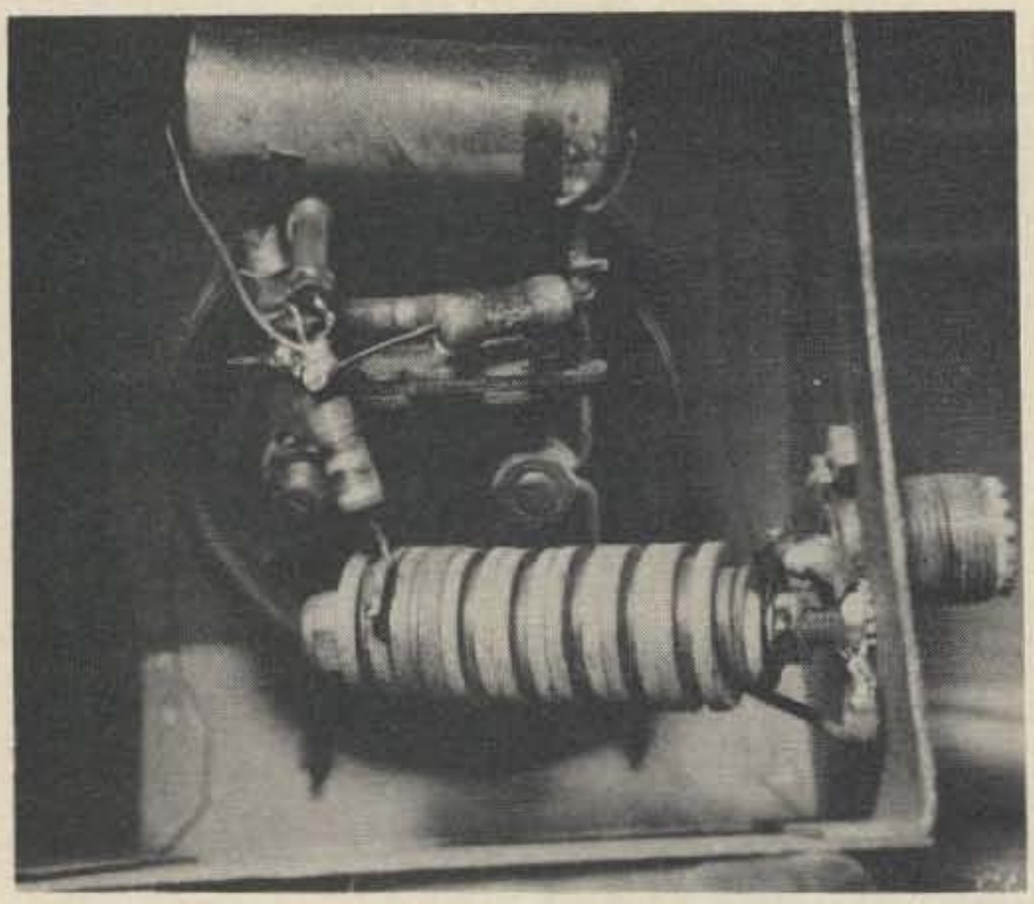
On page 207 of the *Handbook*, 1972 edition, in regard to a description of a simple varactor tripler for 432MHz, is a statement out of context: "Most constructors will find they have to spend more time making test gear to check the varactor than in building the multiplier itself. . .most of the dummy loads available to amateurs are too reactive at 432 MHz to be any good . . . A power indicator is the hardest item of all to come by."

This article will describe a UHF power output meter which is relatively non-reactive (vswr less than 1.5:1.0 at any point in range), will take the average ham less than two hours to construct once all parts are available, is not difficult at all to come by, and is relatively inexpensive compared to any commercial product offered on the market today.

Back in 1948, when the cheapest rf power output meter on the market sold for $185.00, I developed a reliable, accurate rf power output meter which could be home brewed by any amateur for less than $20.00. (*Radio & Television News*, April, 1950. J. A. Houser, "RF Power Output Meter for VHF and UHF.") This original meter was good from 3 to over 300 MHz, with a standing wave ratio of less than 1.5:1.0 over the entire range – quite exceptional for the state of the art at that time.

Since then the state of the art in measuring rf accurately and effectively has advanced slightly. Therefore improvements were made to the original meter and some changes incorporated to extend the frequency range to past 500 MHz; which meant that almost complete redesign and some cautionary factors had to be observed in the use of such a meter. One purpose of this article is to describe these changes and improvements.

The first factor or redesign in order to extend the UHF frequency range was the length of the resistance unit, which in the original meter consisted of two stacks of



25W single range meter, good to over 500 MHz.

silver-plated composition discs, the total length of which was 7 in. Simple computation shows that the stack length must be reduced to much less than this to obviate resonant conditions which appear when the resistive element approaches ¼ wavelength; the 7 in. original stack would resonate at approximately 375 MHz more or less, and this *resonant factor* is of predominant importance in the design of any rf load.

For one thing, when the rf path approaches ¼ wavelength, research work done in our laboratory showed that very strange things occurred, and the meter became erratic to say the least. As there was no literature available which described such things, they had to be learned by experimentation. It was also determined that an erratic area appeared with certain lengths of the RG-8/U connecting cable used to connect the meter to the transmitter. As long as the cable was kept under ¼ wavelength, no erratic conditions occurred, but when it approached ½ wavelength, unreliable operation resulted. Therefore the length of the connecting cable (with regard to the frequencies to be measured) is critical to some degree.

It therefore becomes mandatory that above 300 MHz the cable length should not be greater than about 4 in.

The meter described here is capable of dissipating 25W for up to 30 seconds without undue heating or change of resistance values of the discs, and up to 50W for not more than 5 seconds of intermittent use. This is entirely adequate for tuneup procedures of a transmitter in the 300 to 600 MHz range, as most of these transmitters in the present state of the art have power limitations of 25W or less.

The picture shows the simple, straightforward, short lead construction employed. Note how close the resistance stack is mounted to the input connector (actually, right on it). The ground lead is less than 1/8 in. long, and the high rf lead is actually but 3/8 in. long. A 1N38 diode was found to have a more linear, higher frequency range than the 1N34 diodes originally used, but the 1N34 can be used if that is all that is available, and it will work (however the forward to back ratio of the 1N38 is quite superior to that of the 1N34).

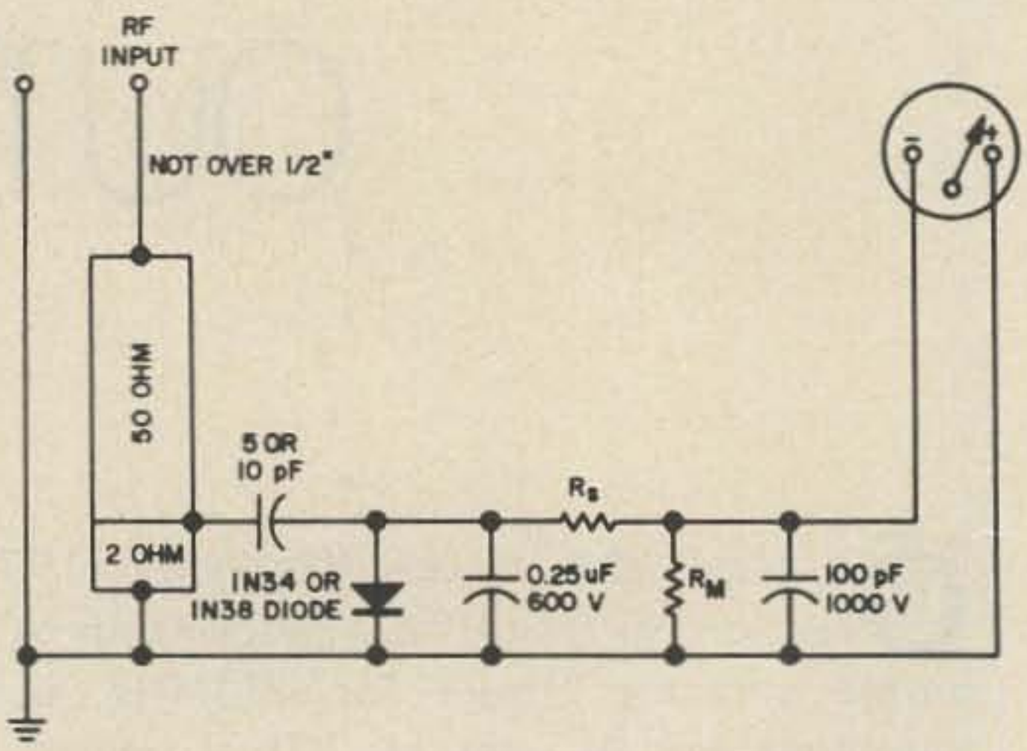


Fig. 1. Circuit schematic.

The parts list which follows is specifically made flexible to adjust to the type (sensitivity) of the meter which the constructor chooses to use, within the ranges specified in the charts:

5–10Ω composition resistor discs
1–2Ω composition resistor disc
2 takeoff tap washer/connectors (see diagram)
1 1N34 or 1N38 diode (or similar)
1 μF mylar capacitor
1.025 μF mylar capacitor
1 R sub s (series) resistor (see table)
1 R sub m (meter parallel) resistor (see table)
1 100 μF capacitor (mica preferred) (meter shunt)
1 meter (constructor's preference)
1 meter and instrument enclosure (Bud or similar)
1 SO-239 chassis connector
4 #6 x 1/4" flat or filister head brass NP machine screws, 32 TPI
Solder and #12 copper connecting wire as required; (about 4" will do)

Create a vast improvement in your two meter performance! Get the advantage of 6 db gain transmitting—6 db gain receiving.
Both are yours in the Hustler Model G6-144, the antenna designed to establish who is who on two meters.

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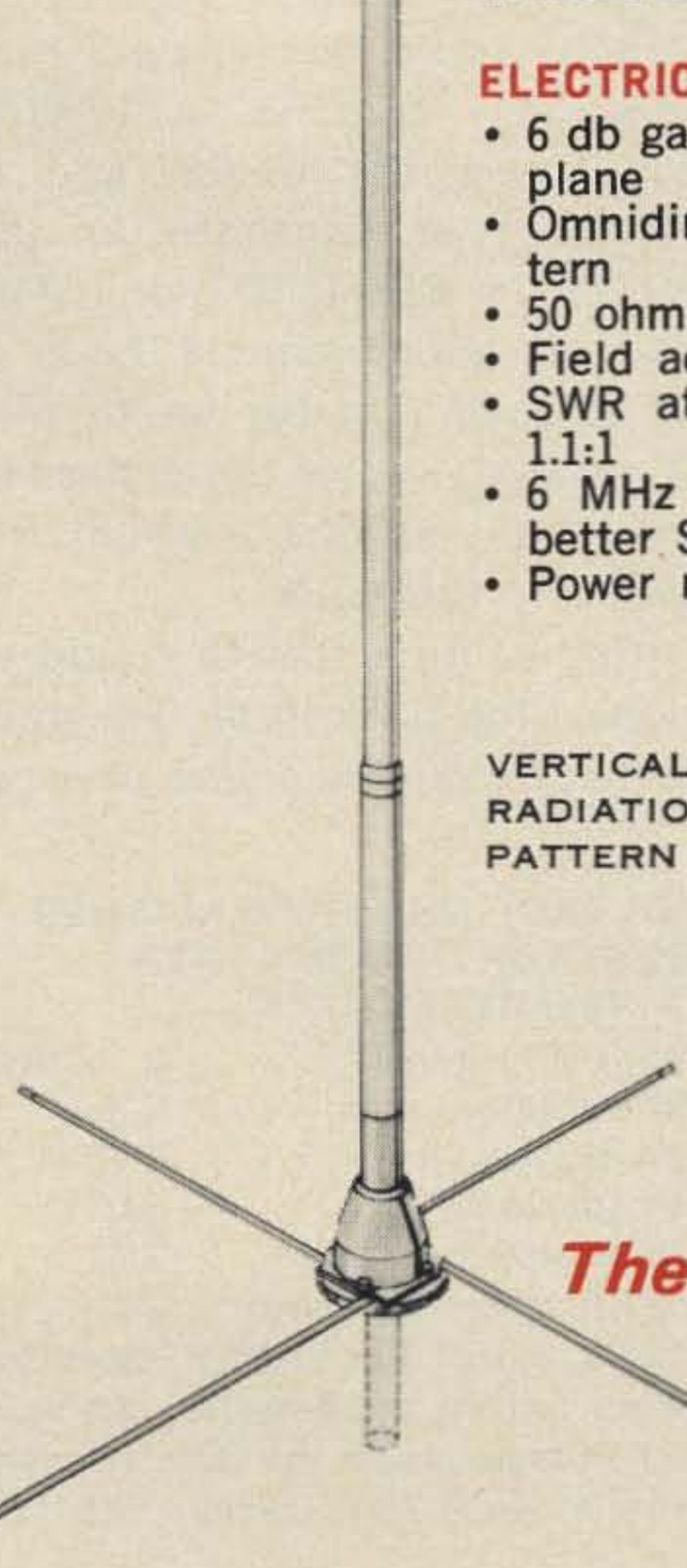


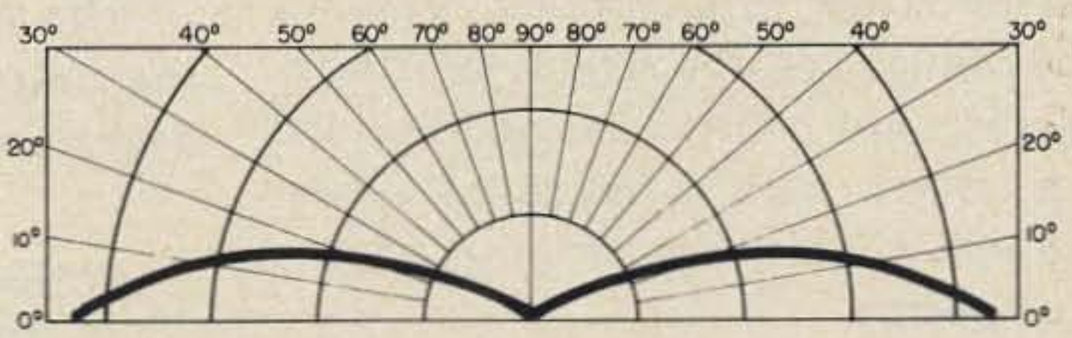
ELECTRICAL:

- 6 db gain over 1/4 wave ground plane
- Omnidirectional radiation pattern
- 50 ohm feed impedance
- Field adjustable
- SWR at resonance — typically 1.1:1
- 6 MHz bandwidth for 1.5:1 or better SWR
- Power rating—250 watts FM

MECHANICAL:

- Radiator: 133" x 1" — 7/8"-3/8" OD high strengtn aluminum tubing
- Radials: Four—21" x 3/16" dia. aluminum rod
- SO-239 coax connector
- Wind load—23 lbs. at 100 mph
- Wind survival—100 mph
- Mounting — cast aluminum flange accepts 1" American standard pipe thread
- Shipping Weight: 4.54 lbs.

VERTICAL RADIATION PATTERN



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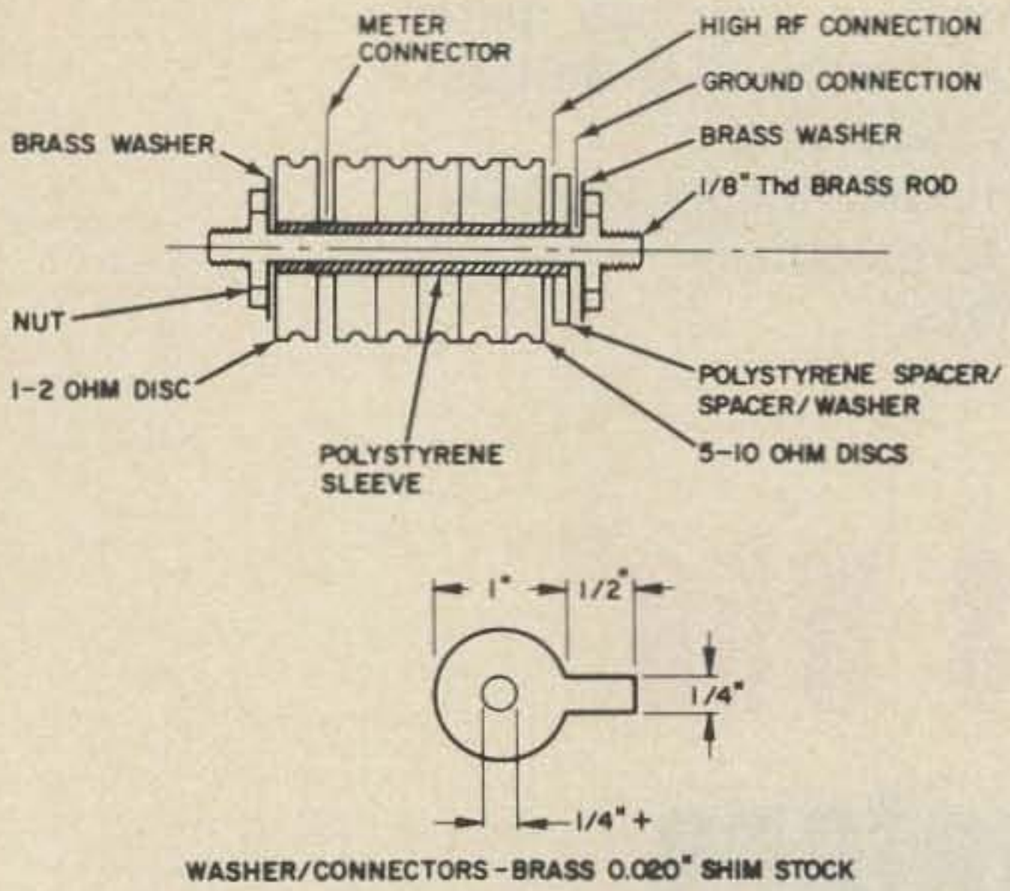

Fig. 2. Split view drawing of the resistor stack assembly.

Several bugs were encountered in the design of this new meter. It was found that there appeared a time-constant effect when an attempt was made to design a dual-range meter (high and low power). This appeared *only* when R sub m and R sub s were made approximately equal in value. As mentioned previously, there is no literature available to act as a guideline in design such as this. However, it was found that the reaction mentioned was taking place in the dual-range switch which was being used, so the dual-range feature was discarded, and a single-range meter was the only solution.

Because the constructor may have various usable old meters of different types around the shack which may be used, Table I is presented showing the values of resistors which can be used with various types of meters. The values are not strictly arbitrary. Nearby values, and a little cut-and-try will result in a meter with a range of power output suitable to the constructor, with a minimum of cost.

It should perhaps be mentioned – and may be of interest to some – that this meter *can be used* in pulsed transmissions and it will *read*; but caution: The reading will be false, and will have to be interpolated against the time on/time off shape of the pulse; and it will not be completely linear, at that.

Over 1,000 sets of elements described in the original meter were dispensed to constructors from the southern tip of Africa, to Alaska, England, Spain, China, Siam, and just about *all* states and possessions; probably because they could be mailed first-class postage; and only two builders had any difficulties, which eventually were straightened out.

In the redesign of the meter, new type discs were secured which are actually larger than the 1 in. disc diameter of those shown in the photograph. Five 10Ω discs, and one 2Ω disc are used in the "stack" to make up exactly 52Ω rf resistive impedance.

The metering/rectifier circuit is taken off at a tap between the 2Ω disc and ground. This results in just about the lowest practical impedance which can be used to feed the rectifier/meter circuit. The meter shown in the photograph was designed to read 20W full scale; it has been used by me for a number of years to test the output of 2-way transmitters (mobile) used in taxi and police cars which have maximum power output of 20W. The original meter is good for up to 100W up to 300 MHz and has been used by me to check fixed-station transmitters used in 2-way work for the past 20 years – and it is still in use.

A caution about parts: Use only the best quality components – such as a 1,000V mica capacitor across the meter, and if possible, a Mylar type capacitor as the rectifier shunt (0.25 μF/60-V type). The coupling capacitor, which should be a 5 pF/1000 for frequency range up to 600 MHz must of necessity be of the deposited silver-on-ceramic type, as that is about the only type available in this range.

The only other caution is with regard to the construction of the stack itself. The discs have a ¼ in. hole through the center of each.

TYPICAL VOLTAGE GRADIENT VALUES ACROSS STACK OF DISCS WITH FIXED RF INPUT**

Top of stack (input rf terminal)	6 Volts rf
Between 1st and 2nd discs	5.2
Between 2nd and 3rd discs	4.1
Between 3rd and 4th discs	3.0
Between 4th and 5th discs	2.5
Between 5th and 6th diss (Tap Point)	2.1

**From this table, note the slightly capacitive effect of the discs, which accounts for the non-linearity of the rf voltages across the same values of resistances – 10Ω in each case except the last, which is 2Ω.

TOTAL

Get total 146-148 MHz coverage without buying a crystal!

The modified Clegg FM 27B transceiver now covers the entire range of 146-148 MHz . . . and needs NO additional crystals. It's the only 2 meter rig *available now* with built-in total coverage that also offers greater than 25 watts output power, uses 10 IC devices, and has Teflon* wiring throughout. Not a single bi-polar device is in the RF path in transmitter or receiver . . . ensuring greater reliability. Accessory power supply and sub-audible tone on transmit are available too. At home or in your car, the FM 27B gives you the ultimate in total 2 meter performance. See your Clegg Dealer NOW or write or phone us today for detailed data sheet on our 2 meter leader.

CHECK THESE SPECIFICATIONS

GENERAL

POWER REQUIREMENTS: 12 to 14 VDC
Current Consumption at 13.5 VDC:
Receive: 4 amps squelched, 1.2 amps unsquelched.
Transmit: 6 amps max.

DIMENSIONS: 7⅜" x 3½" x 9¼" deep; 4 lbs. net weight.

RECEIVER

TUNING RANGE: 146.00 to 148.00 MHz, continuously tuneable with reset capability of approx. 1 KHz to any frequency in range.

SENSITIVITY: .35 μv max. for 20 db quieting; .1 μv for reliable squelch action.

SELECTIVITY: 11 KHz at 3 db; Less than 30 KHz at 70 db. Adjacent (30 KHz spaced) channel rejection more than 70 db.

AUDIO OUTPUT: 2.0 watts (min.) at less than 10% THD into internal or external ohm speaker.

TRANSMITTER

TUNING RANGE AND CONTROLS: Same as RECEIVER.

POWER OUTPUT: 25 watts Min. into 50 ohm load. P/A transistor protected for infinite VSWR.

MODULATION: Internally adjustable up to 10 KHz deviation and up to 12 db peak clipping.

*DuPont trademark

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5 Channels -- .94/.94 and .34/.94 supplied
.3μV receiver - 2+W transmitter - PL available
Compact -- 8"h x 3"w x 1½"d
Full line of optional accessories includes external speaker-mike -- desktop charger -- "stubby" antenna -- and more!
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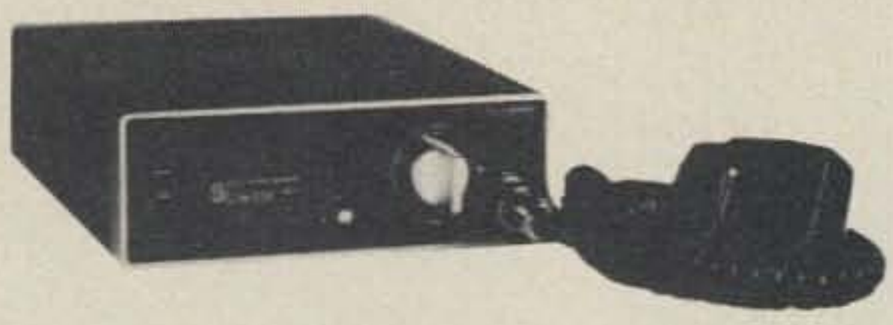

ALL PURPOSE
STANDARD 826MA
12 channels (94/94, 34/94', 16/76, 52/52 supplied).
10 Watt output
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Hot MOSFET receiver, helical resonators
Only $369.00

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12 Channels
13 Watt xmtr - .5μ rcvr
Xtals for 146.94 MHz supplied
Meter for Power Out, Signal Strength, and Discriminator
Size: 2.36" x 7.66"
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6 Channels
(146.94 supplied)
2 W. out
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Sig. Level/Bat. Mtr.
Size: 8.5" x 2.9" x 2"
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MODEL	POWER (in/out)	PRICE
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502	10W/50W	105.00
502B	1W/50W	130.00
802	10W/85+W	180.00
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1002-3B	1W/120+W	235.00

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A 1/8 in. or No. 10/32 threaded brass rod is suitable for the center (ground) conductor. This is insulated from the stack by a length of 1/8 in. inside diameter polystyrene sleeve, which is just less than ¼ in. outside diameter, and fits nicely inside the inside bore of the discs. At the ground end (far end of the stack from the rf input) next to the tapped disc, no insulating washer is used. A brass or copper washer can be used, and then the ground nut, which should be brass or brass nickel-plated of the Castle type.

The high rf end of the stack consists of the takeoff copper washer/strap, which is to be connected to the hot terminal of the chassis connector, and then an insulating polystyrene washer at least 1/8" thick, then the ground washer/strap connector, a brass washer, and then a brass nut. Dimensions are given for the washer/connectors in the event the constructor wishes to make his own, if nothing suitable is available; also a split-view drawing of the stack is given herewith so the constructor will make no error in assembly. The ground rod (brass) actually extends through the center of the stack.

Any suitable meter case (such as bud) can be used. With all materials available, this meter can be constructed in much less than 1 hour. There are but 5 holes to drill. Position the input chassis connector at the side of the case (left side seems more convenient); drill the center hole; position the connector, and mark and drill the 4 small retaining-screw holes (#6/32-1/4" brass nickel-plated screws and nuts were used). One nut retains the ground connector which is soldered to the stack ground strap. There are only 11 soldered connections.

As a matter of information, the curious constructor might like to know what the voltage gradient would be between the 6 discs used in this meter. A General Radio rf VTVM was used to determine the voltages shown in the table herewith. Note from these readings that the very slight capacitive effect of the discs is apparent; which accounts for the non-linearity of voltages appearing across like 10Ω resistor discs.

METER USED FULL SCALE READING	R sub s	R sub m	WATTS FULL SCALE READING
1 mA	4,000	180	400*
	ZERO	180	10
7.5 mA	1,000	1,000	30
12.0 mA	2,000	1,000	-30- (at 3/4 scale)
200 mA (with shunt removed)	5,000	180	-30- (at 1/2 scale)
About 500 μA	2,500	180	-30- (at 1/4 scale)

* The value for 400 watts full scale reading is given; however, 400 watts cannot be applied to the meter described herein.

** Resistors near the values given may be used – cut and try – as the internal resistances of various meters do vary from published figures. The values given herewith are guidelines.

Testing the Meter

Now that you have constructed the meter, how about testing it just to convince yourself it is a good one? The best test of any such output meter is to make up a test line with a RG-8/U "T" fitting in the center of the line. Practically, two short lengths of cable may be made up, each 1/8 wavelength or less in length, and a screw type RG-8/U "T" fitting inserted. Then, cut yourself a piece of RG-8/U cable exactly 1/4 wavelength long at the frequency of the transmitter you are using. Insert this open-ended piece of cable into the "T" fitting, and connect the meter and the transmitter. Turn on the transmitter. The meter will read zero – that is, if everything has been cut exactly, or near zero if there has been a slight error. Now, with the transmitter off, short out the end of the stub of cable inserted into the "T" fitting. Turn on the transmitter and the meter should read exactly as it does with the stub completely removed from the "T" fitting (meter connected directly to transmitter).

To obviate too much computation on the part of the reader, it might be stated that the approximate lengths of 1/4 wavelength line in various frequency ranges are as follows:

150 MHz range – approx. 17½"
300 MHz range – approx. 8¾"
600 MHz range – approx. 4-3/8"

These figures are given as guidelines only. If your actual measurements with exact transmitter frequencies compute out too far away from these figures, you will know you have an error in computation.

. . .K2EE

Heathkit® 2-Meter FM gear is here!

NEW Heathkit 2-Meter FM Transceiver

179.95*

HW-202 shown above with Tone Burst Encoder installed.

All solid-state design • Can be completely aligned without instruments • 36-channel capability *— independent push-button selection of 6 transmit and 6 receive crystals •* ***10-Watts Minimum Output*** *— designed to operate into even an infinite VSWR without failure •* ***Optional Tone Burst Encoder*** *— mounts inside, gives front-panel selection of four presettable tones*

The Heathkit HW-202 compares with the best wired amateur 2M/FM rigs. Plus it has: 36-channel capability via independent selection of 6 transmit and 6 receive crystals. Solid-state circuitry with complete built-in alignment procedures using only the manual and the front-panel meter allow operation over a 1 MHz segment from 143.9 to 148.3 MHz. Removable front-panel bezel permits installation of the new Heathkit HWA-202-2 Tone Burst Encoder.

10-15 watts transmission into an infinite VSWR — indefinitely, with no failure! The HW-202 needs no automatic shut-down — it continues to generate a signal regardless of antenna condition. Transmitter deviation is fully adjustable from 0 to 7.5 kHz, with instantaneous deviation limiting. Harmonic output is greater than −45 dB from carrier. The push-to-talk ceramic microphone supplied has an audio response tailored to the HW-202.

Excellent reception — 0.5 uV or less produces 12 dB Sinad, or 15 dB quieting. Output at the built-in speaker is typically 2 watts at less than 3% total harmonic distortion. The receiver circuitry utilizes diode-protected dual-gate MOSFETS in the front end; an IC IF that completely limits with less than a 10 uV signal; dual conversion, 10.7 MHz and 455 kHz via a 4-pole monolithic 10.7 MHz crystal filter. Image response is −55 dB or better. Spurious response is −75 dB or better.

The Heathkit HW-202 comes with two crystals used in initial set-up and alignment, give you simplex operation on 146.94. Kit includes microphone, quick-connecting cable for 12-volt hook-up, heavy duty alligator clips for use with a temporary battery, antenna coax jack, gimbal bracket, and mobile mount that lets you remove the radio from the car by unscrewing two thumbscrews. The HWA-202-2 Tone Burst Encoder provides four presettable pushbuttons for instant repeater access. Fixed station operation is as easy as adding the HWA-202-1 AC Power Supply. The HA-202 2-Meter Amplifier puts out 40 watts for 10 watts in, and externally it's a perfect mate for your HW-202.

Kit HW-202, 11 lbs., mailable **179.95***

Kit HWA-202-2, Tone Burst Encoder, 1 lb. . . **24.95***

Kit HWA-202-1, AC Power Supply, 7 lbs. . . **29.95***

Kit HWA-202-3, Mobile 2-Meter Antenna, 2 lbs. **17.95***

Kit HWA-202-4, Fixed Station 2-Meter Antenna, 4 lbs. **15.95***

HW-202 SPECIFICATIONS — RECEIVER — Sensitivity: 12 dB SINAD* (or 15 dB of quieting) at .5μv or less. **Squelch threshold:** 3 μv or less. **Audio output:** 2 W at less than 10% total harmonic distortion (THD). **Operating frequency stability:** Better than ±.0015%. **Image rejection:** Greater than 55 dB. **Spurious rejection:** Greater than 60 dB. **IF rejection:** Greater than 75 dB. **First IF frequency:** 10.7 MHz ±2 kHz. **Second IF frequency:** 455 kHz (adjustable). **Receiver bandwidth:** 22 kHz nominal. **De-emphasis:** −6 dB per octave from 300 to 3000 Hz nominal. **Modulation acceptance:** 7.5 kHz minimum. **TRANSMITTER — Power output:** 10 watts minimum. **Spurious output:** Below −45 dB from carrier. **Stability:** Better than ±.0015%. **Oscillator frequency:** 6 MHz, approximately. **Multiplier factor:** X 24. **Modulation:** Phase, adjustable 0-7.5 kHz, with instantaneous limiting. **Duty cycle:** 100% with ∞ VSWR. **High VSWR shutdown:** None. **GENERAL — Speaker impedance:** 4 ohms. **Operating frequency range:** 143.9 to 148.3 MHz. **Current consumption: Receiver** (squelched): Less than 200 mA. Transmitter: Less than 2.2 amperes. **Operating temperature range:** −10° to 122° F (−30° to + 50° C). **Operating voltage range:** 12.6 to 16.0 VDC (13.8 VDC nominal). **Dimensions:** 2¾" H x 8¼" W x 9⅞" D.

*SINAD=$\frac{\text{Signal + noise + distortion}}{\text{Noise + distortion}}$

...and here!

NEW Heathkit
2-Meter Amplifier for cleaner
FM copy on the fringe... 69.95*

40 watts nominal out for 10 watts in — *requires only 12 VDC supply.*

Fully automatic operation — *with any 2-meter exciter delivering 5-15 watts drive.*

Solid-state design — *all components mount on single board for fast, easy assembly.*

If you're regularly working from a fringe area, the new Heathkit HA-202 can boost your mobile output to 40 watts (nominal), while pulling a meager 7 amps from your car's 12-volt battery.

Install it anywhere...in the trunk, under the hood or dashboard. Use it with any 2-meter exciter delivering 5-15 watts drive. Features fully automatic operation. An internal relay automatically switches the antenna from transmit to receiver mode when you release the mike button.

All solid-state design features rugged, emitter-ballasted transistors, combined with a highly efficient heat sink, permitting high VSWR loads. Tuned input-output circuits offer low spurious output to cover the 1.5 MHz segment of the 2-meter band without periodic readjustment. All components mount on a single printed circuit board for easy, 4-hour assembly. Manual shows exact alignment procedures using either a VOM or VTVM. And installation is just as simple.

Kit includes transceiver connecting cable, antenna connector. Operates from any 12 VDC system — additional power supplies are not required. Add HA-202 power to your mobile 2-meter rig, and boom out of the fringe. **Kit HA-202,** 4 lbs.

HA-202 SPECIFICATIONS — Frequency range: 143-149 MHz. **Power output:** 20W @ 5 W in, 30W @ 7.5W in, 40W @ 10 W in, 50W @ 15 W in. **Power input (rf drive):** 5 to 15W. **Input/output impedance:** 50 ohms, nominal. **Input VSWR:** 1.5:1 max. **Load VSWR:** 3:1 max. **Power supply requirements:** 12 to 16 VDC, 7 amps max. **Operating temperature range:** −30° F. to +140° F. **Dimensions:** 3″ H x 4¼″ W x 5½″ D.

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HM-2102 SPECIFICATIONS — Frequency range: 50 MHz to 160 MHz. **Wattmeter accuracy:** ±10% of full-scale reading.* **Power capability:** To 250 W. **SWR sensitivity:** less than 10 W. **Impedance:** 50 ohms nominal. **SWR bridge:** Continuous to 250 W. **Connectors:** UHF type SO-239. **Dimensions:** 5¼″ W, 5⅛″ H and 6½″ D, assembled as one unit.
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REPEATER LICENSE APPLICATION INFO

FCC O.K.'ED!

As a guide to any amateur about to license a repeater, here is the latest poop from the FCC, with sample diagrams, etc. Appended is a section on antennas for repeaters, with a current list of commercially available FCC-approved antennas.

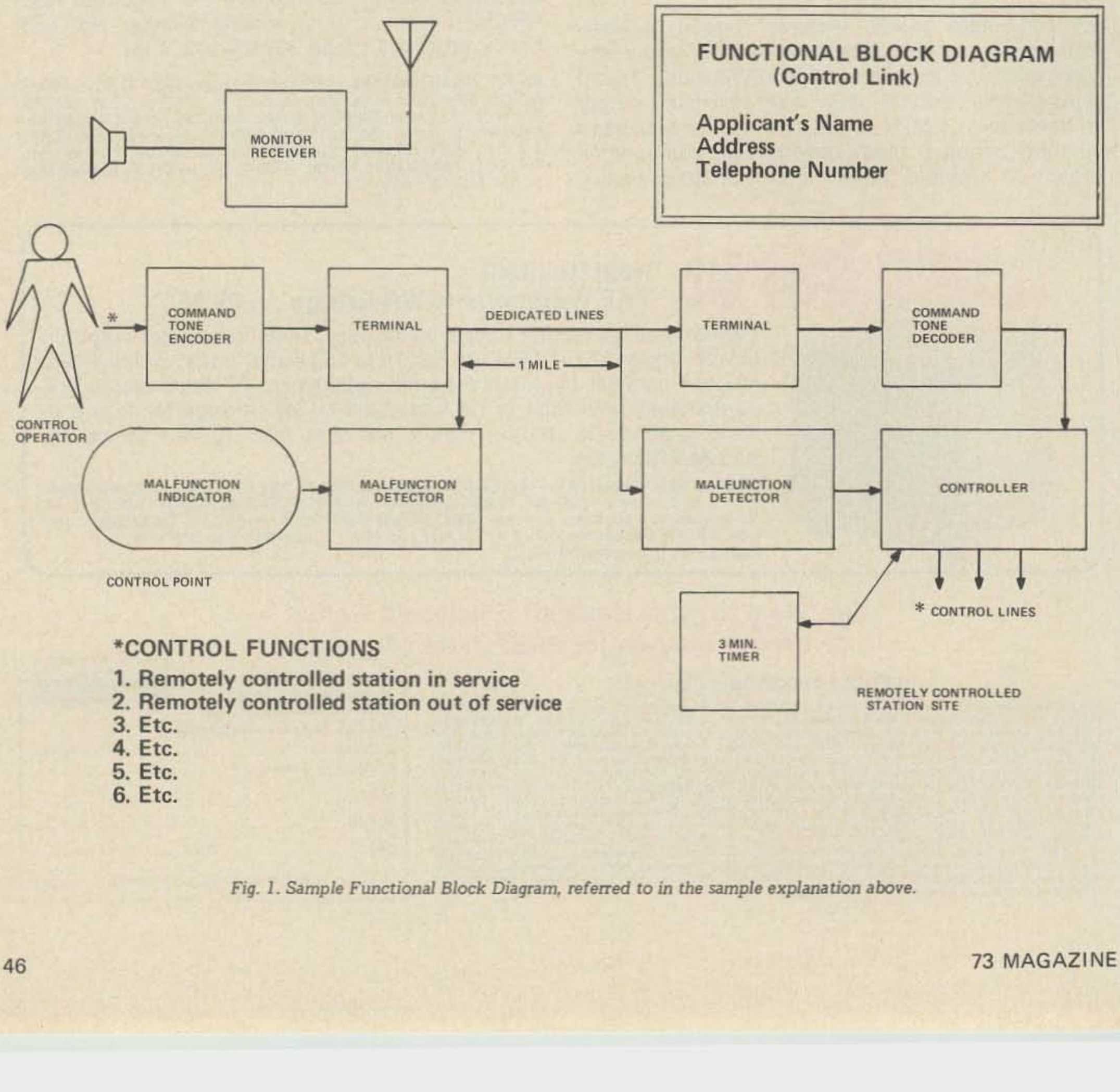
The opening section is a sample "Technical Explanation of the Operation of The Control Link." Be sure your name, address and phone number are on each statement or diagram you submit.

TECHNICAL EXPLANATION OF THE OPERATION OF THE CONTROL LINK

(refer to the functional block diagram)

1. Description – A wire control link is used between the control point and the remotely controlled station. It is used for control and communication purposes. The wire line consists of a dedicated twisted pair, 1 mile long, strung on poles. Command tone signals are transmitted over the wire line from the control point by the control operator to the remotely controlled station where they activate the desired control function.

2. Protection against unauthorized operation through physical access to the remotely controlled station – The remotely controlled station transmitter and control equipment will be housed in a locked building. Only other licensed amateur radio operators authorized by the station licensee will have keys to the building. Based upon



*CONTROL FUNCTIONS

1. Remotely controlled station in service
2. Remotely controlled station out of service
3. Etc.
4. Etc.
5. Etc.
6. Etc.

Fig. 1. Sample Functional Block Diagram, referred to in the sample explanation above.

my experience and knowledge of local conditions, I believe these precautions are adequate to prevent operation of the remotely controlled station by unauthorized persons through physical access to the equipment. In the event unauthorized emissions do occur, station operation will be suspended until such time as adequate protection is incorporated.

3. Protection against unauthorized operation through activation of the remotely controlled station through the control link – The command tone encoder and command tone decoder use a system of five sequential audio tones for each command. The tone frequencies and sequences are treated as privileged information and are not divulged to other than control operators authorized by the station licensee. The tones and sequence codes are changed periodically. Based upon my experience and knowledge of local conditions, I believe these precautions are adequate to prevent operation of the remotely controlled station by unauthorized persons through the control link. In the event unauthorized emissions do occur, station operation will be suspended until such time as adequate protection is incorporated.

4. Malfunction shut down – A malfunction detector monitors for the presence of a continuity current on the wire line at the control point and at the remotely controlled station. When an abnormal continuity current is detected, the malfunction indicator warns the control operator. If the abnormal continuity current persists for a minimum of 3 minutes, the remotely controlled station is automatically taken from service by the controller. The remotely controlled station can only be returned to service by the control operator through the control link.

5. Monitoring provisions – A monitor receiver tuned to the transmitting frequency of the remotely controlled station is located at the control point. Due to the proximity of the control point to the remotely controlled station, the control operator can monitor the transmitted signal of the remotely controlled station for proper operation, and can monitor for the presence of other signals the transmitted signal could interfere with.

MONITORING OF A REPEATER STATION

Section 97.111(b) requires that the transmitting and receiving frequencies utilized by a repeater station be continuously monitored by a control operator (c/o) immediately prior to, and during, periods of operation. For a station having the control point located at the station, the c/o can monitor the repeater input receiver prior to activating the repeater transmitter in order to check for the presence of signals not intended for retransmission. He could, either concurrently or sequentially, also monitor the transmitting frequency for the presence of other signals from stations the repeater station could cause interference to.

In the case of remotely controlled repeater stations, additional provisions will have to be incorporated when the control point is sufficiently far removed from the repeater station site, in order to facilitate proper monitoring. Either a wireline or a point-to-point radio link using an auxiliary link station at the repeater site to the control point may be required. Another method uses a receiver at the repeater station, tuned to the transmitting frequency for activating a lock-out circuit in the presence of another signal on the same frequency. In areas where there is normally no other signal on the repeater input frequency, the control operator can momentarily activate the repeater station and monitor the output for the presence, or absence, of signals not intended for retransmission by that repeater station. In areas where the presence of such signals is a common occurrence, such as where there is more than one repeater station using the same input frequency, it is necessary to employ a system of access signals to insure that such signals are not retransmitted.

SYSTEM NETWORK DIAGRAM

Definition – A System Network Diagram shows each station and its relationship to other stations in a network of stations, and to their control point(s).

Requirements – When application is made for a station having one or more associated stations, i.e. control station and/or auxiliary link station, a System Network Diagram must also be submitted. Control stations and auxiliary link stations may not be used to communicate with any other station than those shown on the System Network Diagram. A copy of the System Network Diagram on file with the Federal Communications Commission, Washington, DC, must be retained at each control point for a remotely controlled station.

The diagram must be in the form of an outline map, and does not have to be drawn to scale (see typical example). The relative location of every station and control point in the system network must be indicated by showing the approximate distance between stations.

Stations – Every station in the system network must be shown by a separate block, even if there is more than one station at a single location. Label each station as appropriate, i.e. repeater station, control station, etc. Also, there must be an indication for each station whether directly controlled, wire remotely controlled, or radio remotely controlled. Every control point for each station must be indicated.

Antennas – The frequency band, effective radiated power, and characteristics of the transmitting antenna, i.e. omnidirectional or directional, general orientation if directional, and relative gain over a half-wave dipole must be indicated for each repeater station, control station, and auxiliary link station.

Format – The System Network Diagram should be prepared and submitted on standard 8½ x 11 inch size

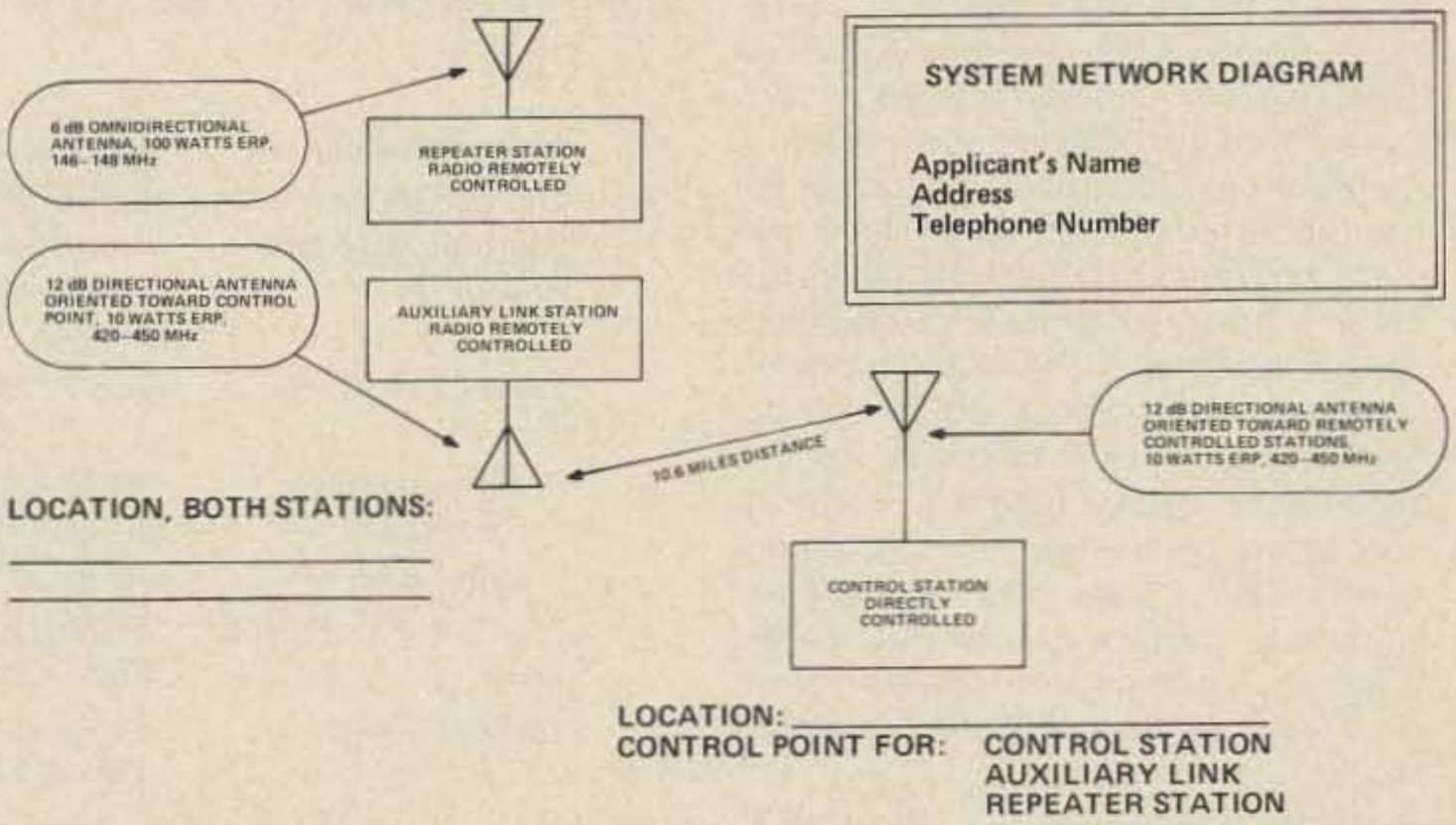


Fig. 2. Sample System Network Diagram (see text above).

paper. It should bear a heading identifying it as the System Network Diagram, and contain the applicant's name, address, and telephone number where the applicant can be reached in case clarification is required.

ANTENNAS USED BY REPEATER STATIONS

1. **Rule reference** – Section 97.41(f)(6) states that the application shall include

"The horizontal and vertical radiation patterns of the transmitting antenna as installed, with reference to True North (for horizontal pattern only), expressed as relative field strength (voltage) or in decibels, drawn upon polar coordinate graph paper, and method of determination of the patterns."

2. The term "as installed" in (1) above does *not* mean that measurements (if required – see below) must be made on the antenna in its normal operating position. It means that the measurements should be made with the antenna mounted in approximately the same position with reference to *a supporting structure* reasonably similar to that used in the intended location. If that is impossible (such as when an antenna would be mounted on a broadcast tower with a 12 foot cross section) a statement should be made to explain why it could not be done. The intent is to obtain pattern results which are *reasonably approximate* to those that *will obtain* when the antenna is mounted in its final position.

3. *When proposing use of a half-wave dipole,* it will be satisfactory to indicate that the gain is zero dBd (dB with reference to a dipole), and the horizontal and vertical patterns to be supplied, commonly contained in recognized amateur handbooks, will be accepted without computations or measurements.

4. When proposing *other than a half-wave dipole,* and the *antenna is not commercially manufactured, horizontal* and *vertical* pattern measurements should be made. In determining the patterns a total of *24 measurement points per pattern,* (6 per quadrant) will be satisfactory to determine the pattern shape. The test description should include a block diagram of the test set-up, brief explanation of the techniques used, together with information concerning the test equipment. Gain in the main lobe of the horizontal pattern may be determined either by computation, measurement, or a combination of both, expressed in dBd.

5. *When proposing use of a commercially manufactured antenna;*

(a) **If the antenna manufacturer has submitted the antenna data to the Amateur and Citizens Division, FCC, and it has been approved,** all the applicant needs to do is *specify the manufacturer, type or model number* of the antenna and the *manufacturer's specified gain figure(s)* in dBd. If you do not know whether the antenna has been approved, consult your manufacturer. *Do not submit patterns from the manufacturer's catalog for approval.*

(b) **If a commercially manufactured antenna has not been submitted or approved by the Amateur and Citizens Division, FCC,** and you wish to use it, proceed as in item 4, or refer it to the manufacturer for resolution of the data.

6. *Antenna showing for use in control and auxiliary circuits:*

Reference is made to the memorandum associated with the Report and Order, Docket 18803, numbered paragraph 15, last sentence which reads:

"... The operation of a control station or an auxiliary link station which does not use directional antennas in conjunction with low transmitter power to minimize the possibility of harmful interference is not considered good amateur practice, and will be carefully evaluated by the Commission if proposed."

It is *not sufficient to merely state* the applicant will conform to Section 97.67(b) regarding use of minimum power to accomplish the purpose of the control of auxiliary link. The showing should indicate the link or control transmitter input power, line loss in dB, type of directional antenna to be used (dish, yagi, etc.), the approximate gain in dBd in the main lobe of the antenna, and a brief statement explaining the reasoning behind the power value proposed to comply with Section 97.67(b).

7. *General information of interest concerning antennas:*

(a) All references to antenna gain should be referred to a half-wave dipole and expressed in "dBd." Some manufacturers advertise antenna gain referred to an isotropic antenna "dBi" which is roughly 2.2 dB greater than when referred to a half-wave dipole. Sometimes this is not made clear.

(b) In rough, mountainous terrain where reflections and shielding may be a problem, it may be advantageous to utilize low antenna gain and higher transmitter power. Another technique which may be used to improve "fill-in" is circular polarization, where the radiated field may be considered composed of both horizontal and vertical components, produced by particular antenna configurations.

(c) For vertically polarized omnidirectional operation, typical antennas with substantial power gains may consist of phased elements (usually dipoles of some kind), spaced one wavelength apart in the vertical plane. Typical power gains in dBd of such arrays using vertical polarization, are as follows:

Number of stacked Elements	Power Gain dBd
2	2.9
3	4.9
4	6.2
5	7.3
6	8.0
7	8.8
8	9.3
10	10.4
12	11.2

(d) For the information of amateurs who wish to become informed about the techniques of antenna measurement in the commercial field, reference is made to a publication of the Electronic Industries Association, 2001 I (Eye) Street, NW, Washington, D.C20006, telephone: 202/659-2200, entitled, "EIA Standard RS-329, Part I, Base or Fixed Station Antennas." This publication may be ordered from the EIA at $2.00 per copy.

(e) The following antennas have been approved for use by amateur repeaters as of 13 April 1973.

Manufacturer	Type or Model	Gain
Phelps Dodge/ Communications Products	220-509 with various mounting configurations 144 MHz "Super Station Master"	5.25 dBd
Cush-Craft Corp.	AR-2 "Ringo"	2.0 dBd in horizontal plane
All with same patterns & gains. See [1,2,3]	AFM-4D	6.0 dBd[1]
	AFM-44D	9.0 dBd[2]
	AFM-24D	3.9 dBd[3]
Hy-Gain Electronics Corp.	362/SJ2S4	5.9 dBd
	268/725	5.9 dBd
Andrew Corp.	161-3	2.8 dBd
	150 B-11	5.25 dBd

1. Elements spaced around mast.
2. Forward gain, elements mounted all on one side of tubular mast.
3. Back side gain with elements mounted as in 2.

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

A SYSTEM FOR DIRECT VIEW COLOR SSTV

During the past year, I have been working on a method of viewing Color SSTV pictures directly from a monitor (no photography necessary). Although I am still developing this system, I feel the information I've obtained thus far should be shared with others throughout the world. Specific circuit details have been omitted since they would be similar to existing circuits (dc amplifiers, voltage controlled audio oscillators, bandpass filters, etc.). Only the actual "food for thought" is presented.

Our present Color Slow Scan system consists of converting a color picture into red, green and blue analyzed frames and transmitting each sequentially. At the receiving end, a multi-exposure photograph is taken of the monitor screen (as each color analyzed frame is presented) through the appropriate filters, thus reconstructing an equivalent color picture.

For direct view Color Slow Scan, the three color separation pictures, one red, one blue and one green picture (previously obtained from the color picture to be transmitted) are placed side by side in front of the camera, so all three pictures are scanned during each frame. This is transmitted, and Fig. 1 shows how they would be displayed on your monitor. Next, red, blue and green filters are placed over the appropriate pictures to reproduce the three basic color images. All we need to do now is to converge the three images onto a common viewing point. This may be accomplished by several

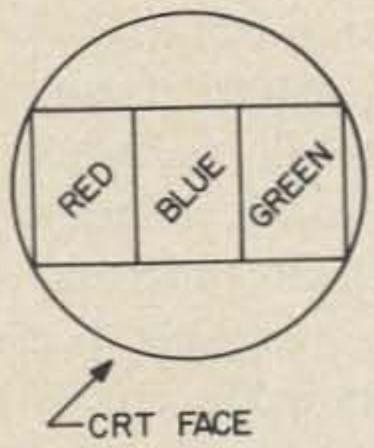


Fig. 1. The three "side by side" pictures as they are displayed on the screen of a monitor.

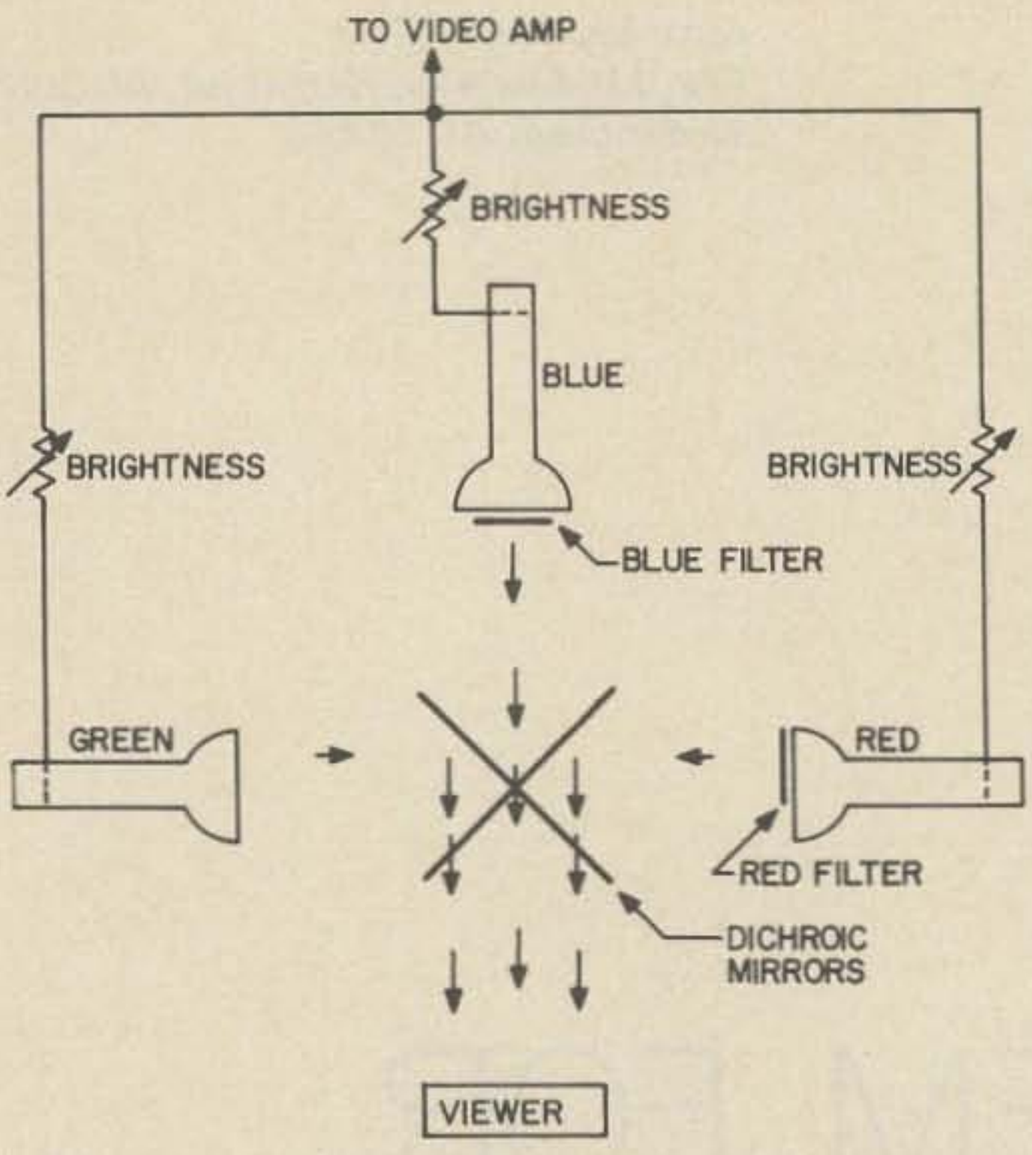


Fig. 2. Color SSTV photos may be viewed directly by using a crt for each color and joining the three images on a viewing screen via dichroic mirrors.

methods varying from a simple lens/mirror arrangement where you "stack" the two outer pictures onto the center picture, to the arrangement shown in Fig. 2. In Fig. 2, three electrostatically deflected tubes are slaved to one monitor. (Taggart, WB8DQT, described this procedure in the July, 1972 *73 Magazine*, page 93.) Electromagnetically deflected tubes could also be used; however, three yokes (with either heavy duty or separate sweep circuits for each yoke) would be required.

Looking at Fig. 2, a red filter is placed over the equivalent pictures on the right hand tube, while cardboard covers the other two pictures on the screen. A weak blue filter is placed over the center image on the center cathode ray tube, while cardboard covers the two outer pictures. No filter is used on the "green" tube, just cover the "red" and "blue" pictures. The red and green pictures now reflect off their associated color dichroic mirrors, while the blue picture passes through both mirrors and blends with the other colors to produce (or in this case, reproduce) a full color image at the viewer.

Color dichroic mirrors are unique in the fact they reflect only one color (like a red frame) while acting like a plain clear glass and passing the other colors (like a blue frame). Incidentally, I understand Dr. Edwin Land's new Polaroid camera uses dichroic mirrors in an arrangement somewhat similar to the previous description; however, I have not personally examined one.

Naturally, proper positioning of all three tubes (plus the viewer) with respect to the dichroic mirrors is necessary. The brightness control on each crt is for balancing the individual colors. This briefly describes the basic "system."

One drawback of this system is the low brightness of the blue picture after placing a blue filter in front of the P7s (primarily) green persistence. This can be corrected somewhat by "dimming" the red and green crt brightness pots. Four second frames also help overcome the dim blue picture by sweeping twice as often, thus giving a brighter picture to drive through the blue filter. The other drawback is small picture size; however this can be overcome by either a magnifier lens, larger screen crt (12DP7s are becoming popular on the surplus market and are a direct substitute for a 5FP7) or high gain separate sweep circuits for each crt. With a separate sweep circuit you could enlarge all three pictures, then re-center just one of the desired pictures to fill each crt screen.

Some time back, Jim Wilson W4RKS and I rigged a P31 phosphor crt to a Slow Scan monitor. Although the pictures were held on the persistence for only half a frame, the blue content was high. This phosphor, plus 4 second frames, would be ideal for the blue picture. I am still awaiting a P26 phosphor crt, so I can't definitely say what effect a blue filter would have on its persistence.

There are other possibilities, including "breaking down" our grey scale frequency range into three color ranges (plus guard bands). However that's a long discussion I will cover in the future.

I would be quite interested in hearing from others on either this or any related Slow Scan experimentation and/or development. You may write me direct, or via *73 Magazine*. Any significant accomplishments can be described in my SSTV Scene column.

. . .K4TWJ

Joseph M. Hood K2YAH
67 Mountain Ash Drive
Rochester NY 14615

RTTY AUTOSWITCH

Reception of a 2125 Hz tone through the local FM repeater will automatically put your receiver on a specified RTTY channel.

The advent of two meter FM has seen the opening of new areas of endeavor for the amateur. Repeaters, autopatch, and many other innovations are made possible by the channelized FM system. This channelized system offers some advantages in local and regional radio Teletype communications. What could be better than a 2 meter FM channel for autostart work, local nets, traffic, or just plain amateur communications? The problem with this is that it requires constant monitoring of the Teletype channel at the expense of monitoring the local repeater or the construction or purchase of an additional receiver to allow simultaneous monitoring of both channels – or does it? In pondering this question, I wondered if there were some way to have my cake and eat it, too. That is to say, to be able to monitor the local repeater but with the capability to switch automatically to the local RTTY channel, should a station wish to send me a printed message. (Teletype is not permitted on the Rochester Repeater, WA2UWQ, for obvious reasons of courtesy to those stations monitoring or wishing to use the repeater.)

The result of this pondering is the autoswitch system. It meets the requirement for minimum annoyance to stations using the

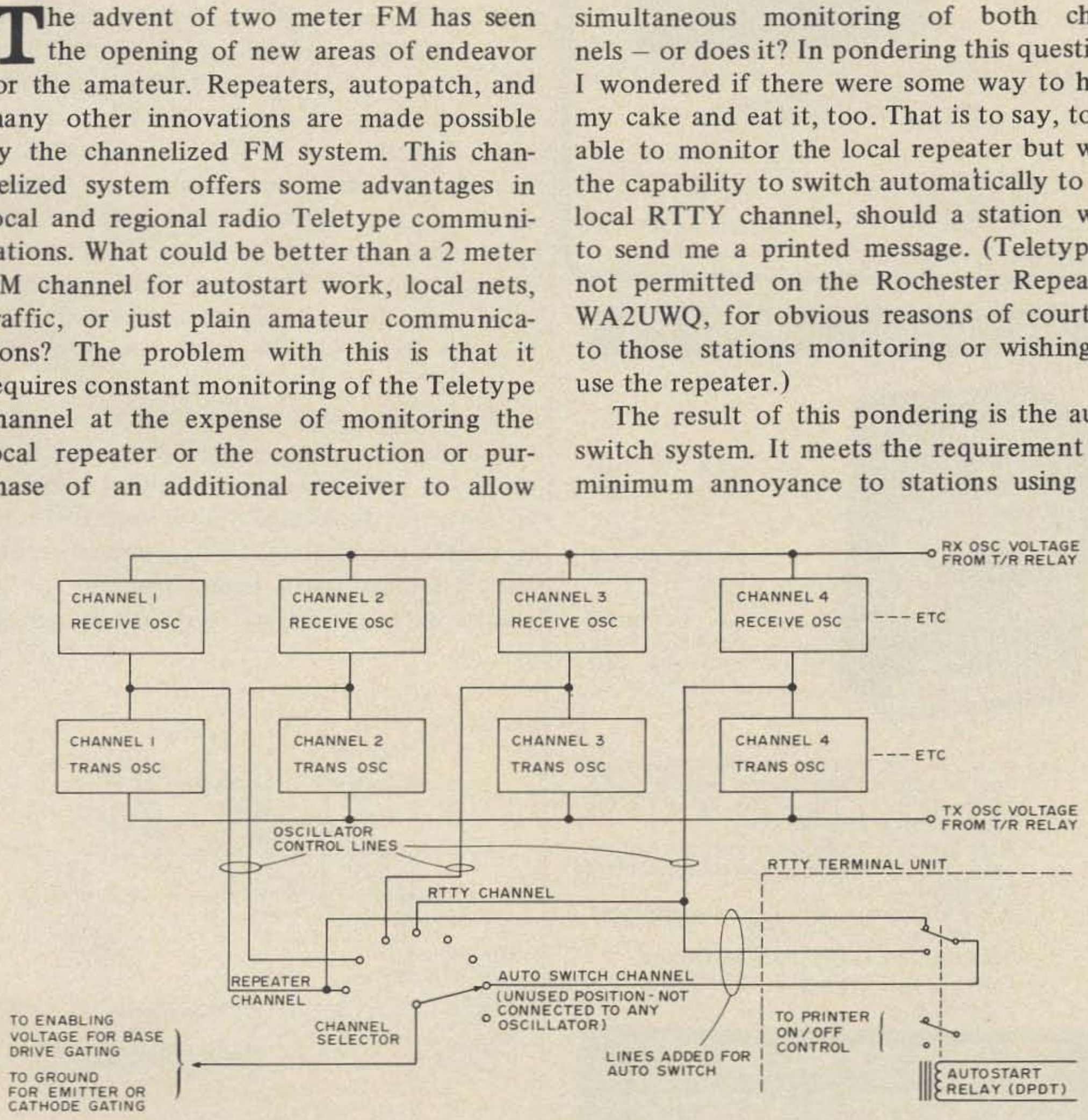


Fig. 1. Connections for autoswitch.

repeater, is extremely simple, costs next to nothing if your TU has autostart, and it works.

The technicality of autoswitch will not amaze you and it won't take a BSEE degree to understand the circuitry. Autoswitch makes use of the autostart feature in the terminal unit to automatically switch the 2 meter FM receiver to the local repeater output (in this case 146.88 MHz) when the printer is off or switch the receiver to the local RTTY channel (in this case 146.70 MHz) when the printer is on.

A station with a Teletype message for a station equipped with autoswitch merely checks in and out of the repeater, calls the station and follows his call with a three or four second mark (2125 Hz) tone burst. The tone burst causes all autoswitch equipped stations to turn on their printers, switch to 146.70 and wait for 20 to 30 seconds for the Teletype signal to appear on 146.70. If the signal appears on 146.70 before the 20–30 second delay time has elapsed the system will print the message received. If no Teletype signal appears after 20 to 30 seconds of listening on 146.70, the system automatically turns the printer off and switches the receiver back to 146.88 to monitor the repeater.

The only other requirement for autoswitch is that your FM receiver uses a dc oscillator gating technique (either a switch to a positive dc voltage or a switch to ground to enable the oscillator. Some receivers, like the Regency HR-2 series, switch the rf excitation to the crystal via a rotary switch.

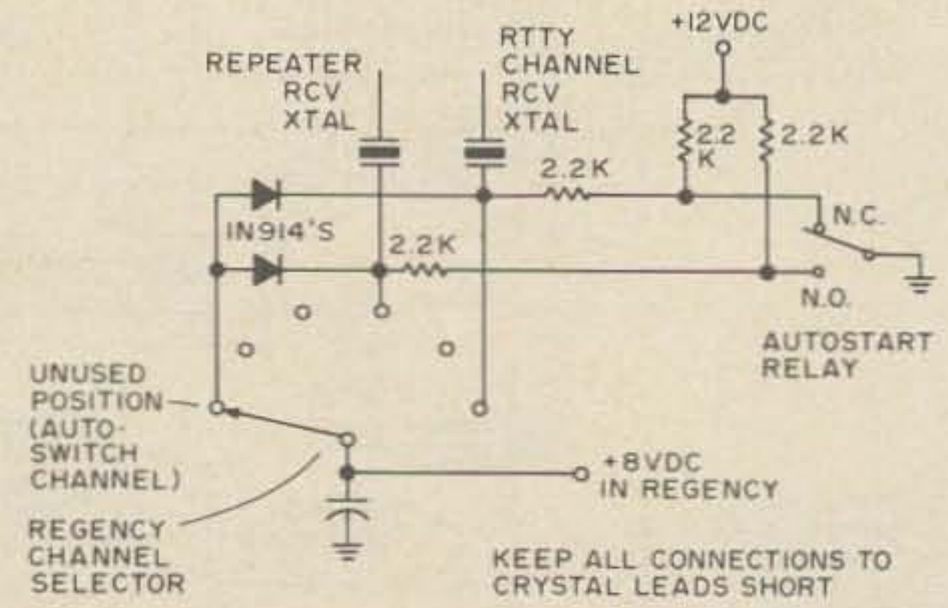


Fig. 2. Autoswitch modification for Regency HR-2.

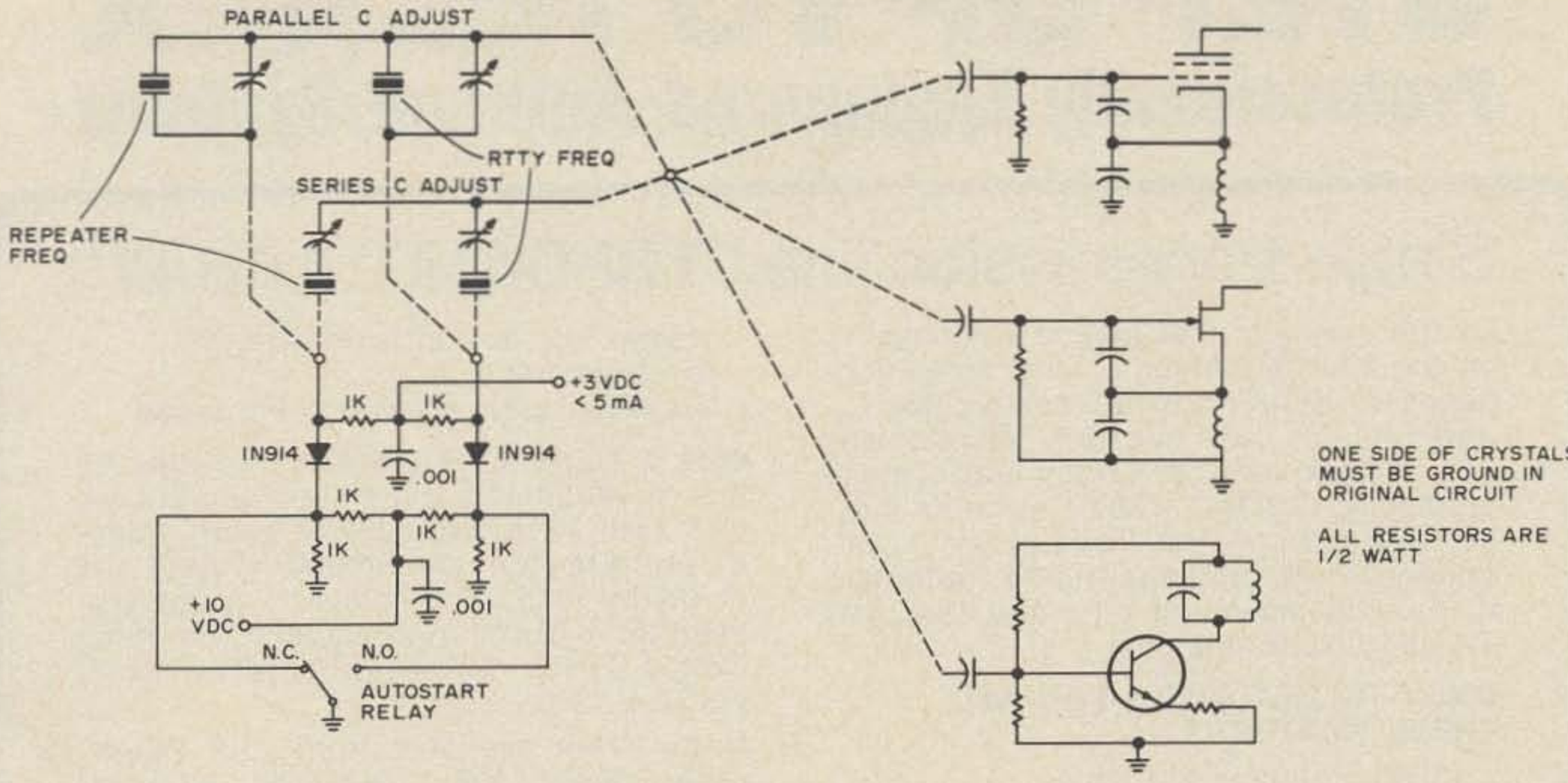


Fig. 3. Diode crystal selection.

This type of switching cannot be used for autoswitch, but the addition of a few diodes and resistors eliminates that problem, as will be discussed later.

I use an RF Communications, Ensign 1, VHF Marine radio which has been converted for use in the 2 meter band. The Ensign has separate transmit and receive oscillators for each channel. The oscillators are gated on by applying a 5V dc signal to the base circuit of the oscillator. Autoswitch merely requires that an unused position on the channel selector switch be brought out along with connections to the repeater channel and RTTY channel positions. The autostart relay in the TU then merely selects the repeater if the printer is off or the RTTY channel if the printer is on. All the delays necessary are already part of the autostart circuitry in the TU. So in this case autoswitch costs three wires! A block diagram/schematic of the lash-up is shown in Fig. 1.

If your rig enables its oscillators by switching an emitter, a source, or a cathode, the connections are equally simple and are essentially the same as in Fig. 1 except that the wiper of the channel switch is connected to ground.

If you own a Regency or some other rig which switches the leads to the crystal directly don't attempt to run the leads out through the autoswitch network and back. You will be adding intolerable lead length to the crystals. Instead, a system for switching the crystals with diode gates must be used. These have been described in other articles describing connection of automatic scanning circuitry to receivers with crystal lead switching.

A method developed by Bob Reifsteck K2LZG for his Regency is shown in Fig. 2. Other methods for other circuits are shown in Fig. 3.

One caution; in any system, always place the channel selector switch in the normal channel (not autoswitch) position when transmitting. If you leave it on autoswitch you're liable to find yourself back on the repeater when you want to be on the RTTY channel if your autoswitch switches off.

Obviously the system is simple. It works extremely well here in Rochester where the number of VHF RTTY stations is reasonable and where the number of messages are low enough to allow all stations to print all traffic. In larger metropolitan areas this simple system might have to be made more sophisticated by using a Touch-tone selective call for the autoswitch to keep the multitudinous printers (which eat gobs of paper) from printing messages not meant for them. When the situation gets that bad here in Rochester we'll go to Touch-Tone autoswitch. Meanwhile, we're happy and everyone is enjoying reading each other's mail.

. . .K2YAH

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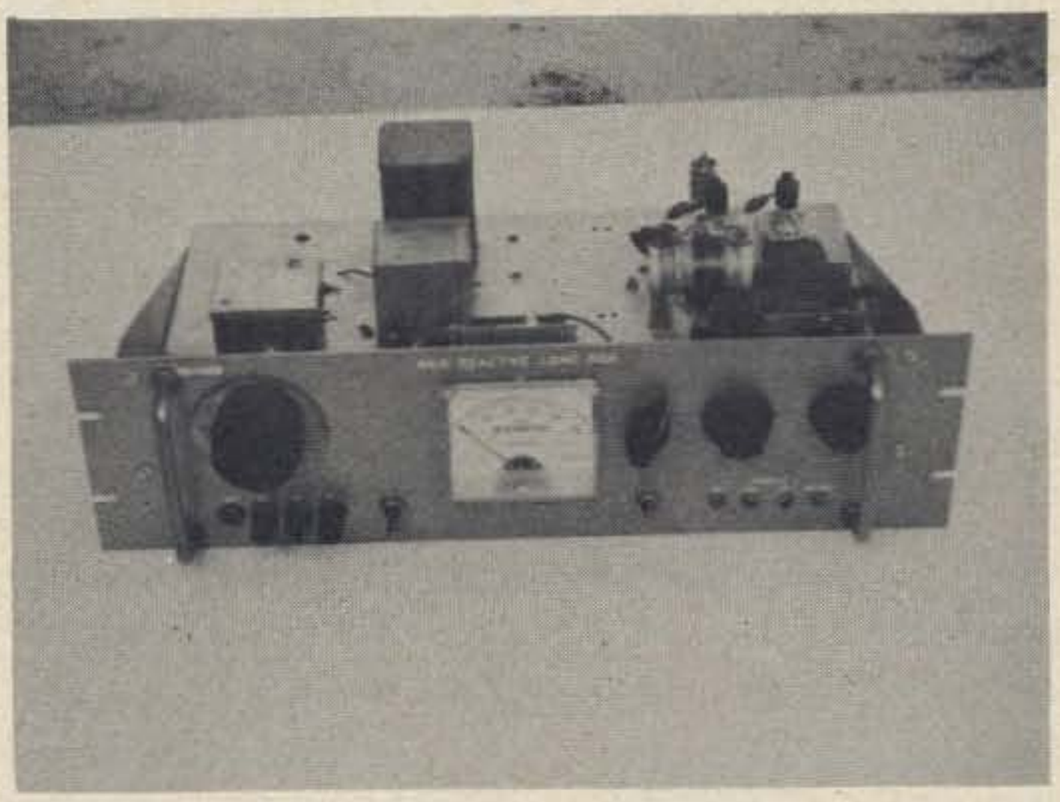
FORTY METER TRANSMITTER

A hybrid design that uses transistors in the low level stages for stability, and easily obtained tubes in the driver and final sections for low cost.

Transistor transmitters are becoming very popular with amateur builders today. The low cost, very high frequency transmitting transistors that are now available make them very popular for portable and mobile rigs. However, the cost and complications of building transmitters of the one hundred watt level with transistors still may be prohibitive for some. Since size, low weight, and low power consumption are not as important in transmitters built for home use, there has been a trend in the past few years to the hybrid concept. In hybrid circuits transistors and tubes are combined to bring out the most desirable characteristics of each.

In this transmitter, transistors are used in the VFO and low level amplifier stages. This makes them ideal for this application because of their low cost (at low power), simplicity (no filaments or screen grids to wire), and low heat dissipation (for stable VFO's). By using tubes in the driver and final amplifier stages, the signal is brought up to the 100W level at junk box cost.

CW was used for simplicity because it is the desired mode at this QTH. AM modula-



Since the transmitter was built from surplus parts, a strange marriage of components results. The old reactive load box chassis makes for a solid and good looking installation, however.

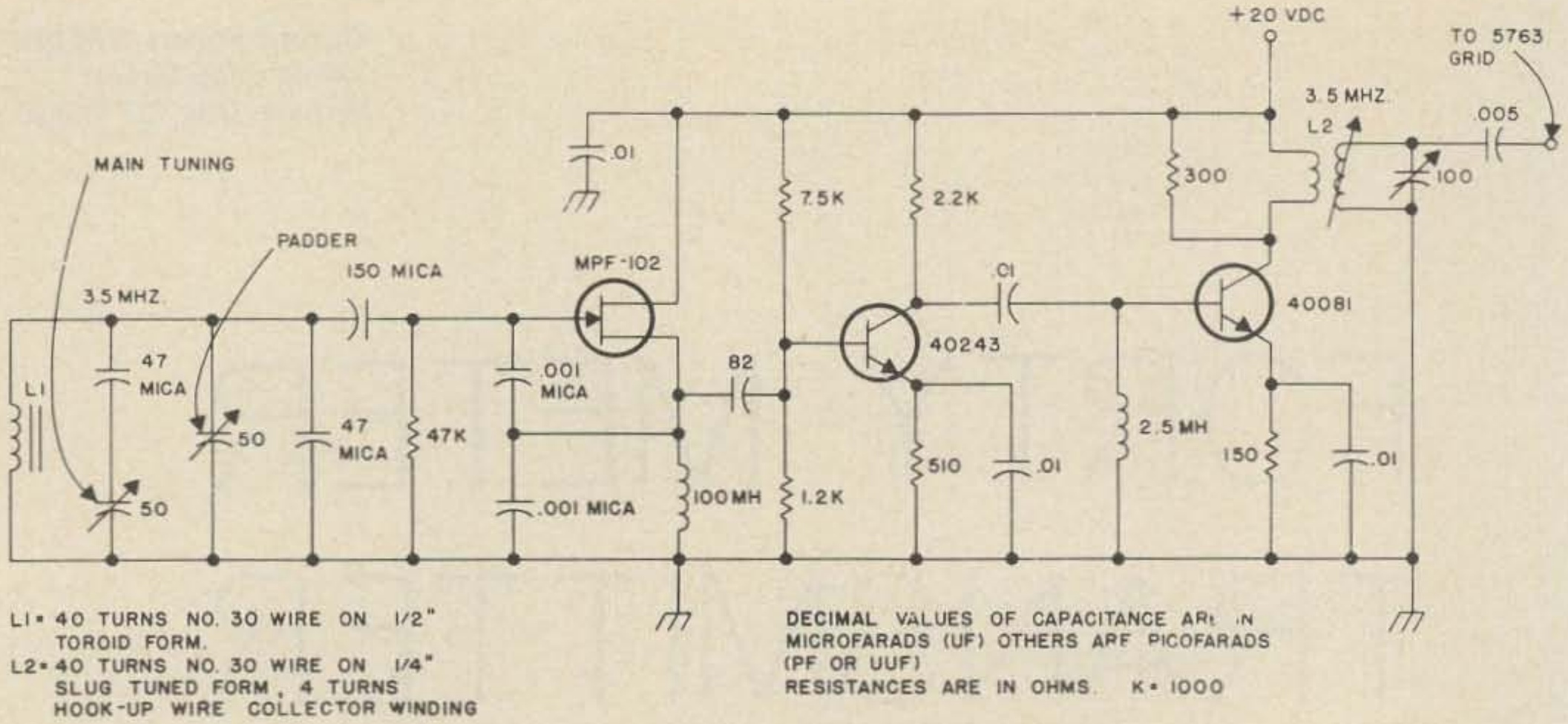


Fig. 1. Schematic of the oscillator and amplifier.

tion was not attempted because of the current unpopularity of this mode on the high frequency bands.

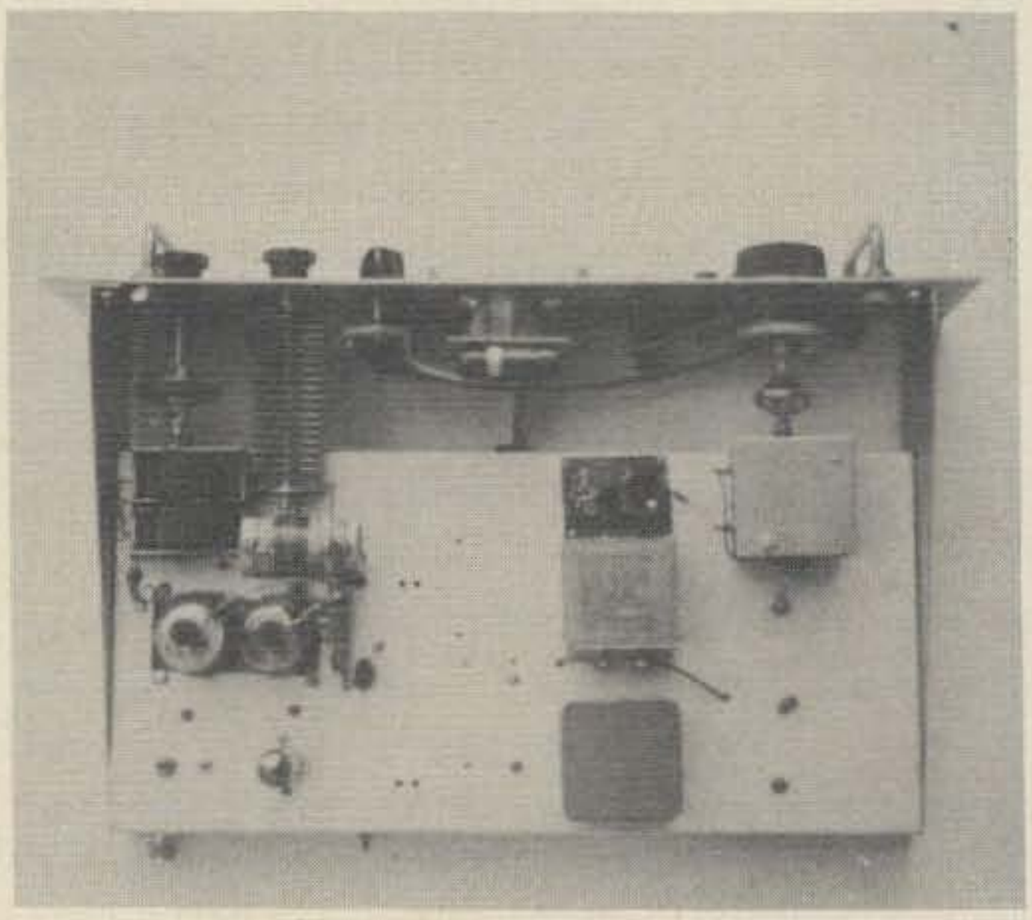
The Oscillator

The Seiler circuit was chosen because of its reliability and excellent stability. The only critical component is the capacitor between the gate of the MPF-102 and the oscillator tank circuit. This capacitor should be just large enough to maintain stable oscillation. The coil used was about forty turns of number 30 wire on an Amidon T-50-2 toroid core. In a different experiment a slug tuned ceramic coil form was used. In this case a gate capacitor on the MPF-102 had to be about 300 pF for stable operation. Either coil resulted in stable operation, but the toroid coil has higher Q, and supposedly better stability. The capacitor values given in the schematic of Fig. 1 give a range of 3.5 to 3.6 MHz. Since this oscillator is so reliable and simple, it is easy to experiment with coil and capacitor values to give different frequency ranges.

The amplifier uses a class A buffer and a class C output amplifier. Some people like to use FET's for buffers, but this was found to be unnecessary. The simple amplifier shown in Fig. 1 was found to be entirely adequate. Almost any high frequency NPN silicon transistor could be used in the amplifier, but the output transistor must be capable of handling a half watt of power or more. A resistor is used across the collector coil of the output transistor to prevent parasitic oscillation and other types of instability. By itself, the VFO would make a fine QRP rig for portable use.

Driver and Final Amplifier

The output stages of the transmitter use conventional tube circuitry, and very little explanation is necessary. The 6146's should be neutralized because they will go into oscillation if drive is reduced. However, there is usually more drive available than is



Top view of the transmitter. The final amplifier with its associated circuitry is to the left and the VFO is at the right. Note the small amount of space taken by the VFO board. With care, the transmitter could be built in a much smaller package.

necessary and instability is no problem. The 5763 need not be neutralized because it is a doubler from the 3.5 MHz oscillator to the 7.0 MHz final amplifiers. The output 6146 stage is cathode keyed while all the other stages run continuously during transmission. The tube portion is shown in Fig. 2.

Power Supply

The power required is 600V or more at 300 mA, and 20V at about 50 mA. The filaments require six volts. The 20V supply should be well regulated for the VFO. In early bench tests a Hewlett-Packard laboratory type power supply was used for the high voltage. This has almost perfect regulation and there was no chirp in the transmitter. However, when a power supply was built, it had poorer regulation. The high voltage output from the homebrew power supply had a 300V drop from no-load to loaded condition, resulting in a slight chirp. No one has ever noticed it, but it becomes more obvious when listening to harmonics of the transmitter. No attempts were made to clear it up, but some voltage regulator tubes in the screens of the driver and finals should help.

The low voltage power supply was a half wave rectifier using a twelve volt filament transformer with the six volt filament voltage connected to the twelve volt side. This gave about fifty volts on the other side of the transformer. The voltage is further dropped by the rectifier diode and the resistance of the filter choke. A twenty volt ten watt zener diode was connected across the output for regulation.

Other than this, the design and construction of the power supplies will not be discussed. There are dozens of articles in magazines and handbooks that tell how to build adequate power supplies.

Construction

Only a brief discussion of the construction will be given. Most hams who would want to build this circuit, or make use of some part of it, will have had enough experience to select and arrange components. The layout and wiring is really not very critical. The main consideration is following a logical step-by-step pattern where one stage follows another so that the output of one stage is not near the input of a previous stage.

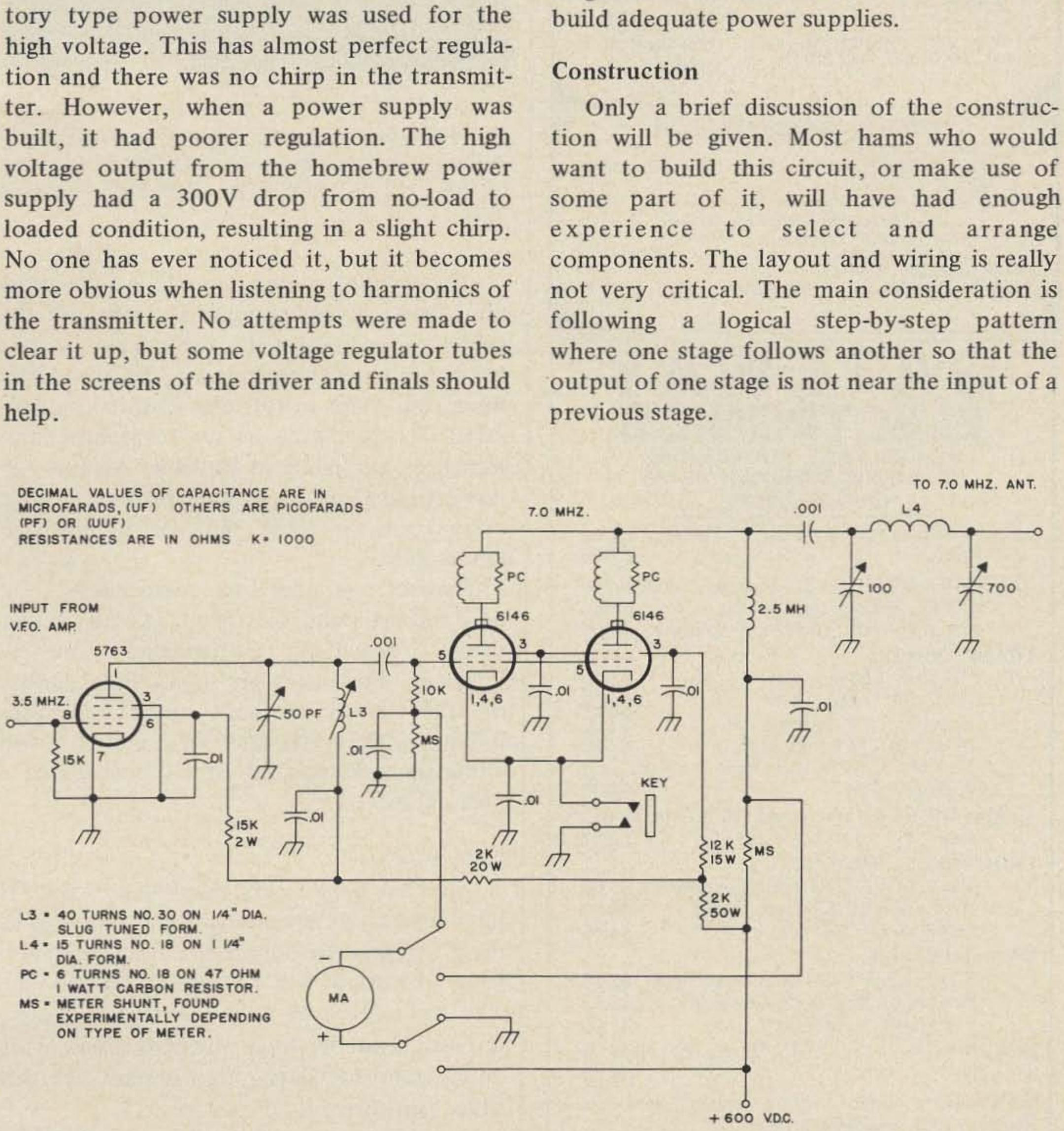


Fig. 2. Driver and final amplifier. This circuit is conventional and is similar to circuits found in many magazines and handbooks.

The 40 meter transmitter mounted in a rack above its power supply. For novice use, just unplug one of the 6146's to reduce the power level below 75 watts.

The oscillator stage is one of the most important. Even though it will not be subject to vibration, it is important to use solid mechanical techniques for the VFO. Since the VFO is not temperature compensated, it should be as far from heat producing components as possible. A small fan was mounted in the cabinet to blow hot air away from the VFO, thus providing excellent stability.

Surplus and junk box components were used entirely, and the layout is really rather sloppy. Excellent performance resulted, however, illustrating the non-critical nature of the circuit. Perhaps some ambitious builder with more time (and money!) will come up with printed circuit boards and a neat cabinet.

Conclusion

This has been a very rewarding project. It illustrates how the transistor and tube can be used together to obtain the best characteristics of both within our present technology. The day of the all tube transmitter is gone forever, and the high power transistors of today tend to "date" even designs like this. Have fun though.

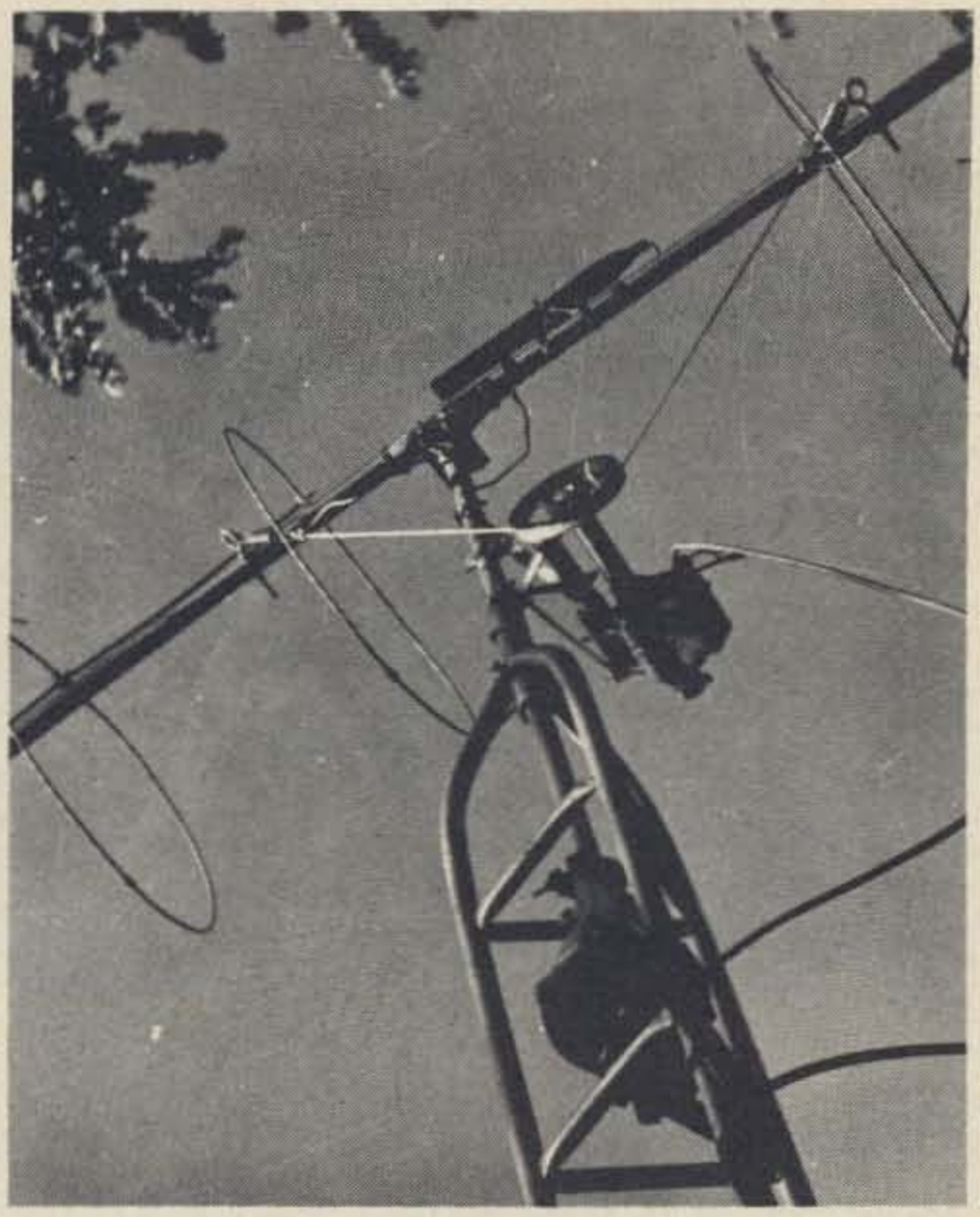
. . .WB6BIH

Ralph W. Campbell W4KAE
316 Mariemont Dr.
Lexington KY 40505

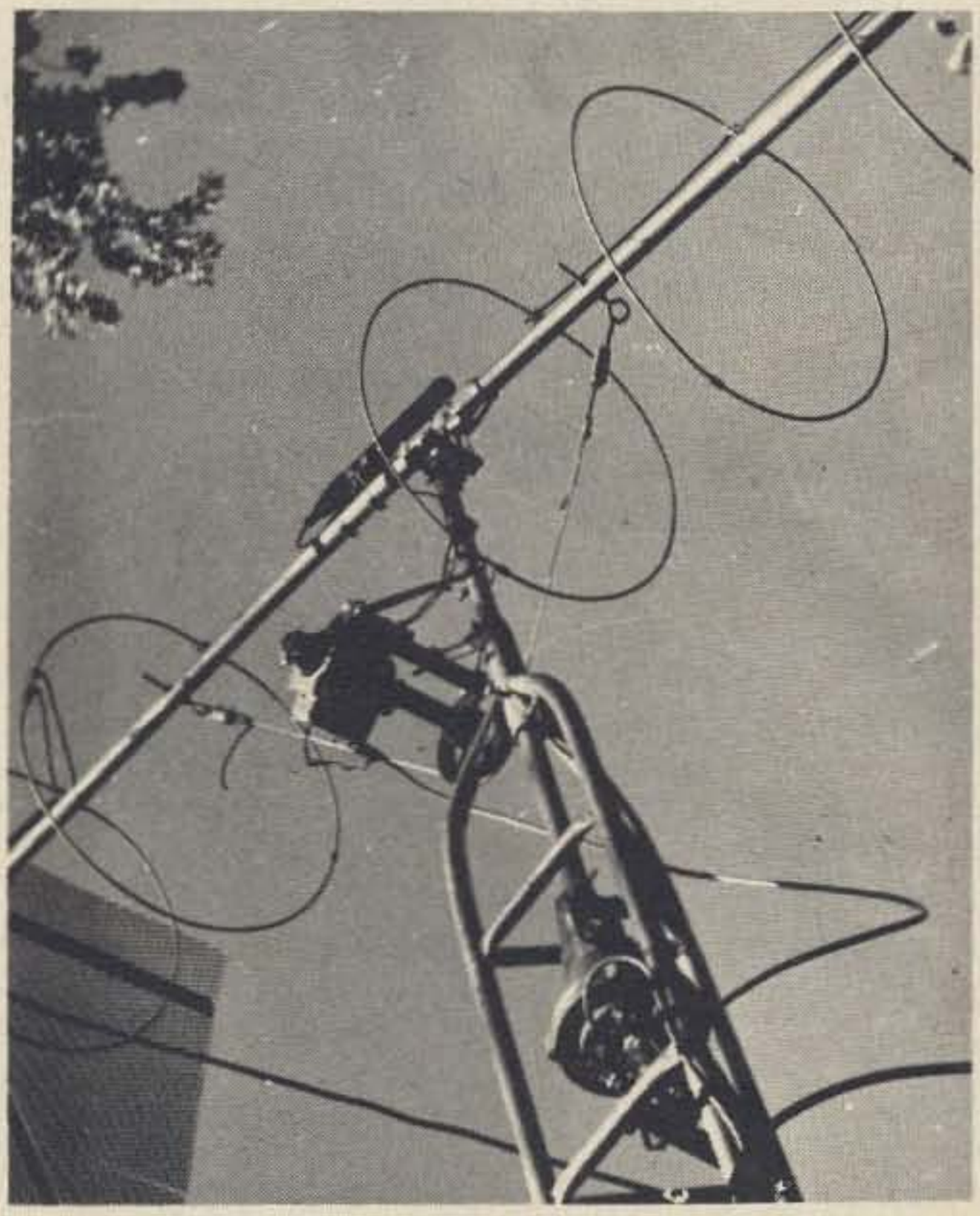
POLAR MOUNT

Attempting moonbounce is a full-time study concerned with azimuth and elevation, moon phases and not-so-amateur communication equipment. Those who succeed are famous, and those who don't make it are ignored. Too many amateurs have been ignored since their attempts were un-proved, or at least un-recorded – but this is wrong, I think, because most of the hardware innovated for this use *is* workable.

I built a moon-tracking antenna about 20 ft in boom length, with questionable success. I heard feeble, chirpy echoes during an aurora. I also had assistance in listening for echoes a few days later when both a good friend and I heard a chirpy twang as we pulsed the moon with irregular dashes. These echoes were not strong enough to be recorded, but there was the characteristic receiving delay of just over 2.5 seconds from the time of key-down; as would be expected! Having un-recorded echoes I felt it would be a good idea to share the experiences I had with inexpensively assembled azimuth and declination rotors and hardware. The antenna is not completely shown on purpose, so that complete details can be reported with recordable echoes at a later date. Many times I've seen articles that supposedly told all, only to be left hanging as to mechanical construction. Here I intend to do a better job.



The most important feature of this view is the pulley wheel. Using an untied system of ropes or cables was not considered because they would have been un-resettable and slip. Two small holes were drilled in the flattened Vee of the pulley for tying. Fastening the pulley to the already shimmed tubing did not hold this wheel without using threaded rod as a set-screw, tightened by a pair of vise-grip pliers, through the hole in the tubing.

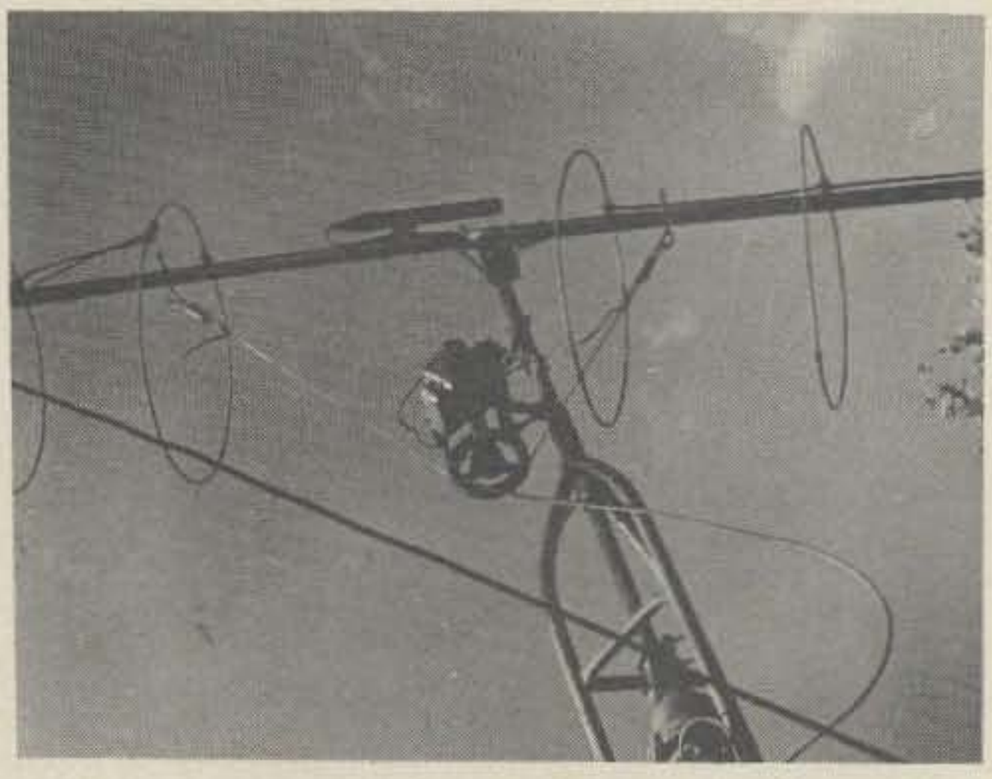


The underside. The most important parts of the mount are: First, front and rear Toro drawbar springs; Second, the Alliance C-225 rotor mount; Third, aluminum strap bracing from the C-225 body-to-mast; Fourth, the WB-3 house bracket fastened to rotating mast (above the nylon bearing); And fifth, the swivel top rotating boom plate, cut from a Dill tilt-over tower footing.

Theory

Not being more than average, mechanically, I cannot always use the most exact terms to describe my efforts; but as an amateur I can point out the approach. Most AZ-EL mounts usually refer to 360° azimuth and 90° elevation rotor systems, using crossed masts and bell-type rotors positioned in some sort of box. This is fine for those who can afford it! However, I used every short cut possible. I rotated the declination rotor on the "azimuth mast" and then I tilted the whole tower on a Pickle base. The Pickle base is a 4 ft section of tower with movable lugs and welded sheet metal, sunk 3½ ft into sandy soil – instead of concrete. One secret which should be passed on is the use of a nylon bearing in the top-section which supports the mast. Without the bearing (see photo) it would be impossible to swing the array in any direction desired because of mechanical drag. An underside view shows two draw-bar springs which take up slack and allow for 180° control-box indication on the declination rotor.

Only 50° of declination rotor control is necessary within the 180° available. That is,



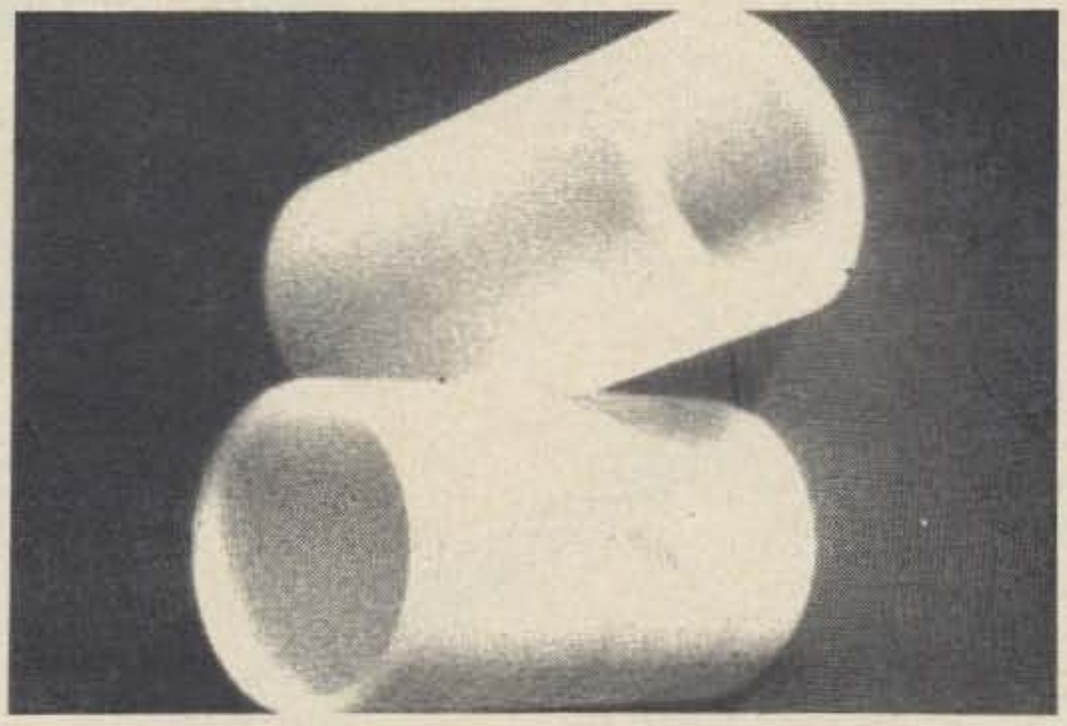
This shows the side view of the mount and the telescope. The telescope is made from a piece of 1½ in. OD aluminum thinwall. It is painted with high-heat flat-back auto paint to minimize internal reflections. A plus 3 diopter closeup lens is used for the optics. This lens is mounted in a series 5 adapter ring, taped to the tubing. An RCA cadmium sulfo-selenide photoconductive cell is mounted inside. We also used a teflon disc inside the tubing, with Loc-Tite epoxy, for cell mounting. Black silicone rubber is used as the encapsulent. The aluminum thinwall is 13 in. long.

This photo shows bracing of the leaning tower. Correct aiming toward the north is most accurately done by incling the structure toward the North Star. In my case, an rdinary pocket compass was adequate since there is only 1° difference between true north and magnetic north. The actual tilt angle is 52° relative to a flat horizon; earlier we said that 90 minus your northern latitude: so, 90 minus 38° is the tilt angle used here.

minimum boom-swing is conveniently limited to plus and minus 25° about a right angle subtended on the tilted mast for an arc across the sky. The rotor indication of 180° is well in excess of this. Moon wobble is caused by the varying orbit of the moon on a day-to-day basis, but the average value of the wobbles is always from east to west across the sky. To follow this arc exactly, it is necessary to incline the tower by 90 minus your north latitude in degrees.

Construction

Most of the mechanical parts secured to the boom are attached with South River WB-3 aluminum house brackets. Hy-Gear screw-straps are used elsewhere (for bracing and for the telescope mount). The swivel-top boom plate was cut from a Dill lift-up roof mount and drilled for 2 WB-3's. The drawbar springs are available as Toro lawnmower parts and should be easily found. They connect the threaded nylon fishline to the boom and declination pulley. Slippage is prevented by connecting the line through the flattened Vee of the pulley; then pulled through 3/16 in. steel washers and knotted.



A close-up view of 2 type 101 nylon bearings. The nylon rod is chosen to have a diameter which will fit (by press-fitting) the inside of the tower mount. Prior to this, the nylon rod stock is chucked in a lathe and a 1¼ in. hole is cut lengthwise. The two sleeve bearings shown here are 3 in. long; however, they're drilled 1½ in. for other tower mast size. After the original 1¼ in. piece was drilled it was hammered into the mount, making a forced-fit.

The AR-22R rotor is located on a pre-drilled mounting tab inside the top section. Top and bottom bells are drilled and have 5/16 in. steel bolts through the mast. Gear slop with this rotor is 6°, which is not exceeded by this method of fastening. The C-225 rotor has only 3½° slop, however; so it was chosen for declination positioning. Bolt threads are treated with Loc-Tite Nut Lock to prevent loosening. The Browning pulley was successfully shimmed using lengthwise cut aluminum thin-wall tubing.

The rotary torsion bar. Although this idea is that of K8ZEU, it works equally well for moon-bounce or regular hamming! This device allows a "give" to rotational torque encountered when starting or stopping a large antenna. The welded plumber's pipe used is internally overlapped to strengthen the mast About 1 in. clearance exists between the overlapped end and the "washer" below.

To those who will try moonbounce, let them experiment with this method and take some of these short-cuts. Maybe this article will help solve some problems! Anyway, E.M.E. will be more in style now with special emphasis placed on communi-cations-through-repeater from the moon.

. . .W4KAE

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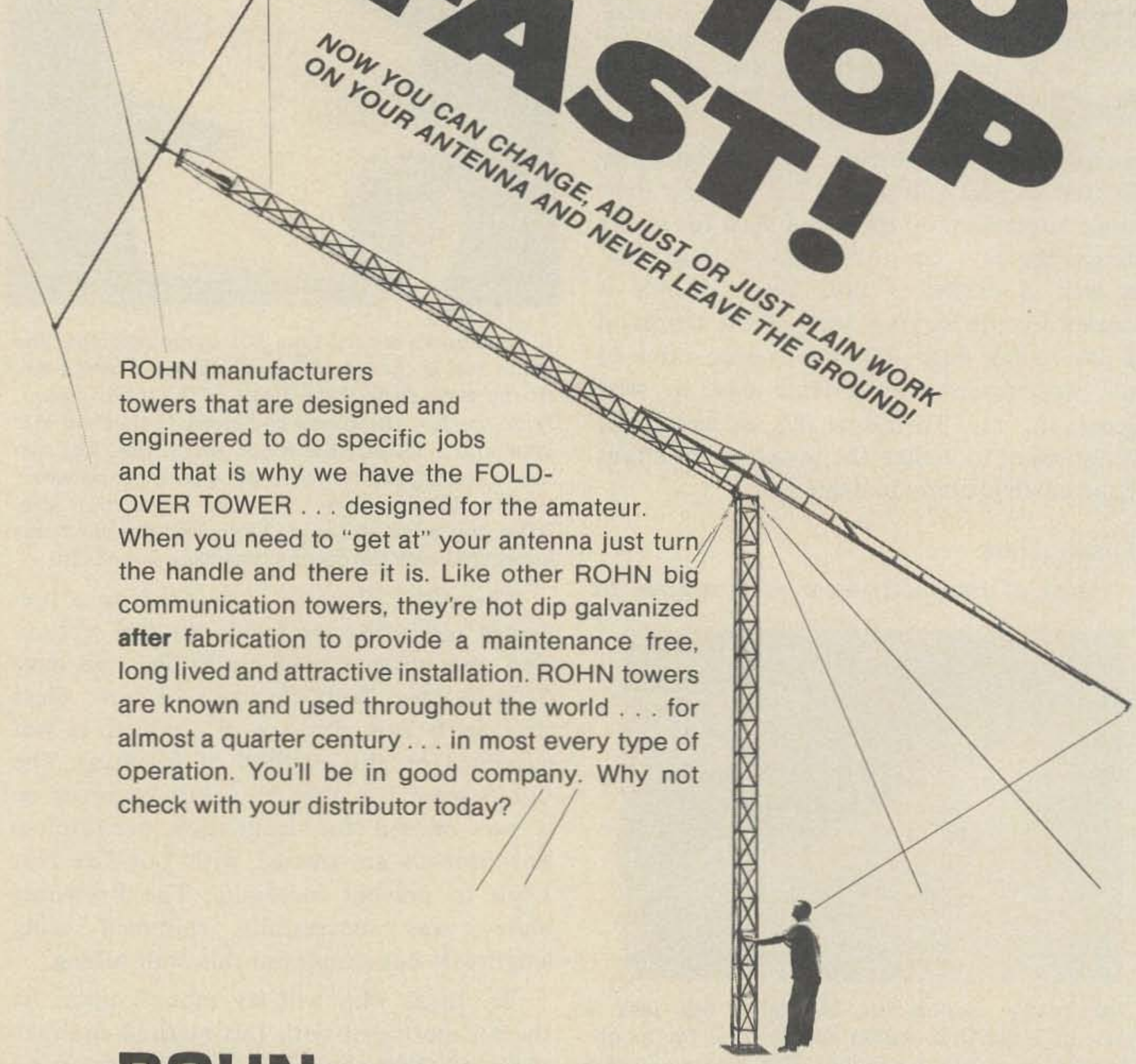

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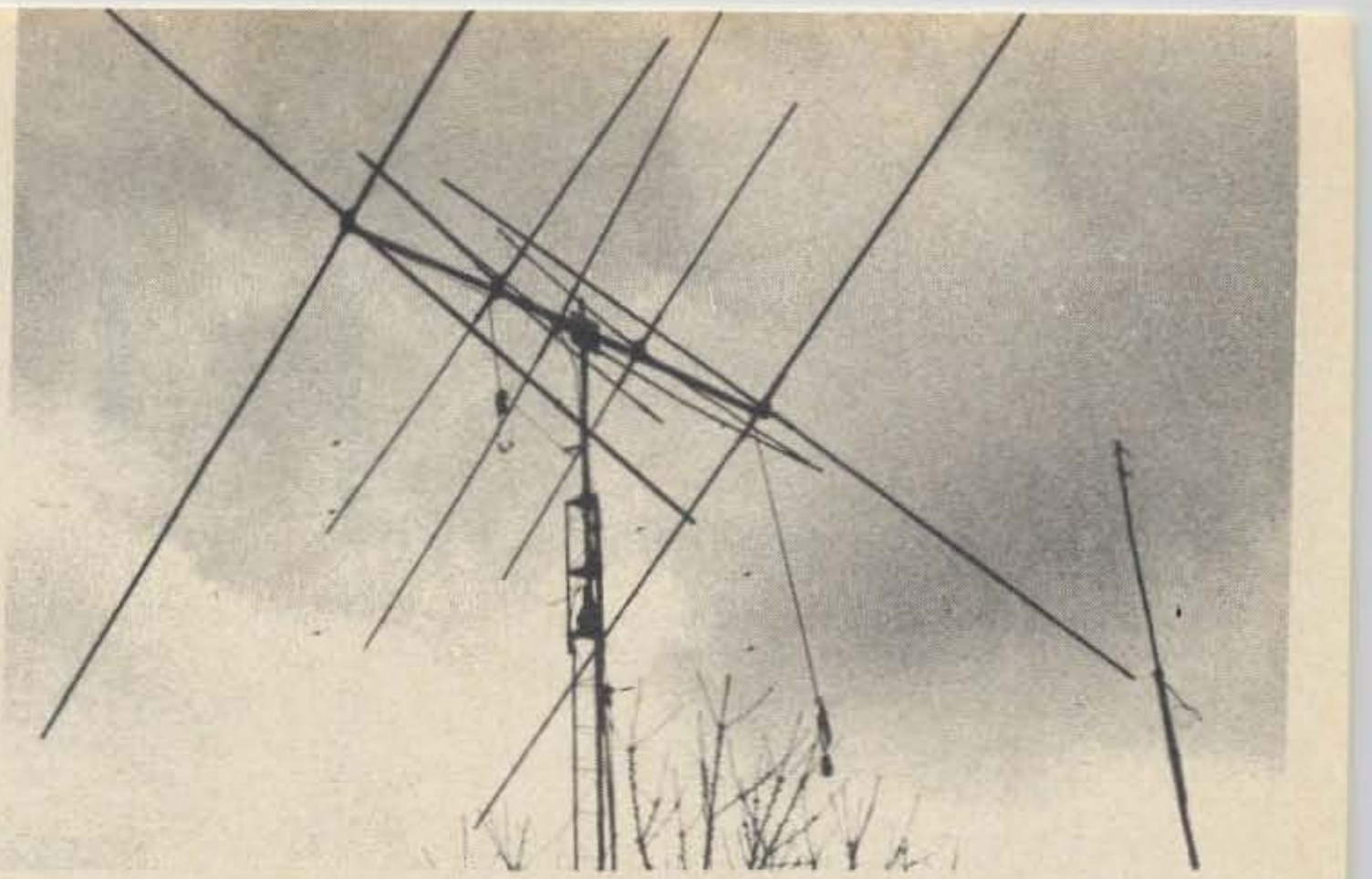

The merits of the cubical quad have already been established, its inherent weaknesses noted and suitably assessed against its formidable strengths, and a myriad of articles published describing various configurations, including one rather unusual array describing the 3-4-6 quad which appeared in this hallowed journal in November, 1971.

The quad pictured is a good all-around antenna for the urban dweller who has limited space and wants something better than the typical commercial triband Yagi, and something cheaper! Clearly it is not an isotropic source and requires some room, but no more than the triband Yagi – less, in fact. It consists of 4 elements on 10m, 3 on 15m and 2 elements on 20m. The spacing is a bit wide on 20m, but there is significant front-to-back and forward gain and a broadbandedness that comes in handy when shifting from low end CW to high end SSB. The spacing on the other bands is somewhat closer to optimal for forward gain, and the array performs most impressively on all bands at a height of only 10.5 meters. The boom is 460 cm long.

In general, the longer the boom length of a directive array – whether Yagi or quad – the higher the forward gain. The unique character of the quad is that for a given required gain it need be only about 0.56 as long as its Yagi counterpart.* Thus, this described quad should approximately equal in performance a Yagi with a boom length of approximately 800 cm. Sounds familiar? Look at the boom length of the larger triband Yagis currently advertised. The question, of course, is whether this antenna does as well.

The following figures are arithmetic averages of a number of tests made with local hams; they do not reflect the low angle of radiation proffered by the quad, nor variations in height or environment. They only suggest that this antenna is at worst in the same league as those *larger* triband Yagis and at best is better. It is significantly better than the *typical* triband Yagi.

**By virtue of vertical lobe compression*

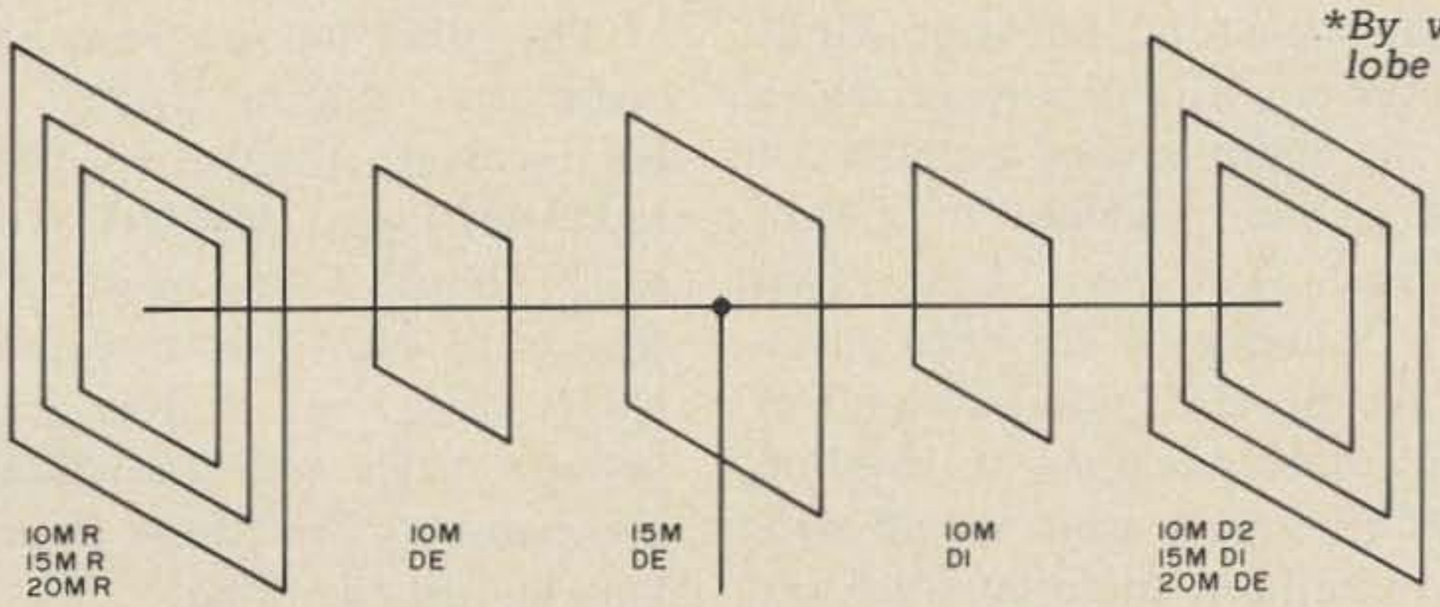

Fig. 1. The Urban Quad.

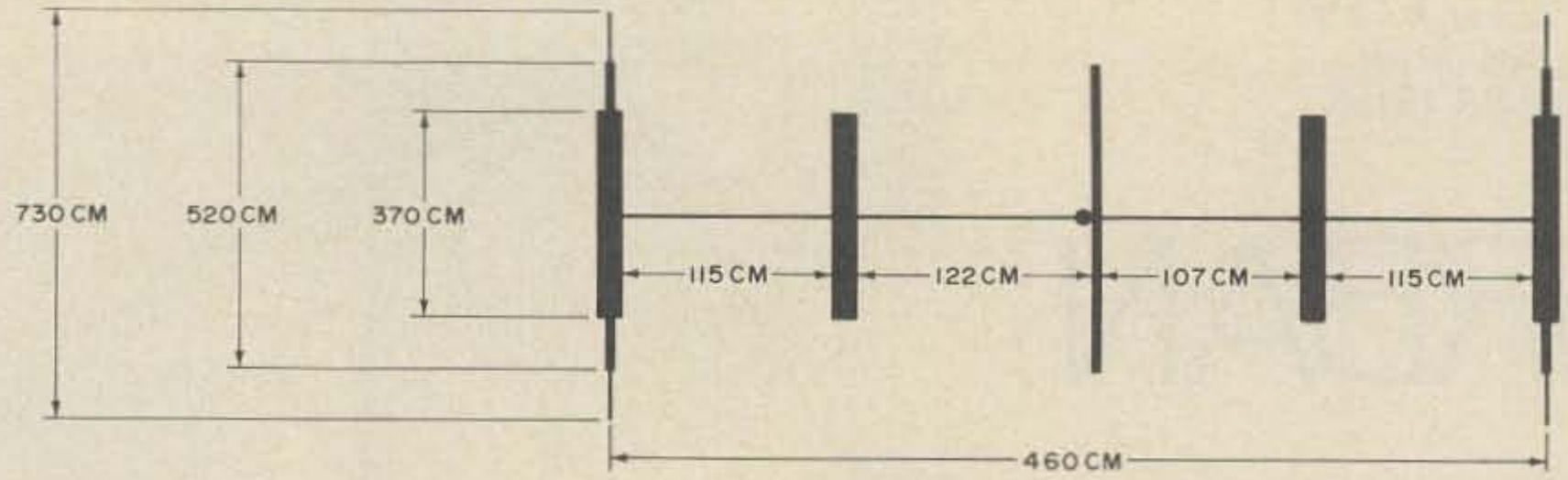

Fig. 2. Element spacing.

Front to side:	10m 45 dB	15m 34 dB	20m 23 dB
back:	26 dB	23 dB	19 dB

There was no convenient way to make forward gain measurements, and indeed a fraction of a dB one way or the other is insignificant and will even vary to some extent as a function of height, tuning, etc. The point is that this antenna, with only 2 elements on 20m and a 460 cm boom is performing well!

Parts and Cost

Improvements may be made on the following figures by using scrap supplies or other materials, but compare the cost with a Yagi of similar characteristics.

Bamboo poles (12-460 cm long; 8-24 cm long) $15
Clamps with stainless screws, #14 wire . . .25
460 cm boom: 5 cm OD, 1/8" wall 15
Aluminum plates for spreader-boom mounting (from junk yard) 6
Coax, RG8/U (3-23m rolls)
3 baluns
Length of quarter wave transformer, RG9/U
Total (plus cables) $61

The array has withstood 64 knot winds and Hurricane Agnes with no damage save a broken wire at the balun-to-loop tie point of the 20m driven element (which could have been avoided had #14 wire been used instead of #16). Number 14 has been specified in the list. At this QTH a fair amount of antenna experimentation is done, so bamboo is practical; but fiberglass arms would probably be a more suitable material since the antenna will likely be up for quite some time! However, the bamboo in this array has been in quad antennas for four years now and has only recently begun to show signs of weathering.

Tuning

Regarding tuning, the spreader assemblies are constructed on the ground and cut to approximate dimensions, preferably a few cm shorter than that required. After mounting them on the boom and hoisting it all off the ground, tuning is accomplished using a grid dip meter, and wire added at the stub tie points as required for ±5% tuning on 15m and 10m, and -3% center frequency resonance for the 20m reflector (longer), since that band already is somewhat broad by virtue of wide spacing and a bit tighter coupling is necessary to lower the impedance and achieve lower vswr. In addition, a quarter wave matching transformer (RG9/U) was used between the balun and the feedline on 20m, though the need for this may depend on tuning. The vswr curves will tell you whether you need the transformer. The wide spacing is worth the return of improved performance on 15 and 10. 20m does not seem to suffer from wide spacing.

Performance

The other day on 15m SSB, half the east coast was calling EA9EJ (I heard them back-scatter, thanks to the low angle of radiation!) and K3MNJ worked him first call. (Should I also mention that I called in Spanish?) No, the antenna is not in the K3JH class, but it does well against those triband Yagis and is relatively compact and inexpensive. For those in urban centers, it may be just the thing.

. . .K3MNJ

Carl C. Drumeller W5JJ
5824 N.W. 58 Street
Warr Acres OK 73122

LOGIC AND REFLECTED POWER

Something you'll understand if and only if you read this article.

Reflected power in mal-terminated transmission lines has triggered more discussion, argumentation, and even anxiety than almost any subject since the famous power factor debates of the early 1920's. Some of the anxieties and worries engendered by overconcern about possible ill effects to equipment or excessive loss of transmitted power can be relieved by the application of logical reasoning. And that application of logic is the purpose of this article.

Let's start with an antenna – an antenna so constructed that its feedpoint impedance is 12.8Ω. It doesn't matter too much if that impedance is composed wholly of resistance or of an admixture of reactance and resistance. In either case, it offers a 4:1 impedance mismatch to a 52Ω transmission line.

In order to effect a match between the line and the antenna, we put an impedance transforming device between the two. This may be one of many different forms; you can call it a Matchbox, a Transmatch, or any other term. In each instance its function is to transform that 12.8Ω impedance to a resistance of 52Ω.

When such a transform has been accomplished, the transmission line is matched to its load, there are no standing waves on the line, and the transmitter feeding it is "happy." This is the condition you want to attain and maintain.

There is no compelling reason that the impedance matching device must be located at the junction of the line and the antenna. Suppose you place it down 10 feet from the junction. Then the line from the device to the transmitter retains its matched condition and the transmitter still is happy. But what about that 10-foot stretch of line between the device and the antenna? Won't there be reflected power coming back from the antenna because of the 4:1 VSWR? And won't

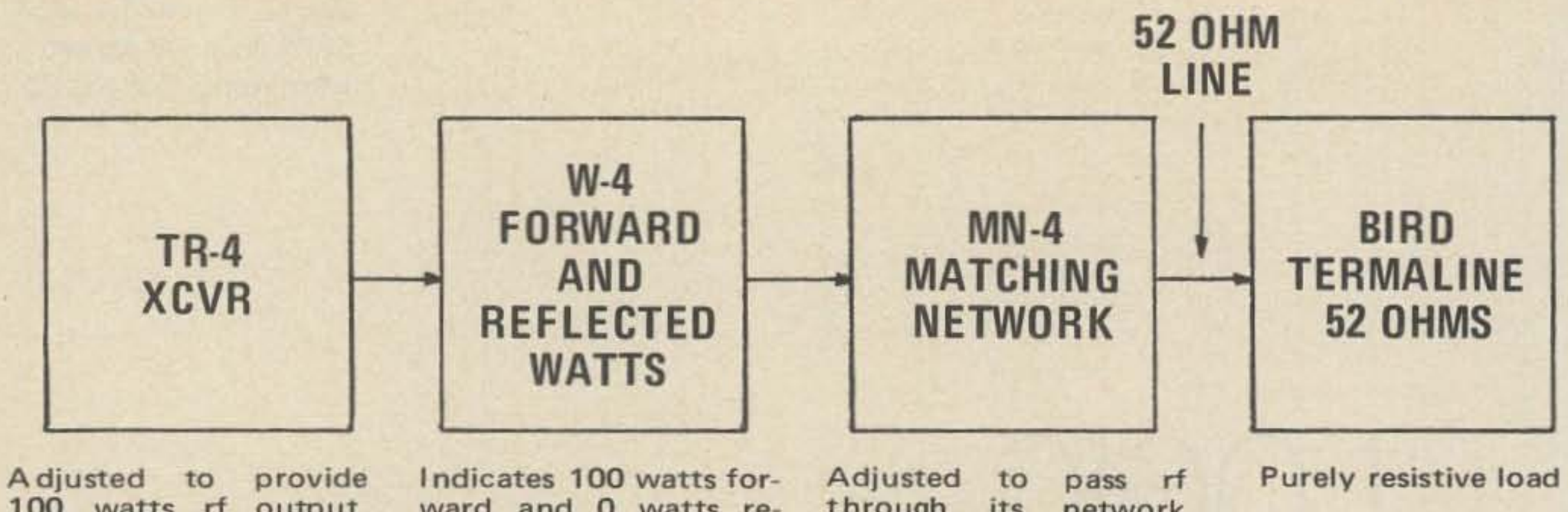

Fig. 1. Properly matched transmitter (running 100 watts output) indicates 100 watts forward and 0 watts reflected on the wattmeter.

that reflected power be lost, be deleted from that available for radiation from the antenna?

Yes, there'll be reflected power in the 10-foot section of line, and this will result in a 4:1 VSWR on that section. But no, there will be no appreciable power deleted from that available for radiation from the antenna.

Let's consider why. In the first instance, when the impedance matching occurred right at the antenna/feedline junction, any reactive element of the antenna feedpoint impedance was negated by a conjugate reactance presented by the matching device. Then the remaining element, purely resistive, was transformed by the matching device to 52Ω. The same situation prevails in the second instance, too. However, the magnitudes of resistance and reactance, and even the sign (+ or -) of the reactance may be changed, especially so if that 10-foot length represented any appreciable fraction of a wavelength, as it would on 6 meters or even 10 meters. But the situation of reflected power remains unchanged; it existed at 0 foot, would exist at 0.25 foot, and exists at 10 feet. In each of these situations the only actual loss of power is that dissipated in the form of heat.

With a VSWR of 4:1, the peak magnitude of voltage present on a transmission line will be four times that which it would be if the line were "flat." The peak value of current also will be four times as high. There will be definite points of high voltage and definite points of high current. Each high voltage point is a half-wave removed from another,

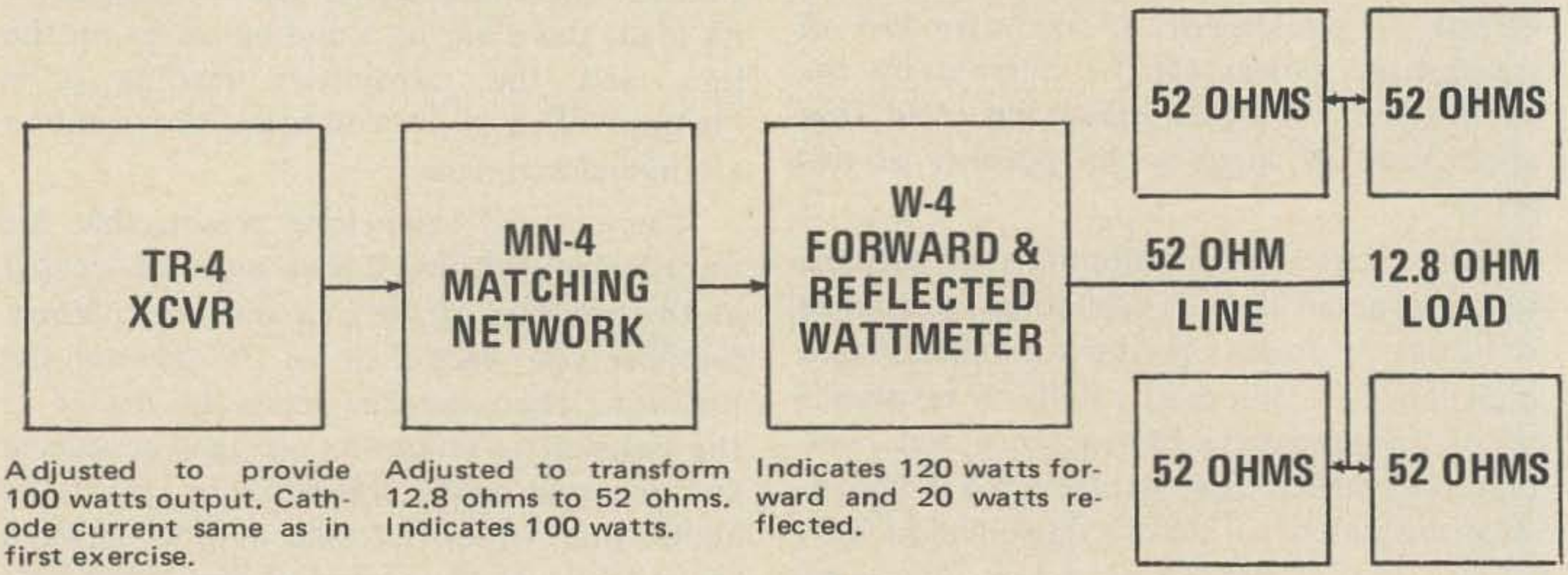

Fig. 2. Improperly matched transmitter (still running 100 watts) indicates 120 watts forward and 20 watts reflected. 100 = 140?

and each high current point is a half-wave removed from another. Each of these high (voltage or current) points occurs at a spot on the transmission line where the line appears as purely resistive. At the high voltage points there will be dielectric losses in proportion to E^2/R, and at the high current points copper losses represented by I^2R. These losses are in addition to those normal losses present in a transmission line, even when the line is "flat." The energy consumed by such losses is dissipated in the form of heat.

But what about reflected "power?" Note that "power" is placed in quotation marks, indicating doubt as to its reality. Can one use logic, logic based upon a demonstrated and reproducible illustration to ascertain whether the "power" is real or illusionary? Yes. Very easily and simply.

Here is what I did: I used a Drake TR-4, a Drake MN-4 matching network, a Drake W-4 forward and reflected power meter, and four Bird Termaline 52Ω dummy loads. See Figs. 1 and 2 for how they were connected.

Using one 52Ω load initially, with the W-4 between the TR-4 and the MN-4, the TR-4 was tuned and loaded to display 100 watts output into the dummy load. This value of power was confirmed both by the W-4 and the MN-4 after the latter was properly adjusted. Then the TR-4 was connected directly to the MN-4, and the W-4 was moved to between the MN-4 and a new terminal load. This load was constituted by four Termaline loads connected in parallel by means of "T" connectors and very short lengths of 52Ω RG-8/U cable. This combination presented a load of 12.8Ω and was purely resistive. With such a load, the VSWR was 4:1. Next, the MN-4 was readjusted to present a 52Ω load to the TR-4, which was still generating 100 watts of rf power, as verified by the wattmeter function of the MN-4. But what about the forward power and the reflected power as shown by the W-4? In the forward position, it indicated 120 watts; in the reflected position, it indicated 20 watts!

Now one sits back and exercises a bit of logical thinking. You know quite well that there was no supplementary power-generating device introduced into the circuit. The 100 watts produced by the TR-4 is the sole source of rf power in the circuit. Unless there's "black magic" concerned, that extra 20 watts of power surely must be illusionary! Then there's that coincidence of the inexplicable 20 watts of not-generated-by-the-transmitter power being exactly matched by 20 watts of reflected power!

It doesn't require much application of logic to come to a valid conclusion: The extra 20 watts of forward power and the 20 watts of reflected power cannot be true power.

This so-called power is represented by standing waves on the feed line. A quick inspection of the points of minimum current and minimum voltage (these are more easily located than the points of maximum current and maximum voltage) shows that they are 90 electrical degrees apart. A quick reference to alternating current theory shows that power is equal to current times voltage times the cosine of the angle between the first two. Another quick reference, this time to a table of cosines, shows that the cosine of 90° is zero. And, of course, any number multiplied by zero is zero.

Therefore your application of logic has demonstrated that reflected "power" is a fiction, a vicious fiction that has caused many radio amateurs much worry and concern.

The knowledge of reflected "power" being truly a figment of nomenclature should not be taken as proof of a low VSWR being of no worth. Under certain circumstances, it can be sorely needed. But when your transmitter will load normally into your transmission line, there is no need for you to be concerned over a VSWR of 5:1, certainly not one of 4:1. If your transmission line is less than several wavelengths long at the frequency you're using, the amount of power that you'll lose as heat along the transmission line will be quite negligible. But if your transmitter doesn't load happily into your line, then you need some sort of an impedance matching device between your transmitter and your line. It won't increase the amount of rf power your antenna will radiate, but it will make your transmitter happy!

...W5JJ

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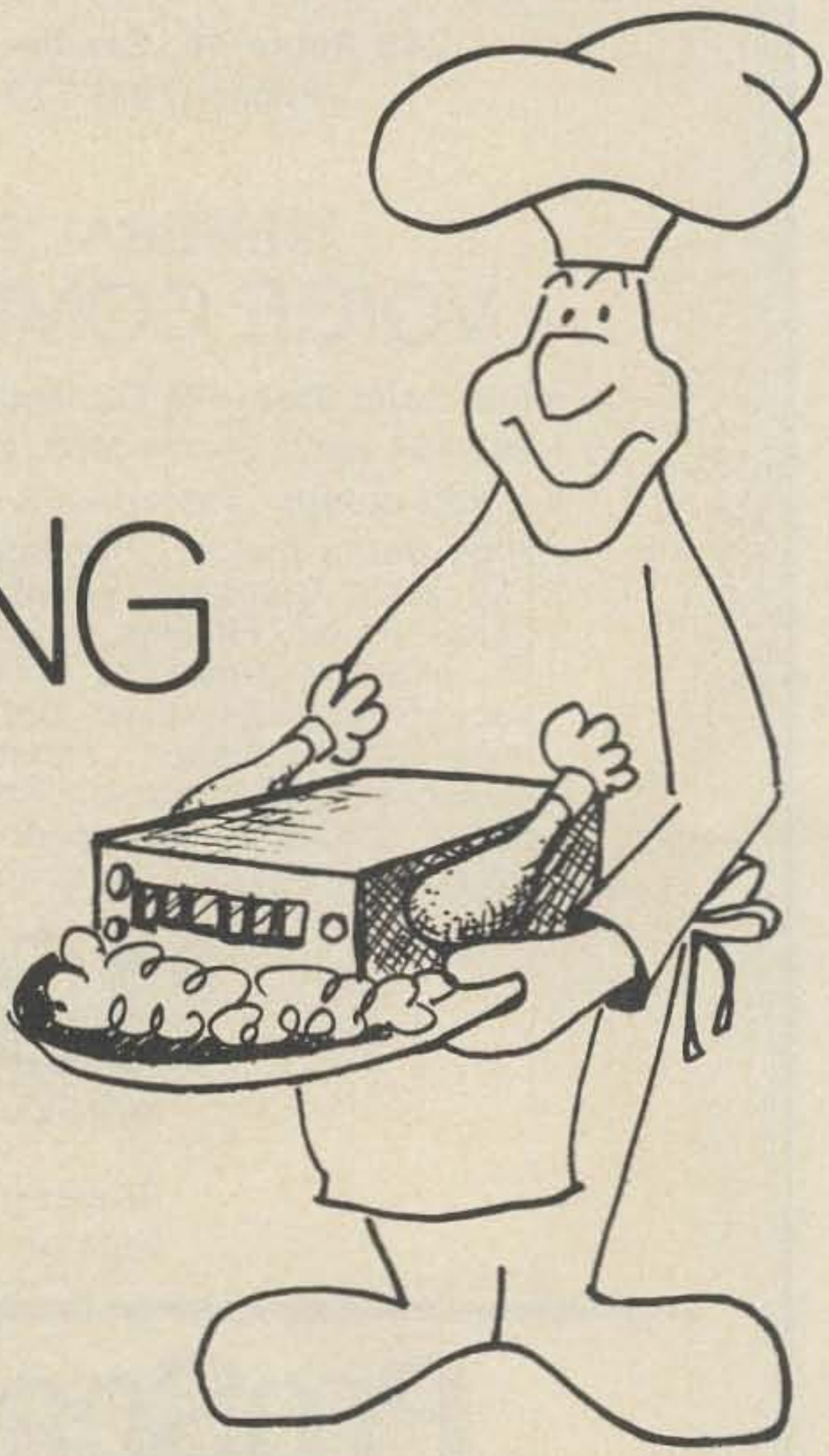
RECIPE FOR GARNISHING A COUNTER

David J. Brown W9CGI
RR5, Box 39
Noblesville IN 46060



My compliments to the chef! The chef in this case being Mr. Peter Stark K2OAW. His article in the May, July and September 1972 issues of *73 Magazine* has presented ham radio with a top grade piece of test equipment right when we need it. Amateurs should be building at least their own test equipment, and the prices and availability of the required parts are at their best. For almost the price of a good VTVM kit, you too can own a commercial quality counter.

While this is a construction article, let me say that Mr. Stark's counter worked perfectly the first time without any of my additions. This says a lot for the three-part layout, good board design, and a lot of hard work on his part. The additions I am going to suggest for his circuit are, as my title implies, gilding an otherwise already fine lily! I will present the additions so that any one or all of them can be made, since each change is complete in itself.

Accuracy

This is the name of the game when dealing with frequency counters. International Crystal was quick to fix me up with a good crystal by only sending them a schematic of the circuit and Mr. Stark's suggestions on this item. I purchased a 10.00000 MHz crystal for $9.50 in holder HA 505. It fits the pins removed from a 9-pin miniature socket and soldered into the board at the proper spacing. I like plug in crystals for ease in changing and do not like to heat up an accurate crystal. Also, if you later use an oven of the right temperature this one could plug right in. This should solve the one part that may be hard to find in some areas. They will air mail the crystal well protected against shipping hazards. The accuracy of my crystal is .0005% (specify a high accuracy crystal when ordering). They are listed under Medium Frequency Crystals in the catalog.

Further on the subject of accuracy, several good articles have appeared recently on WWV converters and receivers (*73 Magazine*, November '72, page 59, WA8OIK , for example). If you allow enough room in your enclosure it is worthwhile to build one into the counter. Depending on your WWV reception it can be designed for 5.0 or 10.0 MHz, since you have both frequencies coming off the timebase divider chain of IC's. I chose a small solid state AM radio available from many of *73*'s advertisers for $5 to $10, and put it into a small aluminum enclosure with an International Crystal SAX-1 (lo kit) rf amplifier, MXX-1 (lo kit) mixer, SAX-1 (lo kit) i-f amplifier-buffer, and OX oscillator (lo kit) running at 10.7 MHz for an instant converter to 700 kHz on the broadcast band. If you like this combination as well as I do, you can always build a duplicate for mobile use. Choose a quiet spot on the AM band for your own particular i-f frequency. Order the EX type crystal for the oscillator module by either adding or subtracting the i-f frequency from 10 MHz or 5 MHz, depending on the WWV signal desired. In this area (central Indiana) a small collapsible CB handi-talkie replacement whip on the cabinet is enough, but a BNC fitting also feeds the rf module just in case.

A Case for Your Better Mousetrap

While aluminum boxes are being discussed, the enclosure you choose adds both to the looks and its versatility. Since my station is all Drake, with homebrew accessory items built into Drake enclosures, it was a natural that I chose that type of enclosure for the counter. An R.L. Drake TR-6 cabinet was ordered with black finish, for approximately $16 postpaid. A panel was punched out of .06 aluminum. I used a 10x12x3" aluminum chassis (common size) for the mainframe. Cut out the front (10x3) to clear the hardware mounted to the front panel, but leave six places for 6-32 screws to mount the panel. A cutout is made in the top of the mainframe (10x12 surface) the same size as the outer copper dimensions of the K2OAW circuit board, leaving a 10x5 area for a 10x5x2 box above the mainframe in which to mount the transformers, power supply board, etc Using the large enclosure yields more space for other modifications.

Hi-Lo Circuits

I used separate BNC fittings to feed the Hi and Lo inputs to allow quick switching between two points in most FM gear, etc. By making the Hi-Lo input switch a DPDT unit, one half can be used as the original SPST, and the other half is wired to two small low drain 6V panel mount bulbs from Southwest Technical Products (in your choice of colors). I mounted these bulbs above their respective BNC connectors to tell at a glance which input was being monitored.

Test Count and Timebase

As can be seen in Fig. 1, one other change is made to add a feature found on the more expensive counters available. You can indirectly read the 10.0 MHz crystal timebase clock generator to determine it is running accurately by adding a SPST momentary pushbutton switch to the front panel below and between the Hi-Lo lamps. A wire is run close to the board from IC-26 pin 14 to one side of the switch, and from IC-4 pins 6 or 9 to the other side of the switch. Keep the leads close to the board, as the timebase chain runs 1.2V to 4.2V squarewaves and that makes an rf generator rich in harmonics if long unshielded leads are not dressed carefully. Momentarily pushing this switch will light 10000 on the readout if the timebase switch is in Hz or 00010 if in kHz position. A nice fast check on all being well

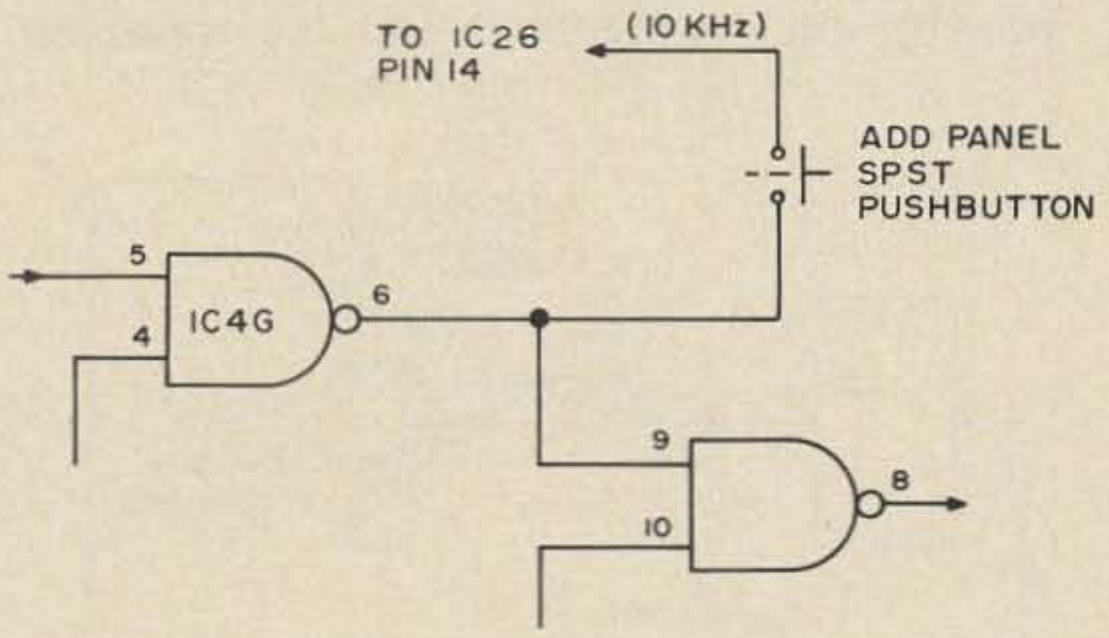


Fig. 1 (modified Fig. 5 of the original K2OAW Counter article). Test count modification. Pushing switch will cause the counter to read the frequency of the 10 kHz time base to determine proper operation.

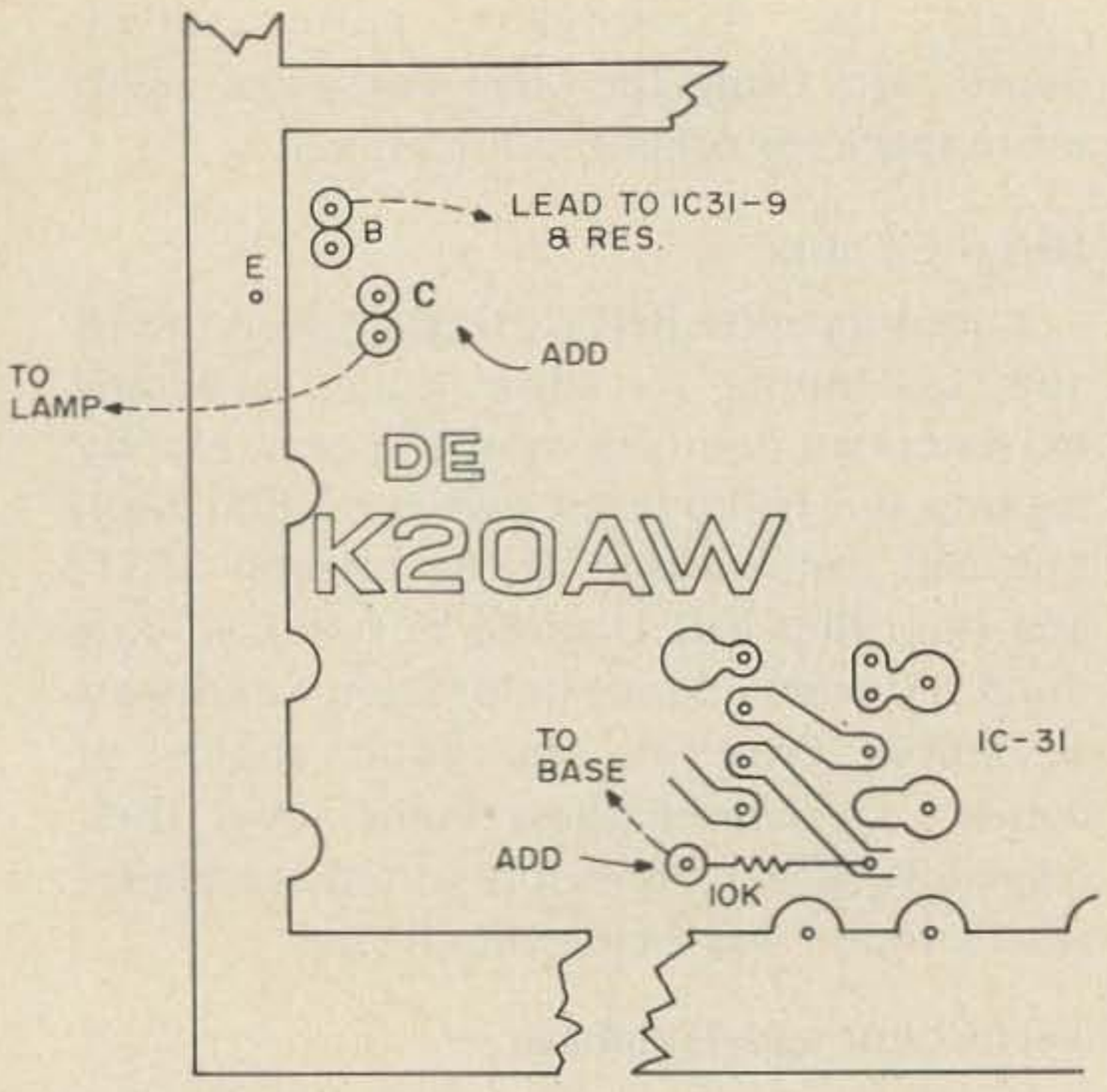


Fig. 2 (modified Fig. 23). Modification of the PC board to incorporate the extra circuitry in Fig. 3.

in that territory, both after building and in the future.

While in the timebase circuit, run a 10K ½W resistor from IC-29 pin 11 (1 Hz) to a nearby open area (no copper pads) and solder a lead from this resistor to a like open area around the large filter capacitor at the rear corner of the board. (See modified layout, Fig. 2.) Drill five small (#60) holes per the new layout to mount a transistor to be wired as in Fig. 3. The hole on the edge of the board is ground for the transistor emitter. The remaining holes accept the base and the wire from the 10K resistor. Run the wire through the board from the top (component side) and fold it and the transistor

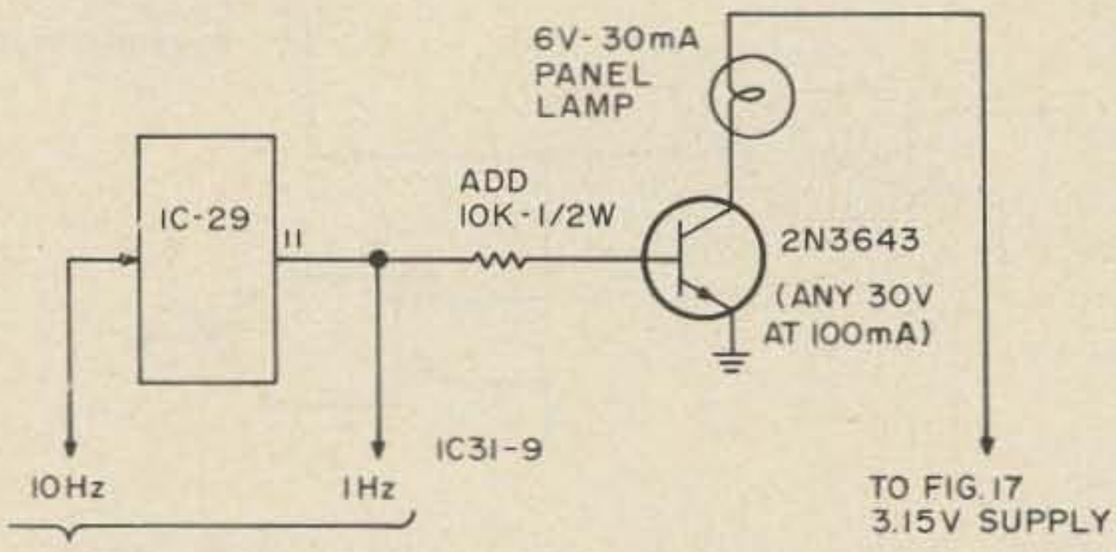


Fig. 3 (modified Fig. 8). The addition of a transistor, a lamp and a resistor adds a visual indication of the operating timebase.

base lead to meet one another and solder. This forms your own "pad" as there is no copper here. The last two holes are for the collector and one lead of another Southwest Technical Products panel lamp mounted below the over-range lamp. The remaining lead of this new lamp goes to the 3.16V Numitron supply as did the added Hi-Lo lamp source leads. The lamp blinks on and off one time per second giving a reassuring blink to let you know all is alive and well in the timebase circuit. It doesn't check the gating controls, but it tells you a crystal and 8 of 33 IC's are running o.k. Even if you don't build in the WWV circuits, it would be wise to put this one in.

Timebase – The Hard Way

By putting in the 1 Hz lamp you can even calibrate the counter to a reasonable degree if you are patient enough. It's not a super accurate means, but it beats no way at all. Count the blinks for exactly 3-5 minutes and compare with the number of seconds in the time period you use (180 blinks for 3 minute period, etc.). Obviously you should use an electric chronometer with smooth sweep second hand as your "standard," and this "formula" should be modified for non 60 cycle mains areas. Compare your "clock" blinks to the standard used and correct your trimmer capacitor to make your clock faster (more blinks) or slower. Power companies maintain 60 CPS ±1 Hz for line frequency, and most keep their short term accuracy even closer since the National Grid System was started. This way your standard clock can give you a very accurate 3 or 5 minute period to use. Give this method a try in your area whether you use the WWV method or not and let me know your results. I know we were somewhat amazed how close one can get with patience. We have gotten to within 10 Hz on the 10 MHz crystal.

Readout Check

This is another item "borrowed" from more expensive counters at the cost of a SPST pushbutton switch. If you are not well acquainted with the ICs used in the project as I am by my employment, you could overlook this addition that is already in-

cluded in the ICs. By carefully connecting all of the pin 3's of the SN7446 or SN7447 readout drivers (whichever you use) together, and then to one side of the SPST switch mentioned, and then connect the other side of the switch to ground, you have a readout check. Mount the switch on the back apron, as it is not used often. Pushing the button briefly (easy on the power supply, fellas!) will light all the readouts with the number "8" (all segments lit). This allows check for filament burnout on Numitrons, open wiring during construction, etc.

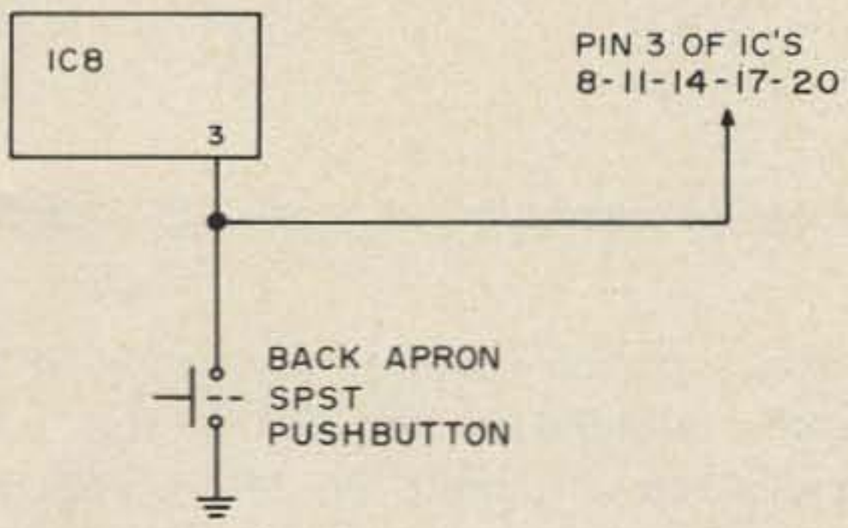


Fig. 4 (modified Fig. 6). Readout check. Pressing the pushbutton causes all segments of the readouts to light.

Burnout Protection

The ECL IC logic being somewhat expensive, you may want to use the same protection used by K2OAW in the June 1972 *73 Magazine* article featuring his 300 MHz frequency scaler. While in the counter he uses an extra amplifier ahead of the somewhat "touchy" IC 2, it still is comforting to have the added protection of the old criss-cross diodes trick of the receiver/converter days. Use 1N914 diodes just as he did in the June article. See Fig. 5.

Accuracy — Accuracy

In the section under accuracy I mentioned the clocking method, but don't get the idea I either prefer it or enjoy the long "blinking" count (pardon the British pun, it's my English ancestry). I have for some time now used a very inexpensive zero-beat method that tops all I have tried. I have used it to zero commercial, amateur, and test gear, and just wasn't aware it wasn't as well known as

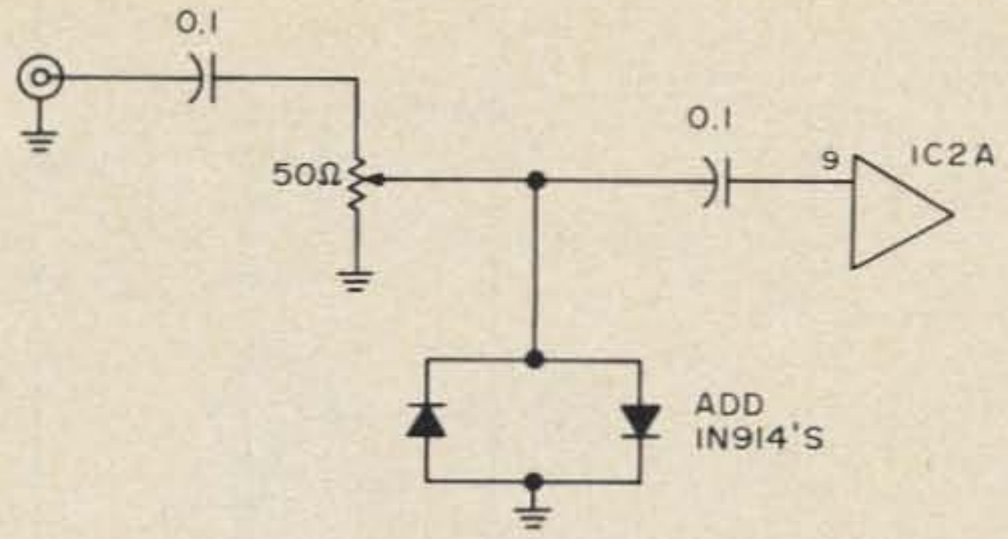


Fig. 5 (modified Fig. 4). The addition of back to back 1N914's adds burnout protection to the front end.

I thought. (See Fig. 6, added). I mounted a speaker in the lid of my TR-6 enclosure since it is already perforated for heat. A shielded cable (RG-174 type, etc.) is used to route it to the back apron of the mainframe. One other small module is added to the converter compartment, namely Fig. 6. Audio is tapped off the speaker lead and fed to the zero-beat detector. Normal leakage or a small lead is used from IC 22 pin 8 to the input rf Sax-1 module to couple a small amount of 10.0 MHz rf from the timebase to the converter. Turn up the volume on the BC radio and tune in WWV by rocking the BC tuning capacitor around the i-f frequency you have chosen. With the counter turned on you should have a nice clear beat note if coupling is correct. Trim this note down as close to zero CPS as you can by adjusting (slowly!) the counter's trimmer capacitor. This will put you within 15 to 20 cycles if you have reasonably good hearing ability. Now, the fact the ear is a good detector from 40 to 15,000 CPS, and the eye is only good for pulsations of zero to 40 CPS, leads you to conclude that when you are at 15–20 CPS and trying for zero it is time to change detectors! By using the circuit shown in Fig. A, you can now see the 15–20 CPS, and by slowly trimming the counter trimmer you can hit fairly near zero. Remember that we are referring to "per second." If you carefully do your job, one cycle per ten seconds is not hard to come by. Where's that steady hand and patience?

To get my crystal to "zero" first I used a 14 pF NPO fixed capacitor in place of the 33 pF in parallel with the trimmer. Next, a piston trimmer 1 to 5 pF is added in parellel with the trimmer as a "fine" adjust. Make a

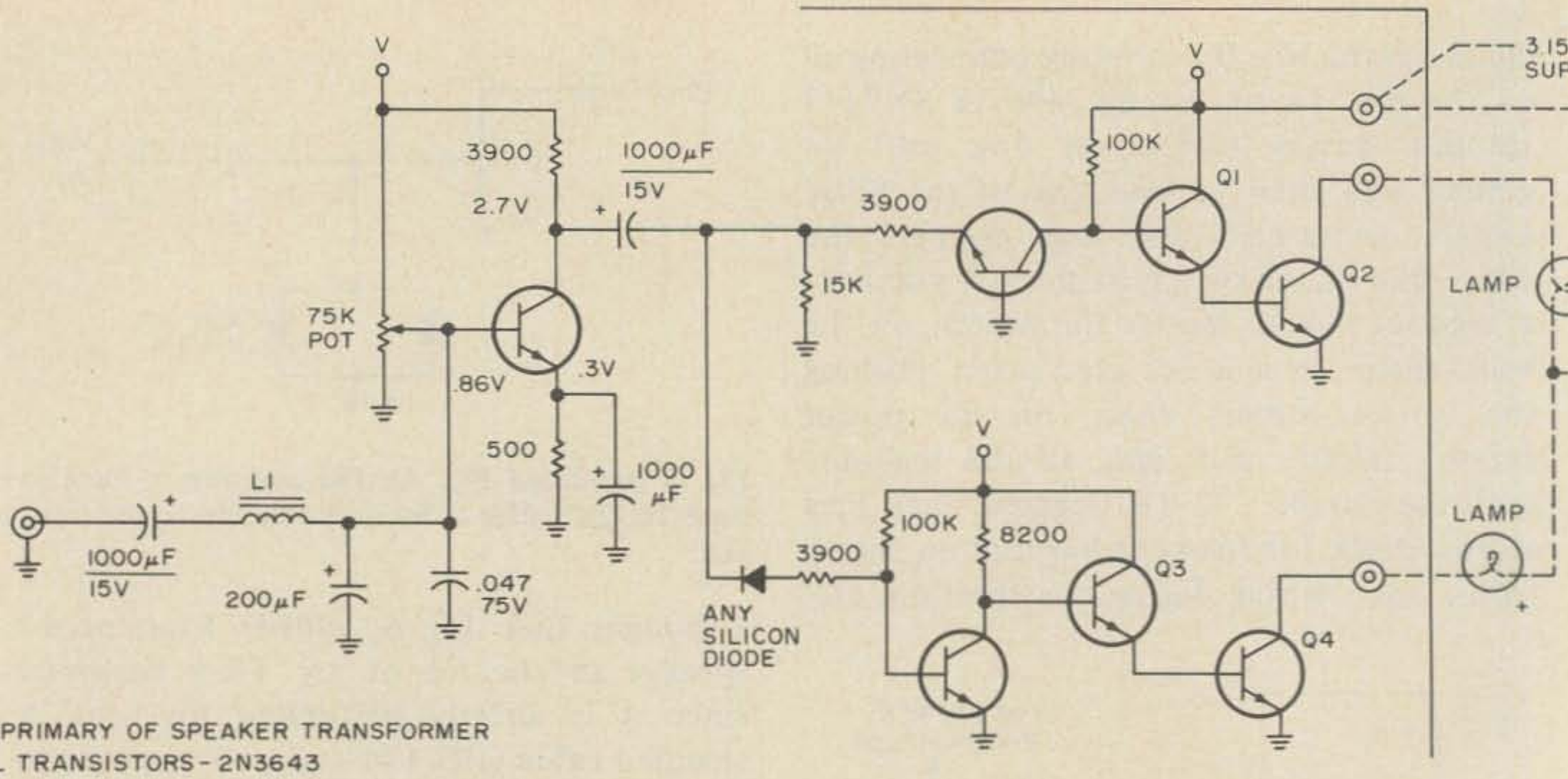


Fig. 6. Schematic of the added zero beat indicator. It can be assembled on a small PC board and mounted in the converter compartment.

small 5-sided cube to cover the crystal out of thin styrofoam packing material using airplane cement or rubber cement to put it together and attach it to the board. The crystal will still run at room ambient, but small air currents won't cause "eddy drifting." From there on, it's only the patience you put into it.

Any further help I can render, please send SASE and your questions worded as best you can. Fortunately I work in a design job requiring my knowledge of this type TTL ICs daily, so I might be able to clear up problems arising from not knowing what makes TTL tick. I must say K2OAW gave an excellent rundown on the use, care and feeding of TTL in the three articles. If you are planning any TTL project I wholeheartedly recommend reading them to keep out of trouble. Time and time again in my job I find TTL has more intelligent logic control than you or I. By this I mean almost without fail it does exactly what it is commanded to do. In three years of working with them I have found only one IC defective from the vendor using over-the-counter commercial grade (not mil-spec) devices. If you choose to save quite a bit by going through one of the many *73 Magazine* advertisers listing TTL devices, I can only speak from my own experience with the three I have tried to date. They have been excellent in quality and service, not to mention price. Incidentally, one of those sources yielded an SN 7473 that counts (divides) to a reliable 36 MHz. This means my basic low frequency part of the counter goes to 36 MHz. Use your best SN 7473 (highest divide frequency) for IC-5. By all means try switching IC-5 and IC-21, since high speed in IC-21 doesn't buy you anything anyway.

Only one comment should be added. The plus 5 volts can be 4.75 to 5.25V dc according to the manufacturer's data and you can still expect proper operation. Use a *stiff* and well regulated supply set to 4.9 to 5.0V dc. Do not try running at over 5.1V dc for any reason, as you are killing any margin of safety you have. At 4.75V dc and down the ICs fail to operate, but at 5.25V dc and above the ICs may and usually do fail permanently. With 33 of them to worry about, the expense of a good supply is small. Several good "Crowbar" circuits have appeared to shut things down in the event of too much current or voltage and I recommend the use of one of them. Also, as K2OAW suggests, put in only one or a few ICs at a time and get sections of the counter going, rather than trying the "in one crunch" method.

Have fun, and more important, thanks to Mr. Peter Stark, who has designed it, have a fine test instrument for a very reasonable fee.

. . .W9CGI

Terry C. Blosser WA8MLG
735 Oakwood Avenue
Lancaster OH 43130

THE HAM'S PERFECT SUMMER JOB?

Like to get away from the city for a summer, to another part of the country, perhaps? Imagine yourself operating your rig under fragrant pines on the edge of a crystal-clear lake in southern Maine. That was my experience a couple of years ago, and it can be yours if you would enjoy teaching amateur radio at one of the numerous private camps located throughout the U.S.

Camp directors are rapidly discovering that it pays to offer more to campers than standard athletic fare. With the boom of technology, parents are anxious to see their offspring getting into the act. And what is a more practical beginning than amateur radio?

Getting in touch with these camps is your first objective. If you're a student, college placement services can generally get you information. Many camps circulate their literature throughout U.S. campuses. The American Camping Association can give you assistance in getting a radio position, and ACA standards assure you of a reputable outfit.

Most private camps operate on an eight-week summer and begin recruiting staff early in the spring. When interviewed for a radio counselor position, there are several important points to note. First of all, camps will generally require counselors to be at least 18 years of age, and most directors prefer staff over 21. Depending on how you present yourself, it's not too difficult for a director to forget the usual age preferences. Naturally you should have at least a General class ticket with a few years background in the technical end of the hobby.

Young camper with two transistor radio he built during the summer course.

Directors are also concerned about how well you can organize and – most important – instruct. Keep these things in mind when you interview and write letters of application.

During the interviewing process, it's important that you seek out information to insure your compatibility with the camp. Try to pin down the director's outlook and goals for the radio program. Get in touch with past radio counselors at the camp to discover their problems and what to expect from the campers and administration. Since the camp will probably be too distant to visit, it's a good time to get opinions on such things as facilities, policies of the camp, and staff relations. Usually camp directors request critiques from specialty counselors at the end of a season, and it would be wise to obtain the latest report.

When things are pretty well squared away between you and the director, there

always exists the question of salary and expenses. Almost all private camps will give you a travel allowance that will cover ninety percent or better of your round trip if you travel frugally. Expect $50 to $100, depending on how far you live from the camp. Many camp directors will allow you to suggest your salary requirements, and it's one time you don't want to sell yourself short. Directors have difficulty finding qualified radio people, mainly because they can be employed elsewhere at higher wages. They are willing to pay if they are impressed with you. Expect upwards of $600 *plus* travel allowances. In addition, you'll receive free room and board and weekly laundry service.

All reputable camps will present you with a contract outlining your wages and any additional duties to be assigned. Be sure to assert yourself to the director that you are a radio specialty counselor, and for the program to be successful, your radio duties must have priority. A less dynamic radio counselor will often find himself saddled with waterfront or athletic duties, which are not that undesirable, but do detract from a successful radio program.

You'll probably discover that the camp already owns some radio gear, and if you are lucky, maybe an SSB transceiver. Usually camps will have a healthy junkbox and a supply of tools, soldering equipment, etc. Don't forget that you're going to need a key and a practice oscillator for code sessions. In addition, most camp directors would be happy to pay shipping charges on any personal gear that would enhance the program. A word of advice here: if you decide to ship any gear via any of the freight services, obtain a footlocker and use your spare clothing to pack it as tightly as possible.

By now you probably know what antenna system the camp has installed, but you may have to allow space in the footlocker for some coax and wire. It would also be wise to take along a small VOM and a few alligator clips. Perhaps the director by this time has forwarded an inventory to you to allow you a little more certainty of available materials. Of course, you'll want to be sure to have a copy of the *Handbook*, and some of the *73 License Study Guides* would be helpful. I used both sources. The *73 License Guides* are excellent texts on which to base a course.

Once you are there, it's good advertising to arrange the shack as attractively as possible. This is for your convenience, that of the campers, and for the director's guests who are likely to appear during the summer.

The overall programming at these private camps is designed to keep the children "in activity." This means that there may be four to six periods split between the morning and afternoon during which the campers are scheduled to, or elect to, attend various activities. At this point, it's necessary that the director and programming personnel understand the academic nature of theory and Morse code sessions. Since radio is a relatively new thing at a lot of these camps, their tendency is to handle radio like any other activity. As anyone who has pursued a ham license would know, code and theory classes must be presented on a regular basis for best results.

During the first week of camp, the object is to expose as many youngsters as possible to the lure of your activity. For the younger groups, the thrill of talking over the ham radio is certain to stimulate a likely chalk talk of what happened. The older fellows can generally get interested in

The shack at camp, WA8MLG/1. The setup provided many thrilling demonstrations for the campers.

View from the shack window.

demonstrations. For example, try using a small AM broadcast transmitter to transmit campers' voices to a radio. Following this, the campers are inevitably curious to know why the things worked, which leads into a block-diagramming chalk talk.

During the second week, you'll probably be scheduled for the remaining groups and certain "optional periods" during which the campers may appear for additional radio instruction. The second week is also an important one as far as you're concerned. By now you'll be familiar with the aptitudes of the campers and be able to spot the shiny, excited eyes that betray a potential radio addict. Many boys will be inquiring about ham licenses and practicing on their own the ten or so Morse code characters you've taught them.

This is the crucial point that can make or break a good camp radio program. Many campers like to tinker with almost anything, and will add radio to their tinkering lists. Many of this genre will not be gung-ho about getting their amateur tickets, but will want to learn more about electronic gadgetry. The other variety of camper is generally the older group (and the non-athletic type) who go in for the challenge of the code and theory. As I discovered, it is necessary to divide these two different types for separate class sessions. Not only does it preserve your own sanity, but it permits more rapid learning and progress for the campers.

When you do this pen and paper juggling act, there are a couple of things to consider. When you request such a separation for the program, you'll be tampering with the administration's programming, which at some camps is considered sacred. Secondly, by this time you should have some idea of construction projects in mind for the groups. You'll discover that construction projects are almost a necessity. After school's out for the summer, most campers balk at a continual diet of lectures and demonstrations. They want to do things with their hands, something electronic that is workable. So, in addition to the two lecture groups, you'll need two lab sessions, or at least one separate lab for the advanced group.

Projects are a consideration in themselves. For the first group, simple transistor radio kits make a nice project when several weeks are taken to explain and construct them. It's the learn-as-you-build approach that retains their interest. The licensing classes will probably want to try their hands at more advanced things like transmitter or receiver kits. My star pupil did a beautiful job of the Heath HW-16 Novice transceiver. It's also a time for the counselor to recognize his own technical limitations.

After all this is on paper, pack up your wit and persuasion and present it to the administration. Assuming you can be guaranteed definite scheduling for your groups, the next bugaboo is projects. These are

Camper with his completed HW-16.

generally ordered from any radio supply house by phone for fast delivery, with simultaneous financial arrangements with the parents. Out of twenty boys in my group, the parents of only one thought the camper couldn't complete a project. As I mentioned before, parents are pleased to see their children dabbling in electronics.

As far as teaching the program, it's largely up to your own doing. The basic radio group will enjoy demonstrations and lectures on simplified theory in addition to their lab. This group will probably shape the course themselves, with the variety of questions you will have to field. In the licensing classes, it's necessary that it be disciplined enough so that Novice examinations can be given during the last week of camp.

As far as licensing procedures go, it is wise to give the FCC three weeks to handle your 610 forms and volunteer examiner certification. If you are under 21, the ARRL will be glad to supply you with a few addresses of qualified hams near the camp. Write them all, explaining the situation, and invite any takers over for lunch on the day of the exam. I wrote to three amateurs and all three responded affirmatively, and I had the awkward pleasure of refusing two. It only testifies to the helpfulness of the radio fraternity.

In addition to your radio program, you can expect much more from the summer. You'll probably be assigned "bunk duty" which means you'll share bunk supervision with another staffer over ten or so campers of the same age group. I found bunk duty to be a great break from the shack and a fine experience in learning about children and helping them to grow. You'll probably be asked to help set up a PA system occasionally, and maybe even operate a movie projector. There's still plenty of time to enjoy waterfront and sports activities in addition to evening ragchews with the gang back home. On your one day off per week, you are free to tour the surrounding countryside. Above all, the letters you'll receive later on from your summer camp boys will put the icing on the cake. Have a good summer, and good luck!

. . .WA8MLG

THE DOUBLE COAXIAL ANTENNA

John J. Schultz W2EEY
1829 Cornelia Street
Brooklyn NY 11227

A simple antenna form that provides essentially the same performance characteristics as a folded dipole antenna but with direct coaxial-line feed requiring no baluns or other matching devices

The folded dipole antenna is one of the most popular antenna forms used by amateurs. This is still true today, although the folded dipole has declined a bit in popularity over that which it enjoyed in the 1950s. The reason for the decline in popularity is undoubtedly due to the fact that the usual folded dipole cannot be directly fed with a coaxial transmission line. The usual half-wave folded dipole constructed of 300Ω twinlead must be fed with 300Ω transmission line and a balun used at the output of a transmitter having a 50-75Ω coaxial output, or the antenna can be fed with coaxial transmission line and a balun transformer used at the antenna. In either case, a certain amount of inconvenience and expense is involved. Some amateurs simply do not want to add the necessary components to the antenna system and settle for the use of a simple dipole which can be directly fed with a coaxial transmission line.

Anyone who has ever used a folded dipole, however, will usually notice the difference in performance between a folded dipole and a simple dipole. The folded dipole antenna has a much broader bandwidth and far less retuning of a transmitter is required as frequency changes are made within a band. On the higher frequency bands especially, one can often QSY across the entire CW or phone portion of a band without having to touch the output tuning on a transmitter (assuming a relatively low Q transmitter output circuit).

Also tied in with its bandwidth characteristics, the folded dipole seems to be far less sensitive to its physical placement effecting its swr. Thus a folded dipole can be put up in many situations where the antenna legs must be bent or otherwise not run in a straight line and still perform well. A regular dipole erected in a similar situation may well have to be carefully pruned to work well on a narrow portion of a band. Sometimes operators who use a folded dipole after having used a simple dipole claim that the folded dipole performs better. This is usually only true because the simple dipole was not carefully matched to begin with, or the relatively severe frequency bandwidth limitation of a simple dipole made of thin wire was not fully realized.

After the above discussion, the reader may expect that the antenna to be described in this article is some new form of folded dipole. That is actually not the case, although the antenna described does have the performance characteristics of a folded dipole but with a direct coaxial transmission line feed. It basically adapts the desirable features of the folded dipole antenna form to the present day almost universal use of coaxial transmission lines without requiring the use of any impedance matching devices. The antenna form described dates back to at

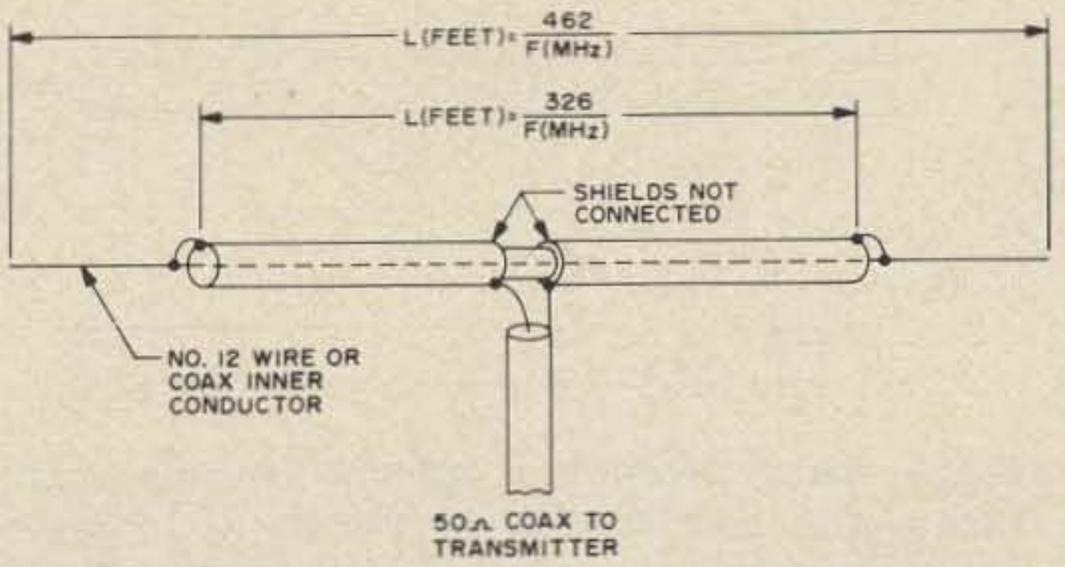


Fig. 1. Basic dimensions of the double-coax antenna.

least WW II days but then most transmitters had balanced outputs and a regular folded dipole was a more convenient antenna form to use.

The basic dimension of the double-coax dipole is shown in Fig. 1. Note that the shield of each coaxial line section in the antenna flat-top is connected to the inner conductor only at the outer end of each section. The shield of each coaxial line section at the center of the antenna is not connected to the inner conductor, but only to the coaxial transmission line.

The electrical operation of the antenna may not be apparent at first glance but it is basically simple. If one forgets for the moment that each coaxial section in the antenna flat-top has an inner conductor, it will be seen that the shield of each section and the wire extension at the outer end of each section form together a simple dipole antenna. Considering then the inner conductor of each coaxial section, each coaxial section forms a shorted stub placed across the dipole terminals. Since each stub is less than 0.25λ long, it produces an inductive reactance. As shown in Fig. 2, the reactance of the shorted stub varies as its effective length varies with frequency and the reactance at the antenna terminals of a simple dipole vary with frequency as the effective length of the antenna changes. The overall result is that over a broad portion of each band, the reactances cancel each other and the input impedance of the antenna remains essentially constant. This is true because the resistive portion of the antenna impedance varies in value slower around the resonant frequency of the dipole than does the reactive component of the impedance.

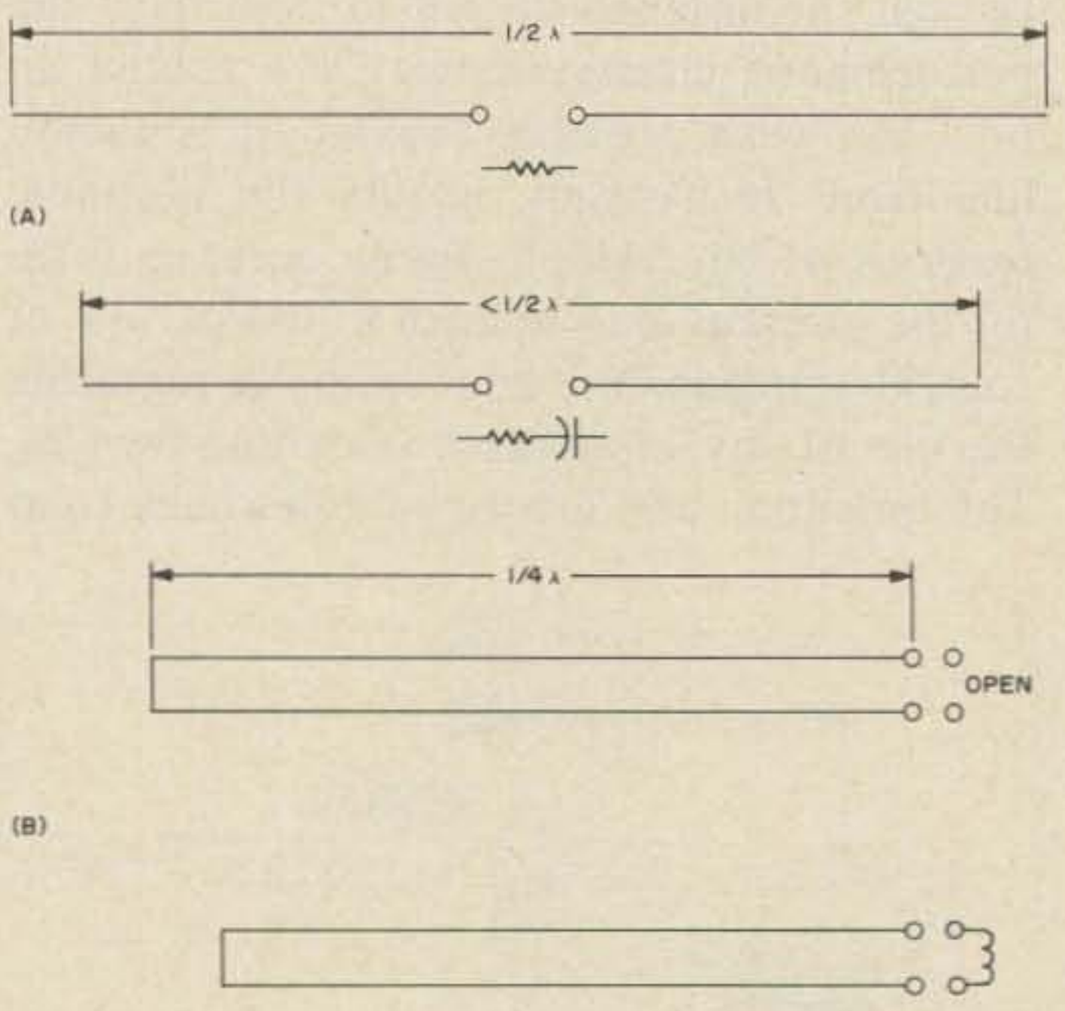


Fig. 2. Basic operation of antenna depends on fact that slightly shorter than ½λ antenna (A) presents capacitive terminal reactance while slightly shorter than ¼λ shorted stub (B) can present compensating inductive reactance.

Construction

The antenna can usually be constructed without the use of any special materials. It is not necessary to use the same type of coaxial cable for the stubs in the flat-top portion of the antenna as is used for the transmission line. Usually, however, it will be convenient to do so. In any case, a 50Ω coaxial tranmission line should be used to feed the antenna.

The center connector for the antenna can be a coaxial tee if care is taken to insulate the necessary portions of the antenna. That is, the shield of one of the coaxial sections in the flat-top will have to be insulated from the coaxial connector going into the tee and connected via an external wire lead to the center conductor of the coaxial transmission line which feeds the antenna. The center pin of the coaxial connector used for the coaxial transmission line into the tee connector also has to be removed.

An alternative to the use of a tee connector is to simply construct a center connector using a small piece of 3 x 3 in. Bakelite, or similar insulating material, as shown in Fig. 3. Simple hardware store U-clamps are used to hold each coaxial line section in place. Once the connector is constructed and wired, it should be thoroughly covered with a good coating of insulating varnish both to prevent the hardware components from rusting and to prevent moisture from entering the exposed ends of the coaxial lines. The use of this type of connector does not require that the length of coaxial line used in the flat-top portion of the antenna be cut in the middle in two pieces. Thus, the flat-top portion of the antenna gains added mechanical strength.

Figure 1 shows the end sections of the antenna flat-top as single pieces of wire. This

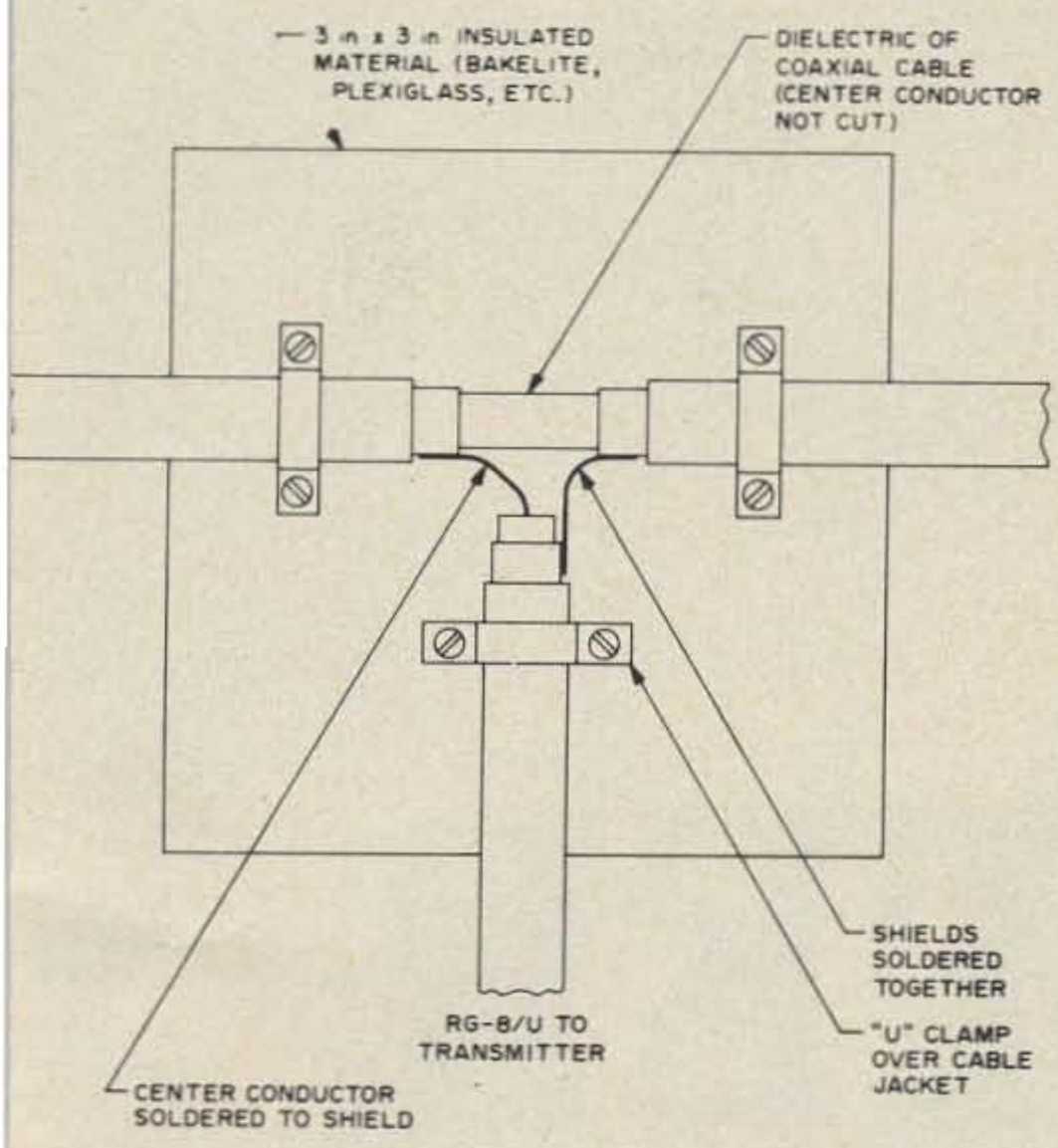


Fig. 3. Simple home-brew center connector for antenna easily interconnects coaxial lines. Finished assembly should be weather protected with varnish.

type of construction will suffice for operation over almost all of every high-frequency band except 80m. The swr will generally be less than 1.5:1 over a band. If some additional "peaking up" is desired to optimize the swr in some portion of a band, this can be done by varying the length of the end sections. Generally, this procedure is not necessary nor will it provide any worthwhile improvement. For maximum bandwidth on 80m, the end sections can be made from a "fan" of several wires joined together at the points where the coaxial sections are shorted. The center wire in the "fan" should have the length of the single wire end section as calculated from Fig. 1.

Summary

It would be nice to claim that the antenna form presented is a new one. Such is not the case, however, although the antenna will be new to many amateurs and should solve many of the operational problems encountered with simple wire dipole antennas. Certainly for the expense of a bit of extra coaxial line, anyone about to construct a single-band dipole antenna should seriously consider the advantages of the double-coax antenna.

...W2EEY

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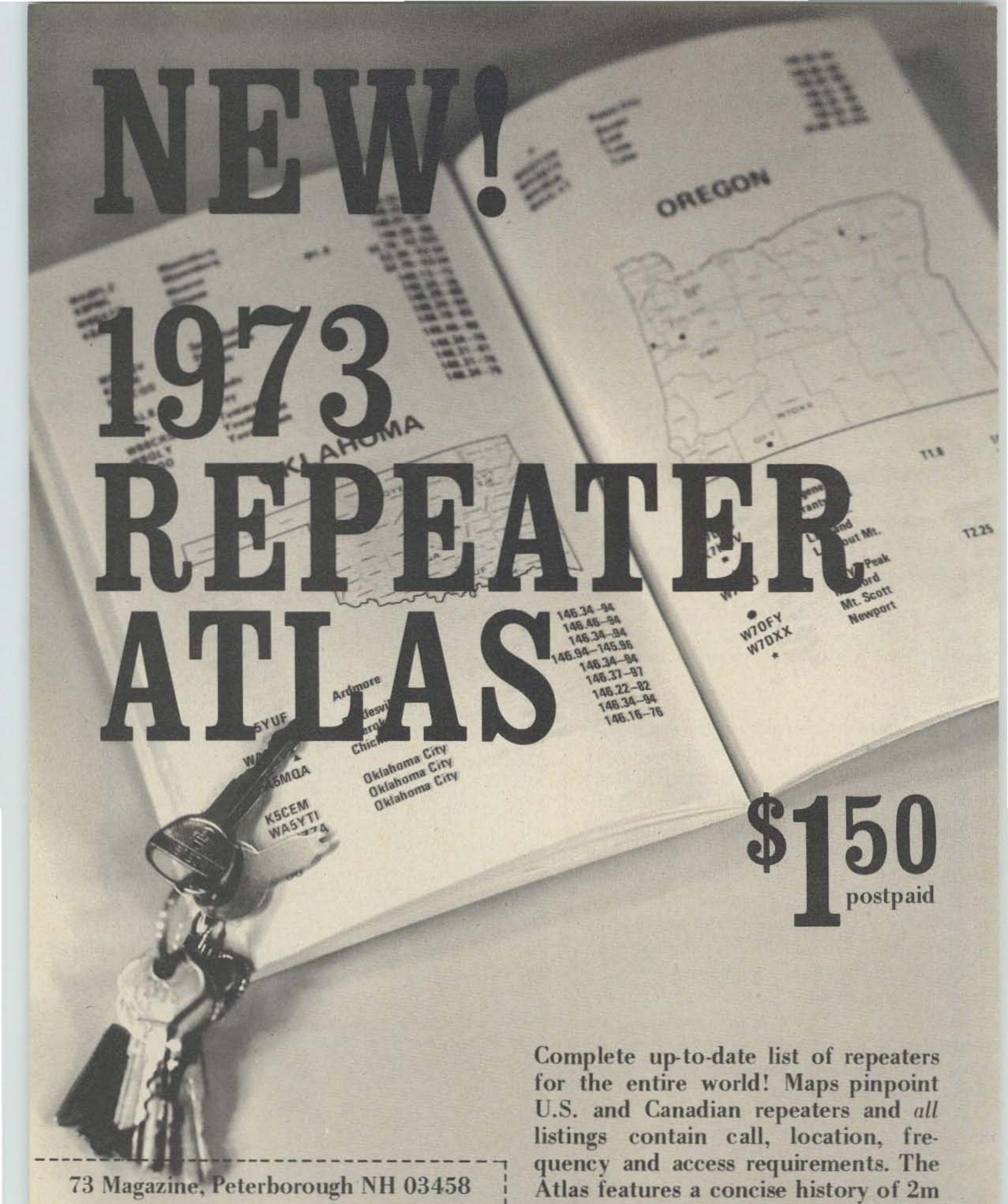

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Curtis Hoffman W1ELU
169 Milham Street
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AN ULTRA-RELIABLE NON-FALSING TONE DECODER

Once a simple repeater has been constructed and debugged it is quite natural to consider the addition of extra receivers, autopatch, etc. To graduate from the simple single receiver transmitter to a complex and sophisticated machine is basically quite simple. The basic holdup in my experience is a simple foolproof method of controlling "extras" in an advanced repeater from the car or base station. The first and most sensible method of remote control is of course in band signaling or tone control. Basic problems exist with this inasmuch as users' voices, touch tone dialing of autopatch units, etc. contain frequencies in the "in band" (300–3000 Hz band). When voices, noise or other undesirable short term energy falls in the pass band of the decoder, unwanted tripping of control circuits occurs. This problem, which is quite real, can cause serious control difficulties to the home-designed and some of the commercially available decoders. Other problems such as temperature, unstable frequency determining elements, critical input level adjustments, high Q LC, ringing problems, etc. discourage most people from ever even thinking about tone control for repeater or other voice channel operation. As black as the tone control picture appears from above, useable and very reliable control can be utilized by careful design and the use of modern micro circuits.

The circuit to be described is a design which has been in use in many amateur repeaters, fire department radio control of town sirens, and call up of auxiliary firemen. The heart of the decoder is a recently available micro circuit, a Signetics NE 567. Within its little 8 pin DIP body lies approximately 60 transistors. They function as a highly stable phase locked loop with detection and logic output circuitry. Frequency and bandwidth are independently adjustable externally. With the pot shown between pins 5 and 6 of the NE 567 the frequency is adjustable between 500 and 3000 Hz. The internal oscillator is available at pin 5 so decode frequency can be set very accurately with the use of a digital counter. Pin 8 provides an output transistor from the decoder; when a signal is being decoded, the output transistor conducts turning off Q1. The 270K resistor and 2 μF capacitor form a time constant of approximately 1 second. With Q1 off, the C charges. If and only if the decoded tone remains for 1 second will the voltage in the 2 μF reach the firing point of Q2, a unijunction. If the tone does not remain for a full second, the output transistor in the NE 567 turns off and in turn Q1 conducts, discharging very rapidly the 2 μF capacitor. Using this method of non linear integration, transients, voice peaks, etc. cannot trip the decoder. A steady frequency stable tone of 1 second duration is all that

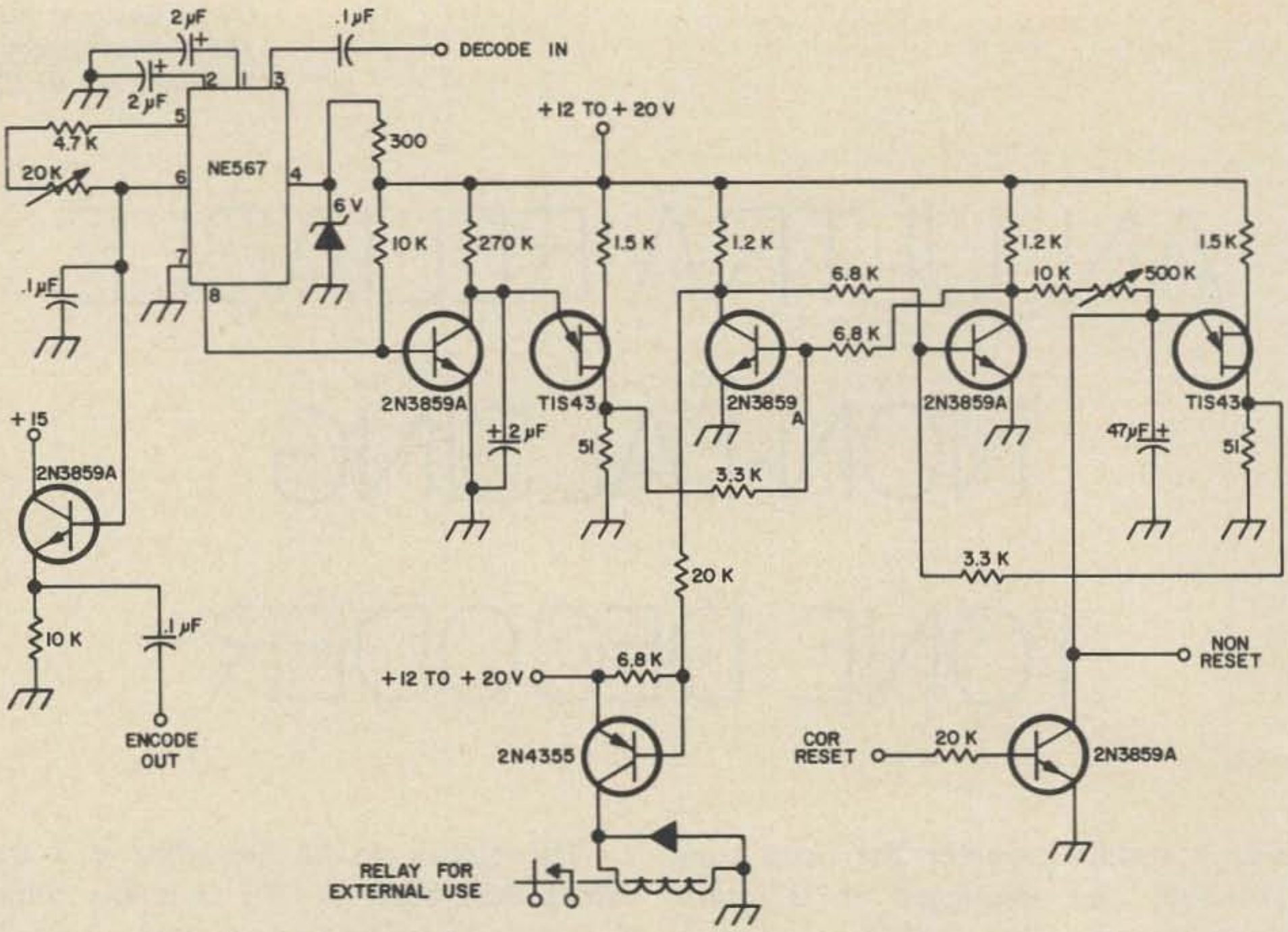

Fig. 1. Schematic. All transistors 2N3859A unless specified otherwise.

can fire Q2. When Q2 fires, it pulses the base of Q3 which with Q4 forms a flip-flop. Q3 conducts causing Q4 to open. A time constant formed by the 10k, 500k pot and the 47 µF capacitor will then begin to charge. When the firing point of Q5, another unijunction, is reached a pulse will be delivered to the base of Q4 resetting the flip-flop to its original state. If the COR input to Q8 is made positive any time during the charging of the 47 µF capacitor it will be dumped very quickly and will not allow the flip-flop to be reset by the unijunction. In this way, a function can be "toned" in and kept in operation until no COR is produced by the repeater or other device for a set period of 1–30 seconds. If a function is to be kept on (or off) by the decoder, pin 6 can be grounded, thus not allowing the reset timer to work. Pins 3 and 4 provide normally open contacts that close when tone is decoded. These contacts will open when reset timer resets the flip-flop or Q4 collector is grounded by external means. Q6 is an emitter follower providing low impedance tone output from the NE 567 chip. This output can be used to encode another unit similar to the one described, such as mobile to mobile tone burst applications.

Another use for this feature being put into use locally is to control voice coil connections with the relay RLY1 so that base station monitoring of a crowded repeater channel is endurable. When someone wishes to communicate with a so equipped station, a 1 second tone burst is all that is required to open the speaker. Using the timed turn off option, messages can be left on a tape recorder via a repeater without using excessive tape. One of these decoders was recently put into use to access an autopatch on a small private repeater. This provided a quickly constructed full autopatch hookup for a group that did not want to get involved with large "open" repeaters.

These boards completely assembled and tested are available from *Hoffman Electronics, 169 Millham Street, Marlboro MA 01752.* The cost including postage within the U.S. is $35.00. No COD's. I think you'll find this decoder circuit a joy to use and as indispensable in repeater operation as "COR's."

. . .W1ELU

J. L. Iliffe VE3CES
1159 Flagship Drive
Mississauga, Ontario
Canada

AN AMPLIFIED, CALIBRATED, SIGNAL STRENGTH METER

Tune quads, coils, mobile whips, all sorts of things with this simple resettable device.

Recently, I had the problem of tuning a four element quad. As you may or may not be aware, these beasties are supposed to be tuned from the rear for minimum signal. A quick check showed none of my friends had a signal strength meter, so I prepared to degrade myself and buy one. A look at a few prices convinced me to build.

Since I wanted some other information on the quad, like front to back ratio and the effect of more or fewer elements, I decided to add a calibrated attenuator and enough gain to make a fairly wide input range. It also had to be cheap!

The result is shown in Fig. 1.

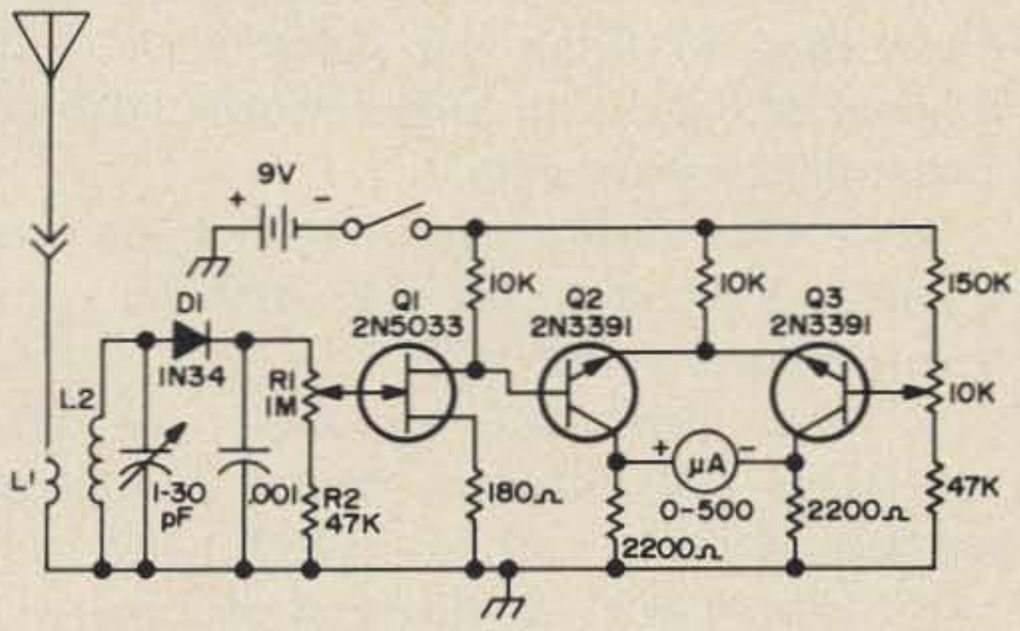

Fig. 1. Diagram of the field strength meter.

To use the normal rf attenuator method of switched T-pads requires complicated shields and quite a few resistors. Also the attenuator has to be terminated in its characteristic impedance to read correctly. To bypass this problem I first detect the rf, then attenuate the dc. This has the added advantage that the circuit is no longer frequency sensitive.

The incoming rf is tuned by C1-L2. C1 can be any small variable. I used both sections of a dual 15 pF because my local surplus store has them for 60¢. For VHF use only 1 section.

L2 is wound on a plastic pill bottle about 1" in diameter and tapering to 7/8". To cover 13–24 MHz, I used 11 turns spaced over about an inch. L1 is 2 turns over top of L2. I tried bandswitching with another pill bottle fastened on the other side of the shield from L2. The idea was to bandswitch another frequency range but I find it more convenient to wind on coils as needed. Use the grid dipper to get you in the ballpark. I have used this meter as high as 72 MHz without trouble. D1 can be any diode. I used a 1N34 because I could then specify it and know it would work, but I tried a computer type which also worked. If you prefer the meter to peak rather than dip, reverse D1.

Rectified rf from D1 is put on the top of R1, the calibrated attenuator. R2 in series with R1 gives the 0 dB point at its junction. For a 30 dB range, R2 is 47K if R1 is 1 MΩ This doesn't quite fill the range but is close. Changing the value of R2 will change the

range but 30 dB is considerably more than the F/B ratio of most beams.

Q1 is a 2N5033 FET. The high input impedance of Q1 allows us to set the calibration of R1 directly by dc voltage measurements on the VTVM since it does not draw any base (gate) current. It is a p-channel device. If you use an n-channel type you will have to change the entire biasing of the circuit and also reverse D1.

Q2 and Q3 form a differential amplifier to drive the meter. Q2 is necessary to avoid loading Q1 and I had quite a bit of trouble balancing the meter against battery voltage changes until I added Q3. It will now operate from 8.5–9.2 volts with no trouble. The 10K pot in Q3's base centers the meter. The meter I used is a 250 μA tuning meter with no markings on it except a red/white/blue bar. This is all you need since we calibrate on R1, not the meter.

Operation

The meter is quite sensitive and with a two foot antenna I could get a reading several hundred feet behind my quad at 60 watts input. First tune the input (which is quite sharp) with the attenuator set at zero. This is the least sensitive position. Now set the meter for a convenient reading near the center scale with the incoming signal still on using R3. Adjust your antenna. When you feed it power again the reading will not be quite on scale on the meter but turning up R1 will allow you to put the meter back to the original position. Do not touch R3. The reading on R1 is now the increased gain in dB needed to bring the signal back to its original strength. In other words, the decrease in signal strength.

Note that during measurements you need a received signal to use R1. With no signal the meter will be off scale.

I have also used the meter to align oscillators and doublers in my two meter receiver. A probe can be made for this from two turns of wire on the end of a piece of coax. The high gain available allows the pickup loop to be quite far away which reduces detuning. Adjustments show up well on the meter.

. . .VE3CES

Paul L. Rinaldo K4YKB
1524 Springvale Avenue
McLean, VA 22101

NICKEL-CADMIUM BATTERY PACK FOR PORTABLE FM

The nickel-cadmium battery pack described in this article was designed to match my two meter transceiver. This home brew project was undertaken to equip the transceiver for portable operation in the field away from the car or ac power. The construction mainly involves cutting and bending sheet aluminum. The entire project can be completed in about three or four evenings.

Considerations

My unit is a 12-channel, solid state FM transceiver capable of 10 watts of rf output. My transceiver case measures about 3½" x 8" x 7½" and it weighs about 8½ lbs. It operates to full specifications at 13.8V dc and gracefully degrades as the voltage is decreased. Measured current requirements are 2.5 A transmit, 220 mA standby and an average of about 220 mA receive.

Overall, the electrical characteristics of the unit lend themselves to battery operation, except for the relatively high battery drain in the receive and standby conditions. The drain can be reduced by about 120 mA by switching off the pilot lamps.

The station junk box was the source of 10 size D nickel-cadmium cells which were saved for such an occasion. These cells are mounted in a plastic "egg crate" measuring 7½" x 3" x. 2½". Fortunately, the plastic

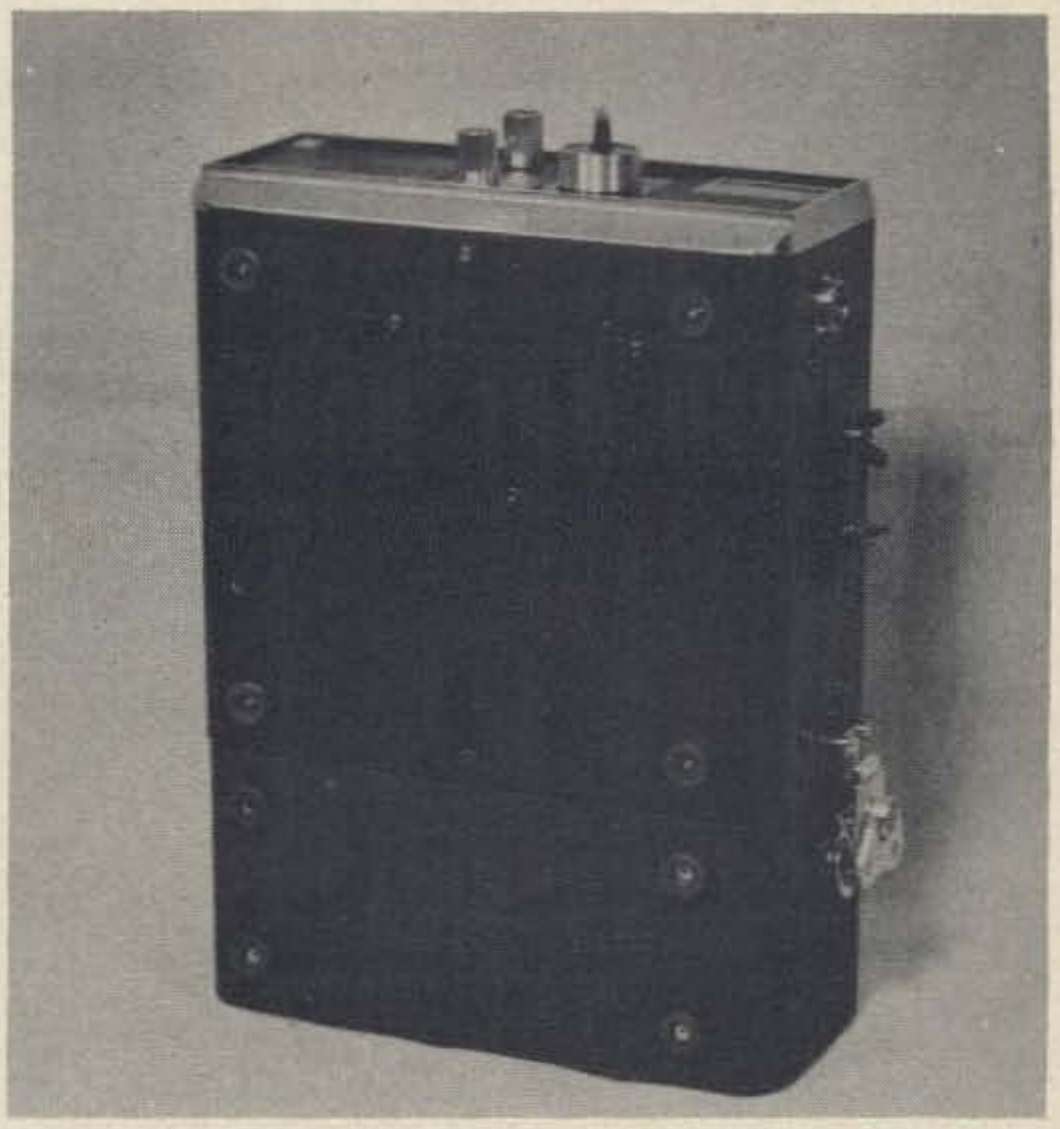

Photo 1. Bottom view of transceiver and nickel-cadmium battery pack.

container proved to be a perfect fit for the outline dimensions of the transceiver. The same is true for F cells which have the same diameter as the D cell but are somewhat longer. The capacity of a nickel-cadmium F cell is 6.5 Ah at the 5-hour discharge rate, while that of the smaller D cell is 4.0 Ah. Although the larger F cells were preferred, none could be located at low or no cost. So the D cells were used.

Construction

The basic box is constructed of 0.063-inch thick sheet aluminum. The top consists of a sheet folded at right angles 1½" from each end to match the top of the transceiver cabinet. The length of the top is 3½".

The bottom of the battery box is somewhat difficult to form using tools available to the amateur. So, after some experimenting, I elected to cut the top and bottom covers so that they just meet. The joint was made by mounting a 3½" x 3/4" aluminum strip inside the seam. The bottom of the strip is secured to the bottom cover by means of two aluminum rivets. The top of the strip is joined to the top cover with two small metal screws. Like the top cover, the bottom cover is cut to a length of 3½". The difficulty with the bottom cover is bending the corners to match the transceiver outline. The start and finish of each bend were first determined by measuring the transceiver bottom cover by making pencil marks on masking tape. These marks were then transferred to the aluminum sheet to be bent. Numerous slight bends were then made between these marks until the original bend was virtually matched. An aluminum break was used. An expedient is to use a bench vice and several pieces of hard wood.

The back cover of the battery box (not shown in the pictures) is a flat sheet of aluminum with the corners rounded to conform to the outline of the case. The back cover is secured by 4 machine screws that mate with nutplates riveted to the top and bottom covers.

The front panel is formed from sheet aluminum cut to size. The four corners are cut off diagonally, and the last 1/2" margins on all sides are folded at right angles. A chassis receptacle and guide pin are mounted on the front panel to mate with the rear panel of the transceiver. The battery box front panel is secured to the top and bottom covers by four metal screws.

The plastic "egg crate" needs to be cut down on two of its corners to conform to the rounded corners of the bottom cover of the battery case. A power drill and sanding disc can be used. Depending on the length of the metal screws used to complete the seam between the top and bottom covers, it may be necessary to cut an additional groove on each end of the "egg crate." When the batteries are inserted and the battery box is assembled, the "egg crate" is held securely around the edges by the folded margins of the front panel and the nutplates used to mount the back cover.

Finishing

After the aluminum work is finished, the corners and edges should be filed smooth. Emery cloth is used to remove any scratches, and a buffer may then be used if one is available. Before painting, it is important to remove all dirt and grease. This is best done by taking the aluminum parts to a shop with anodizing or other suitable finishing process. A fair substitute is to clean the aluminum with alcohol. After the aluminum is cleaned, it should not be touched with the hands and should be painted as soon as possible.

A search of the local paint stores and a few random inquiries failed to turn up an answer on how to match the paint used on my rig. Apparently, it is a sputtered semi-gloss epoxy enamel. Rather than to prolong the search, black wrinkle varnish was used

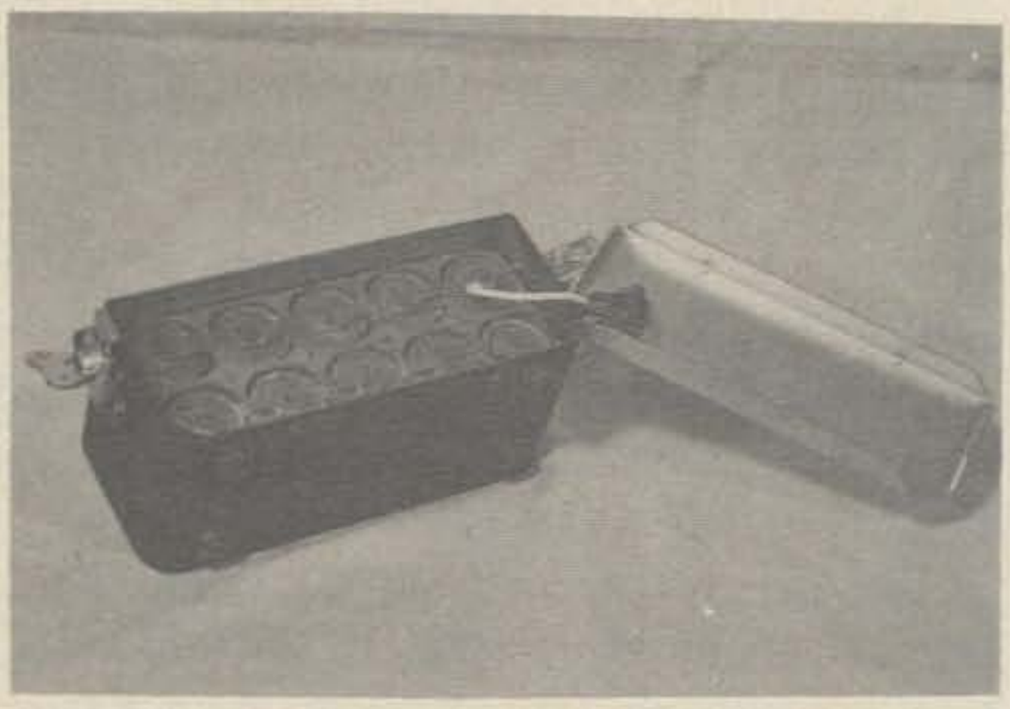

Photo 2. Nickel-cadmium battery pack with front panel open to show individual cells in their plastic "egg crate."

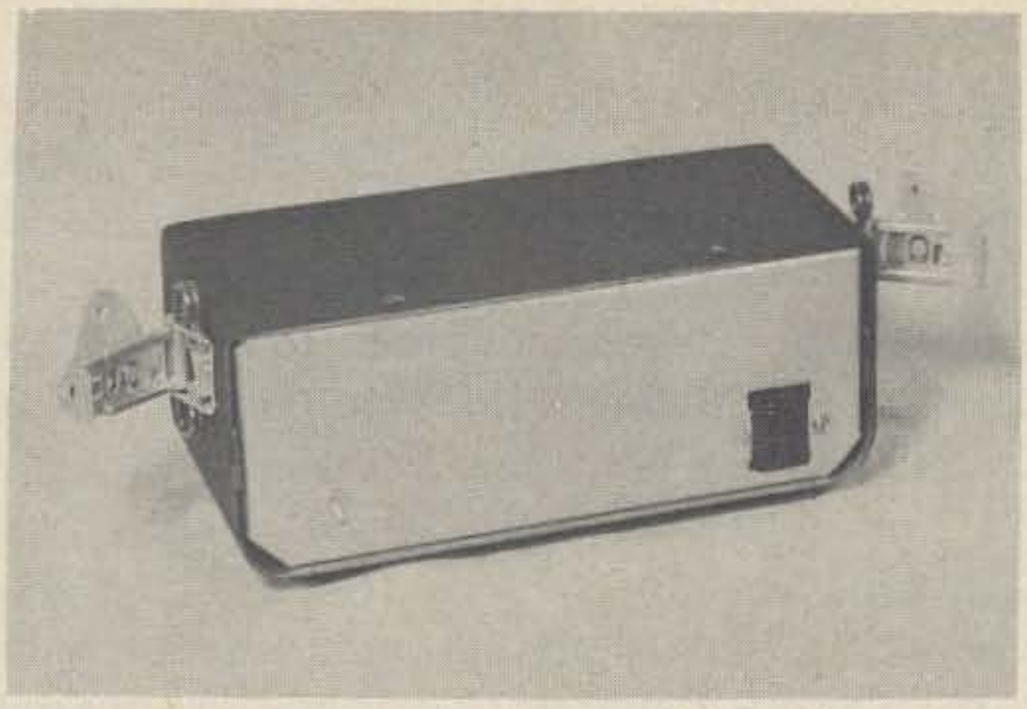

Photo 3. Nickel-cadmium battery pack front panel showing 6-pin "Jones" receptacle and guide pin.

on all parts of the battery box except for the front panel. The painted parts were baked in a 250° oven for 15 minutes.

Following the painting, four rubber bumpers (feet) are riveted to the bottom cover. Rivets are used because the "egg crate" does not leave enough room for the nut and screw normally supplied with the bumpers.

Wiring of the receptacle is simple. Heat-shrinkable tubing is used to cover each solder connection.

The final touches are the addition of the guide pin and catches on the sides of the battery box. Suitable catches are somewhat hard to find in the usual electronics or hardware stores. The catches used were from someone else's junkbox, and their origin is unknown.

Charging

Nickel-cadmium D cells (when fully discharged) should be charged for 14 hours at a constant-current rate of 400 mA. When discharged, the voltage is about 1.0 to 1.1 volt per cell. Near the end of its charging cycle, the voltage is 1.35 to 1.45 volt per cell. After settling down after a charge, the voltage should be nominally 1.25 volt per cell. If you have one in the shack, a dc bench supply with voltage and current meters can do a nice job of charging nickel-cadmium batteries. Or, a small battery charger could be built from available parts.

An ac power supply can be used as a constant-voltage charger for the nickel-cadmium batteries. When the battery is initially placed on charge, the charging current is high. The current tapers to a trickle as the battery approaches end of charge.

Switching Lamps Off

Because the two pilot lamps used in the transceiver draw about 120 mA, it is desirable to eliminate this drain when operating from batteries. A ground rule for the switching scheme was that this be a "no holes" modification to maintain the resale value of the transceiver. After some thought, a magnetic proximity reed switch was chosen. An SPDT type was selected and wired so that the lamps would be normally on. The reed switch is mounted on a small aluminum bracket and is located immediately behind the front panel just below the panel meter. To turn off the lamps a bar magnet is placed over that section of the front panel. Some rubber cement helps the magnet stay in place yet leaves no permanent residue.

If you have never worked with magnetic reed switches, a word of caution is in order. If you plan to bend the leads, long-nose pliers should be used to hold the wire to provide some relief to the delicate glass envelope.

Results

In theory, if you use the battery on an 80/10/10% (standby/receive/transmit) basis, the power required for one hour of operation should be as follows:

48 min, 80% standby (.8h x .08A) = 0.64 Ah
6 min, 10% receive (.1h x .10A) = 0.01 Ah
6 min, 10% transmit (.1h x 2.5A) = 0.25
Total for 1 hour of operation = 0.90 Ah

Thus, if you divide 0.9 Ah required for 1 hour of operation into the total of 4.0 Ah available from the battery, the battery life should be 4.4 hours per charge. However, most (alas not all) amateurs listen much more than the arbitrary 80/10/10 formula would suggest. So far, an average of 6 hours operation per charge has been obtained.

Summary

This battery pack can be constructed by the average amateur in several evenings. It will operate the average FM rig for more than 4 hours in the field or during emergency power outages. The construction techniques are straightforward and may be modified to suit other solid state equipment.

. . . K4YKB

Irving M. Gottlieb W6HDM
931 Olive St.
Menlo Park CA 94025

An Ohmmeter that develops only 250 mV accross its terminals will take the headaches out of checking circuitry that fools the average VOM.

AN OHMMETER FOR SOLID-STATE CIRCUITS

It might appear neither relevant nor timely to state that an instrument for making quick resistance-measurements is indispenable in servicing and development work. It certainly is true that the VOM and the electronic meter have been with us for many a moon. And look at the recent sophistications and improvements – tautband meters, VOM's with 20,000Ω per volt and even greater sensitivities, FET "front ends," digital VOM's, etc. Quick resistance-measurements, indeed! *Where is the problem?*

Have you ever tried to trouble-shoot a PC board loaded with semiconductor devices as well as resistors, capacitors, and maybe inductors, transformers, and you-name-it? Chances are it proved deceptively difficult because the 1½V developed between the test prods of the ohmmeter forward-biased various PN junctions, thereby making resistance measurements questionable, indeterminate, and downright bewildering. Oh sure, reversing the polarity of the prods can pay dividends, but in a complex circuit it is often only possible to make limited progress in this way. Besides, it is a pain in the neck because one has to constantly analyze and practically redesign the circuit in order to ascertain which way the prods should be applied.

How much nicer it would be to be able to move nimbly from point to point, or component to component, and not have to worry about the shunting action of PN junctions. For example, consider the typical audio amplifier. Suppose the circuit is inoperative and it is desired to check all components with the ohmmeter. We could remove all of the semiconductor devices and then apply the ohmmeter test prods to the remaining components. In this way a bad or wrong-valued resistor could be readily found, as could a leaky or otherwise defective capacitor. If none of the remaining board-components are faulty, we could then concentrate on the semiconductors (or for that matter, the semiconductors could be checked first).

The only trouble with the above procedure is that the semiconductors are often *soldered in place.* Removing them is very time-consuming and more likely than not, thermal damage will be inflicted as one's patience depletes during extrication of a stubborn element. There just has to be a better way! One can purchase a VOM or electronic meter with much less than six-hundred millivolts developed between the test prods. Such an instrument will ignore healthy solid-state elements, greatly facilitating test procedure.

Another way to fly is to rapidly and inexpensively construct a special ohmmeter

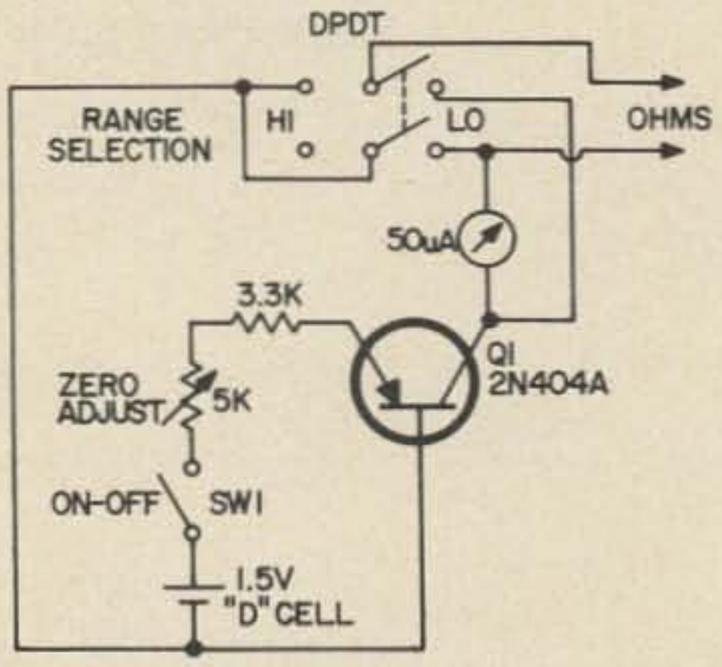

Fig. 1. Schematic circuit of the ohmmeter for solid-state circuits. Transistor Q1 need not be a 2N404A. Any small signal PNP germanium type will work.

for testing solid-state circuits. I have developed a simple but effective ohmmeter which I will now describe.

Figure 1 shows the circuit of the low-voltage ohmmeter. Only about 250 mV are developed across the test prods, far below the value capable of forward-biasing silicon junctions in solid-state devices. But what have we here? A dc current meter is in the collector-base circuit of a transistor connected in the common-base configuration. Emitter-base bias is provided by B1, but look as one may, there is no obvious source of collector bias. Nor is there any subtle or tricky current path for polarizing the collector. How then can the transistor deliver current to the meter? Actually, this is a valid way of utilizing the characteristics of a transistor. Although infrequently encountered, a transistor so employed is capable of providing collector current with zero-applied collector voltage! In so doing, the transistor develops about 250 mV between collector and base (this is the maximum voltage available at the test prods). Although this mode of transistor operation is not generally useful, it is just what the doctor ordered for our purpose. It should, however, be realized that a *germanium* transistor such as the 2N404A must be used.

Other than the unique current-source for the microammeter, this ohmmeter operates in the same manner as conventional instruments. Note the range switch, SW2, enables the meter to be used as a shunt-type ohmmeter for the low range, or as a series-type ohmmeter for the high range.

Popular 20,000Ω per volt VOM's employ 50 μA meter movements which have an internal resistance in the vicinity of 5000Ω. On many of these instruments, a 50 μA current-measuring function is provided. However, rather than clutter up the already congested scales of such meters with additional markings, it would appear desirable to make a conversion table relating microamperes to ohms. Inasmuch as this introduces an inconvenience during test procedures, the best bet is probably to obtain a 50 μA dc current meter. Then one is free to inscribe high and low ohms calibrations as shown in Fig. 2. This drawing is intended as a general guide and is very approximate. So-called 5000Ω meters will vary considerably in actual resistance and it would not be practical to provide a universal template for transferring scale markings to meters. Meters also vary in linearity and accuracy. It is much better to calibrate the individual meter even though accuracy may not be the primary goal in a meter for generalized trouble-shooting.

With regard to scale calibration of the meter face, the ensuing procedure is a straightforward way to get a reasonable start. Acquire *pairs* of the following 5%, ½W, composition resistors: 10, 100, 1000, 10K and 100KΩ. According to the way each pair is used (parallel, singly or series) we then have *at least* the following calibration values:

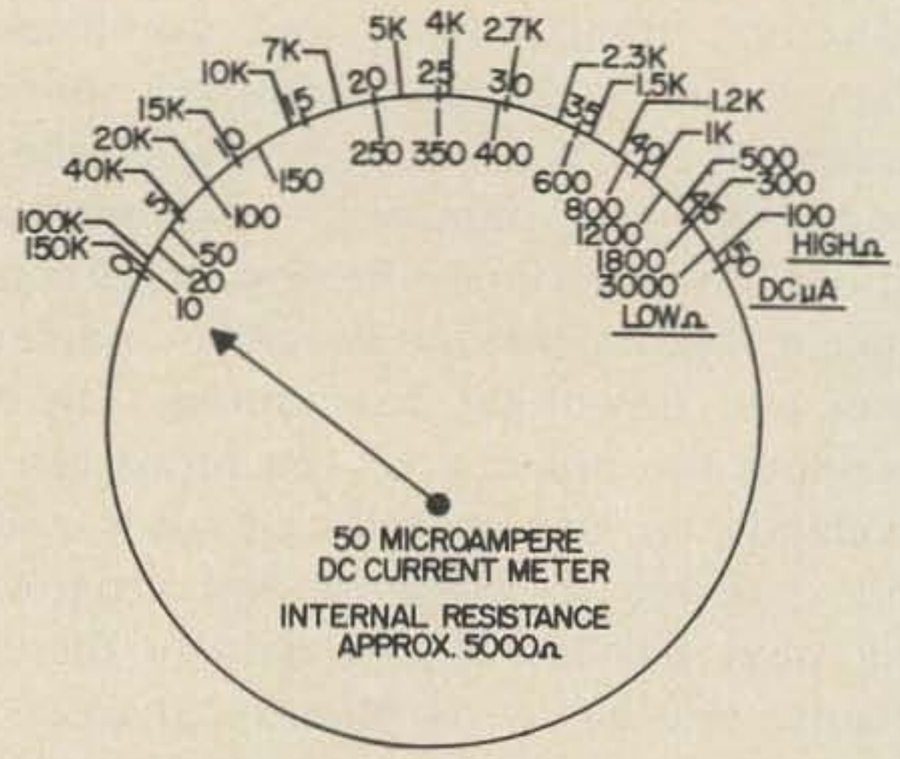

Fig. 2. Approximate appearance of high and low range ohms scales. To be used only as a guide. Actual calibration is made with the use of known resistances.

5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5K, 10K, 20K, 50K, 100K, 200K. By appropriate combinations of different values, one readily comes up with such values at 70, 700, 7000Ω, etc., or approximately 14, 140, 1400, etc. Additional resistors can be obtained for more extensive calibration. Decade values are the most useful. Caution should be exercised in any attempt to interpolate calibration markings – this just is not easy to do on a scale as nonlinear as that of an ohmmeter. Two scales are calibrated on the meter face, one for the high ohms-range, and the other for the low-ohms range. The extremes of the high range are 100Ω and 150K. The 150K marking is close to the zero of the 50 μA scale. The extremes of the low range are 10Ω and 3K. The 3K marking is close to the "50" of the 50 μA scale. When calibrating, frequently check the zeroing of the meter. This is accomplished by means of R1. On the high range, an exact full-scale meter-deflection must exist with the test prods *shorted*. On the low range, an exact-full-scale meter-deflection must exist with the test prods *apart*.

The total measurement range of this ohmmeter is ten to one-hundred thousand ohms with useful estimates possible somewhat beyond this range. It happens that such a range is adequate for the majority of tests in solid-state circuits. Although megohm resistance values are occasionally encountered, the pronounced tendency is for the resistances to range from several tens of ohms to several tens of kilo-ohms.

To use the ohmmeter simply place switch SW1 in its ON position and zero the meter (full-scale deflection, or 50 μA on the current scale) by means of R1. If range switch SW1 is on "high-ohms," zeroing is accomplished with the test prods shorted. If SW2 is on "low-ohms," zeroing is accomplished with the test prods apart. As with a conventional ohmmeter, ascertain that no voltage sources are active in the circuitry to be tested. In using this ohmmeter, the circuit can be investigated without regard to the polarity of the test prods. This applies to electrolytic capacitors and to all semiconductor devices, except tunnel diodes. In the vast majority of test procedures using this ohmmeter, it will be unnecessary to remove solid-state devices in order to make meaningful resistance tests of the associated passive-circuitry. Possible exceptions can occur with germanium devices. In the case of germanium transistors, one can revert to the technique of reversing the polarity of the test prods. Germanium tunnel-diodes, however, should have one lead disconnected in order to free circuit tests from the effect of their conductivity. Most modern circuit-boards tend to have silicon devices. In addition to ignoring the junctions of bipolar transistors, this ohmmeter will ignore the junctions of common signal-diodes, rectifier diodes, zeners and varactors. A similar statement applies to the gates of FET's, the emitters of UJT's, and the entire family of SCR devices, including TRIACS. Insofar as I have been able to determine, one should likewise be able to ignore the presence of most IC modules. Because of the great variety and the rapid evolution of IC's, some reservation is purposely held here.

A minor, but important, detail to remember when using this ohmmeter: do not forget to *turn off SW1 when the instrument is not being used.* Whether used alone, or in conjunction with conventional ohmmeters, this low-voltage ohmmeter can add a new dimension of ease in working with solid-state circuitry. Although one need not go overboard in attaining calibration-accuracy, an interesting characteristic should be mentioned for the benefit of those who would like to exert some effort to achieve high accuracy. Unlike the ohmmeter in conventional VOM's, the precision of this ohmmeter will not be adversely affected by the aging of the cell, B1. An increase in the internal resistance of B1, or reduction of its terminal voltage or current capacity will only manifest itself as a nuisance in requiring more frequent zero-adjustments. But any time the meter remains zeroed over a measurement interval, precision will be maintained regardless of the position of the zero-adjust control, R1. If one starts out with a fresh cell, many months of stable operation should be had, providing the admonition to turn off SW1 is heeded when the ohmmeter is idle.

...W6HDM

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FCC RULES AND REGULATIONS, PART 97 (I)

Starting this month, 73 will run the complete, most up-to-date text of the FCC Rules & Regulations, Part 97, pertaining to the amateur radio service. The subparts and sections reprinted each month will be listed at the head of each installment.

CONTENTS THIS MONTH

Subpart A—General

Subpart B—Amateur Operator and Station Licenses

OPERATOR LICENSES

OPERATOR LICENSE EXAMINATIONS

SUBPART A—GENERAL

§ 97.1 Basis and purpose.

The rules and regulations in this part are designed to provide an amateur radio service having a fundamental purpose as expressed in the following principles:

(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.

(b) Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

(c) Encouragement and improvement of the amateur radio service through rules which provide for advancing skills in both the communication and technical phases of the art.

(d) Expansion of the existing reservoir within the amateur radio service of trained operators, technicians, and electronics experts.

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

§ 97.3 Definitions.

(a) *Amateur radio service.* A radio communication service of self-training, intercommunication, and technical investigation carried on by amateur radio operators.

(b) *Amateur radio communication.* Noncommercial radio communication by or among amateur radio stations solely with a personal aim and without pecuniary or business interest.

(c) *Amateur radio operator.* A person interested in radio technique solely with a personal aim and without pecuniary interest, holding a valid Federal Communications Commission license to operate amateur radio stations.

(d) *Amateur radio license.* The instrument of authorization issued by the Federal Communications Commission comprised of a station license, and in the case of the primary station, also incorporating an operator license.

Operator license. The instrument of operator authorization including the class of operator privileges.

Station license. The instrument of authorization for a radio station in the amateur radio service.

(e) *Amateur radio station.* A station licensed in the amateur radio service embracing necessary apparatus at a particular location used for amateur radio communication.

(f) *Primary station.* The principal amateur radio station at a specific land location shown on the station license.

(g) *Military recreation station.* An amateur radio station licensed to the person in charge of a station at a land location provided for the recreational use of amateur radio operators, under military auspices of the Armed Forces of the United States.

(h) *Club station.* A separate amateur radio station for use by the members of a bona fide amateur radio society and licensed to an amateur radio operator acting as the station trustee for the society.

(i) *Additional station.* Any amateur radio station licensed to an amateur radio operator normally for a specific land location other than the primary station, may be one or more of the following:

Secondary station. Station licensed for a land location other than the primary station location, i.e., for use at a subordinate location such as an office, vacation home, etc.

Control station. Station licensed to conduct remote control of another amateur radio station.

Auxiliary link station. Station, other than a repeater station, at a specific land location licensed only for the purpose of automatically relaying radio signals from that location to another specific land location.

Repeater station. Station licensed to automatically retransmit the radio signals of other amateur radio stations for the purpose of extending their intracommunity radio communication range.

(j) *Space radio station.* An amateur radio station located on an object which is beyond, is intended to go beyond, or has been beyond the major portion of the earth's atmosphere. (Regulations governing this type of station have not yet been adopted and all applications will be considered on an individual basis.)

(k) *Terrestrial location.* Any point within the major portion of the earth's atmosphere, including aeronautical, land, and maritime locations.

(l) *Space location.* [Reserved]

(m) *Amateur radio operation.* Amateur radio communication conducted by an amateur radio operator from an amateur radio station. May include one or more of the following:

Fixed operation. Radio communication conducted from the specific geographical land location shown on the station license.

Portable operation Radio communication conducted from a specific geographical location other than that shown on the station license.

Mobile operation. Radio communication conducted while in motion or during halts at unspecified locations.

(n) *Remote control.* Control of transmitting apparatus of an amateur radio station from a position other than one at which the transmitter is located and immediately accessible, except that direct mechanical control, or direct electrical control by wired connections, of an amateur radio transmitter from a point located on board any aircraft, vessel, vehicle, or on the same premises on which the transmitter is located, shall not be considered remote control within the meaning of this definition.

(o) *Control link.* Apparatus for effecting remote control between a control point and a remotely controlled station.

(p) *Control operator.* An amateur radio operator designated by the licensee of an amateur radio station to also be responsible for the emissions from that station.

(q) *Control point.* The operating position of an amateur radio station where the control operator function is performed.

(r) *Antenna structures.* Antenna structures include the radiating system, its supporting structures, and any appurtenances mounted thereon.

(s) *Antenna height above average terrain.* The height of the center of radiation of an antenna above an averaged value of the elevation above sea level for the surrounding terrain.

(t) *Transmitter.* Apparatus for converting electrical energy received from a source into radio-frequency electromagnetic energy capable of being radiated.

(u) *Effective radiated power.* The product of the radio-frequency power, expressed in watts, delivered to an antenna, and the relative gain of the antenna over that of a half-wave dipole antenna.

(v) *System network diagram.* A diagram showing each station and its relationship to the other stations in a network of stations, and to the control point(s).

(w) *Third-party traffic.* Amateur radio communication by or under the supervision of the control operator at an amateur radio station to another amateur radio station on behalf of anyone other than the control operator.

(x) *Emergency communication.* Any amateur radio communication directly relating to the immediate safety of life of individuals or the immediate protection of property.

[*§ 97.3 revised eff. 10-17-72, and (w) & (x) added eff. 12-1-72; VI(72)-1*]

SUBPART B—AMATEUR OPERATOR AND STATION LICENSES

Operator Licenses

§ 97.5 Classes of operator licenses.

Amateur extra class.
Advanced class (previously class A).
General class (previously class B).
Conditional class (previously class C).
Technician class.
Novice class.

§ 97.7 Privileges of operator licenses.

(a) *Amateur Extra Class and Advanced Class.* All authorized amateur privileges including exclusive frequency operating authority in accordance with the following table:

Frequencies	Class of license authorized
3500–3525 kHz	Amateur Extra Only.
3775–3800 kHz	
7000–7025 kHz	
14,000–14,025 kHz	
21,000–21,025 kHz	
21,250–21,270 kHz	
3800–3890 kHz	Amateur Extra and Advanced.
7150–7225 kHz	
14,200–14,275 kHz	
21,270–21,350 kHz	
50–50.1 MHz	

(b) *General Class and Conditional Class.* All authorized amateur privileges except those exclusive frequency operating privileges which are reserved to the Advanced Class and/or the Amateur Extra Class.

(c) *Technician class.* All authorized amateur privileges on the frequencies 50.1–54.0 MHz and 145–148 MHz and in the amateur frequency bands above 220 MHz.

(d) *Novice class.* Those amateur privileges designated and limited as follows:

(1) The power input to the transmitter final amplifying stage supplying radio frequency energy to the antenna shall not exceed 75 watts, exclusive of power for heating the cathode of a vacuum tube(s).

(2) Radio telegraphy is authorized in the frequency bands 3700–3750 kHz, 7100–7150 kHz (7050–7075 kHz when the terrestrial location of the station is not within Region 2), 21,100–21,200 kHz, and 28,100–28,200 kHz, using only Type A–1 emission.

[*§ 97.7(c) amended and Note deleted eff. 10–17–72; and (a) & (d) amended eff. 11–22–72; VI(72)–1*]

§ 97.9 Eligibility for new operator license.

Persons are eligible to apply for the various classes of amateur operator licenses as follows:

(a) *Amateur extra class.* Any citizen or national of the United States who either (1) any time prior to receipt of his application by the Commission has held

for at least 1 year an amateur operator license of other than the novice or technician class, issued by any agency of the U.S. Government, or submits proof that he held for a period of 1 year an amateur operator license at least equivalent to a general class license issued by a foreign government, or (2) submits evidence of having held a valid amateur radio station or operator license issued by any agency of the U.S. Government during or prior to April 1917.

(b) *Advanced Class.* Any citizen or national of the United States.

(c) *General class.* Any citizen or national of the United States.

(d) *Conditional class.* Any citizen or national of the United States:

(1) Whose actual residence and amateur station location are more than 175 miles airline distance from the nearest location at which examinations are held at intervals of not more than 6 months for General Class amateur operator licenses.

(2) Who is shown by physician's certificate to be unable to appear for examination because of protracted disability.

(3) Who is shown by certificate of the commanding officer to be in the armed forces of the United States at any Army, Navy, Air Force, or Coast Guard station and, for that reason, to be unable to appear for examination at the time and place designated by the Commission.

(4) Who furnishes sufficient evidence, at the time of filing, of temporary residence for a continuous period of at least 12 months outside the continental limits of the United States, its territories or possessions, irrespective of other provisions of this paragraph.

(e) *Technician class.* Any citizen or national of the United States.

(f) *Novice Class.* Any citizen or national of the United States, except a person who holds, or who has held within the 12-month period prior to the date of receipt of his application, a Commission-issued amateur radio license. The Novice Class license may not be concurrently held with any other class of amateur radio license.

[*§ 97.9(a) amended eff. 10-27-72; VI(72)-1*]

§ 97.11 Application for operator license.

(a) An application (FCC Form 610) for a new operator license, including an application for change in operating privileges, which will require an examination supervised by Commission personnel at a regular Commission examining office shall be submitted to such office in advance of or at the time of the examination, except that, whenever an examination is to be taken at a designated examination point away from a Commission office, the application, together with the necessary filing fee should be submitted in advance of the examination date to the office which has jurisdiction over the examination point involved.

(b) An application (FCC Form 610) for a new operator license, including an application for change in operating privileges, which requests an examination supervised by a volunteer examiner under the provisions of § 97.29(b), shall be submitted to the Commission's office at Gettysburg, Pennsylvania, 17325. The application shall be accompanied by any necessary filing fee and by a request for the written examination material (see § 97.29(b)).

(c) An application (FCC Form 610) for renewal and/or modification of license when no change in operating privileges is involved shall be submitted, together with any necessary filing fee, to the Commission's office at Gettysburg, Pennsylvania, 17325.

§ 97.13 Renewal or modification of operator license.

(a) An amateur operator license, except the Novice Class, may be renewed upon proper application in which it is stated that the applicant has lawfully accumulated, at an amateur station licensed by the Commission, a minimum total of either 2 hours operating time during the last 3 months or 5 hours operating time during the last 12 months of the license term. Such operating time, for the purpose of renewal, shall be counted as the total of all that time between the entries in the station log showing the beginning and end of transmissions as required in § 97.103(a), both during single transmissions and during a sequence of transmissions. The application shall, in addition to the foregoing, include a statement that the applicant can send by hand key, i.e., straight key or any other type of hand operated key such as a semi-automatic or electronic key, and receive by ear, in plain language, messages in the International Morse Code at a speed of not less than that which is required in qualifying for an original license of the class being renewed.

NOTE: Until further order of the Commission, the showing that the applicant actually operated an amateur radio station or stations for the periods of time specified in § 97.13 will not be required in cases where it is shown that the applicant was unable to conduct such operation because he was on active duty overseas in the armed forces of the United States or was duly enrolled as an employee of an agency of the Federal Government and in the course of such employment was on duty in a foreign country continuously during the last year of the license term: *Provided,* That any such employee of the Federal Government shall submit with his application for renewal of license a statement signed by his agency head, or the chief of the Bureau or Division in which he is employed attesting to such employment.

(b) The Novice Class license will not be renewed.

(c) The applicant shall qualify for a new license by examination if the requirements of this section are not fulfilled.

(d) Application for renewed and/or modification of an amateur operator license shall be submitted on FCC Form 610 and shall be accompanied by the applicant's license. Application for renewal of unexpired licenses must be made during the license term and should be filed within 90 days but not later than 30 days prior to the end of the license term. In any case in which the licensee has, in accordance with the provisions of this chapter, made timely and sufficient application for renewal of an unexpired license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined.

(e) If a license is allowed to expire, application for renewal may be made during a period of grace of one year after the expiration date. During this one year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be backdated to the date of its expiration. Application for renewal shall be submitted on FCC Form 610 and shall be accompanied by the applicant's expired license.

(f) When the name of a licensee is changed or when the mailing address is changed a formal application for modification of license is not required. However, the licensee shall notify the Commission promptly of these changes. The notice, which may be in letter form, shall contain the name and address of the licensee as they appear in the Commission's records, the new name and/or address, as the case may be, the radio station call sign and class of operator license. The notice shall be sent to Federal Communications Commission, Gettysburg, Pa., 17325, and a copy shall be kept by the licensee until a new license is issued.

§ 97.19 When examination is required.

Examination is required for the issuance of a new amateur operator license, and for a change in class of operating privileges. Credit may be given, however, for certain elements of examination as provided in § 97.25.

§ 97.21 Examination elements.

Examinations for amateur operator privileges will comprise one or more of the following examination elements:

(a) Element 1(A): Beginner's code test at five (5) words per minute;

(b) Element 1(B): General code test at thirteen (13) words per minute;

(c) Element 1(C): Expert's code test at twenty (20) words per minute;

(d) Element 2: Basic law comprising rules and regulations essential to beginners' operation, including sufficient elementary radio theory for the understanding of those rules;

(e) Element 3: General amateur practice and regulations involving radio operation and apparatus and provisions of treaties, statutes, and rules affecting amateur stations and operators;

(f) Element 4(A): Intermediate amateur practice involving intermediate level radio theory and operation as applicable to modern amateur techniques, including, but not limited to, radiotelephony and radiotelegraphy;

(g) Element 4(B): Advanced amateur practice involving advanced radio theory and operation as applicable to modern amateur techniques, including, but not limited to, radiotelephony, radiotelegraphy, and transmissions of energy for measurements and observations applied to propagation, for the radio control of remote objects and for similar experimental purposes.

§ 97.23 Examination requirements.

Applicants for original licenses will be required to pass the following examination elements:

(a) Amateur Extra Class: Elements 1(C), 3, 4(A), and 4(B);

(b) Advanced Class: Elements 1(B), 3, and 4(A);

(c) General Class and Conditional Class: Elements 1(B) and 3;

(d) Technician Class: Elements 1(A) and 3;

(e) Novice Class: Elements 1(A) and 2.

§ 97.25 Examination credit.

(a) An applicant for a higher class of amateur operator license who holds a valid amateur operator license issued upon the basis of an examination by the Commission will be required to pass only those elements of the higher class examination that were not included in the examination for the amateur license held when such application was filed. However, credit will not be allowed for licenses issued on the basis of an examination given under the provisions of § 97.29(b).

(b) An applicant for an amateur operator license will be given credit for either telegraph code element 1(A) or 1(B) if within 5 years prior to the receipt of his application by the Commission he held a commercial radiotelegraph operator license or permit issued by the Federal Communications Commission. An applicant for an amateur extra class license will be given credit for the telegraph code element 1(C) if he holds a valid first class commercial radiotelegraph operator license or permit issued by the Federal Communications Commission or holds any commercial radiotelegraph operator license or permit issued by the Federal Communications Commission containing an aircraft radiotelegraph endorsement.

(c) An applicant for the Amateur Extra Class operator license will be given credit for examination elements 1(C), 4(A), and 4(B), if he so requests and submits evidence of having held a valid amateur radio station or operator license issued by any agency of the U.S. Government during or prior to April 1917, and qualifies for or currently holds a valid amateur operator license of the General or Advanced Class.

(d) An applicant for the amateur extra class operator license will be given credit for examination element 1(C) if he so requests and submits evidence of having held the amateur extra first class license, having continuously held its successor license. An applicant should present his proof in advance of the desired examination time to the Chief, Amateur and Citizens Division, Washington, D.C. 20554 and receive a letter of certification for presentation to the field office where the examination will be taken. No code credit will be given without the letter of certification.

(e) No examination credit, except as herein provided, shall be allowed on the basis of holding or having held any amateur or commercial operator license.

[*§ 97.25(b) amended, (d) redes. as (e) and new (d) added eff. 10-27-72; VI(72)-1*]

§ 97.27 Availability of Conditional Class license examinations.

The examinations for Conditional Class will be available only under one or more of the following conditions:

(a) If the applicant's actual residence and proposed amateur station location are more than 175 miles airline distance from the nearest location at which examinations are conducted by an authorized Commission employee or representative at intervals of not more than 6 months for amateur operator license.

(b) If the applicant is shown by physician's certificate to be unable to appear for examination because of protracted disability.

(c) If the applicant is shown by certificate of the commanding officer to be in the armed forces of the United States at an Army, Navy, Air Force, or Coast Guard station and, for that reason, to be unable to appear for examination at the time and place designated by the Commission.

(d) If the applicant demonstrates by sufficient evidence that his temporary residence is for a continuous period of at least 12 months outside the continental limits of the United States, its territories or possessions, irrespective of other provisions of this section.

§ 97.28 Mail examinations for disabled applicants for Amateur Extra and Advanced Class licenses.

(a) The Commission may permit the examination for an Amateur Extra or Advanced Class license to be administered by a volunteer examiner selected by the applicant when it is shown by a physician's certificate that the applicant is unable to appear for a Commission supervised examination because of protracted disability.

(b) The volunteer examiner for an Amateur Extra or Advanced Class license examination shall be at least 21 years of age and shall be the holder of a class of amateur operator license equal to or higher than the class of license for which the applicant is being examined. The written portion of the examination shall be obtained, supervised, and submitted in accordance with the procedures set forth in § 97.29(b).

(To be continued next month)

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

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SSTV ROBOT CAMERA OWNERS – NOW available a vidicon carriage kit for micro photography to take pictures as small as a postage stamp. INSTALL IT YOURSELF, $12.00 prepaid anywhere in U.S.A. Write to K8NTE, BOB PINDER, 1277 Cricklewood S.W., Wyoming, Michigan 49509.

WILL PAY $4.00 each for magnetic tapes for IBM MT/ST Selectric Composer. Must be in top condition. Box UN11M, 73 Magazine, Peterborough NH 03458.

GLOBAL RESEARCH & Supplies. Amateur Equipment & Service. Dycomm, Galaxy, Tempo, Kenwood, Inoue, B&W, SBE, Hy-Gain, CushCraft, Larsen. 312/2794658. P.O. Box 271, Lombard, Ill., 60148.

VACUUM MOLDING BUSINESS for sale, complete with orders. Ideal for Magnetic Plastic Signs, etc. 24" x 30" Machine & associated Equipment. $5000.00. P.O. Box HT, 73 Magazine, Peterborough NH 03458.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis.

Hallicrafters FPM 300 SSB xcvr	$480
Heath IB 101 and Vanguard Scaler	$250
Miida Digipet 60 counter with Digipet 160 converter	$400
Tempo CL 220 220 xcvr	$265
HR2MS 8 ch scanning 2m xcvr 15W	$255
TME-H-LMU 16 ch scanning rcvr 6/2/¾m	$255
Digital Logiclocks	$80
Midland 13509 220 Xcvr	$200
Midland 1520 Hand-held 2 meter	$190

"DON AND BOB" guaranteed buys. Triex W-51 386.00; MW50 250.75; MW65 331.50; Ham-M 99.00; TR44 59.95; AR22R 31.95; Belden 8214 RG8 foam coax 17¢/ft; 8448 rotor cable 10¢/ft; HyGain TH6DXX 139.00; 204BA 129.00; TH3MK3 114.00; 400 rotor 179.95; Mosley CL36 149.00; CL33 124.00; TA33 114.00; MCQ3B 91.00; S402 143.00; 3/16" cable clamp 18¢; Mallory 2.5A /1000PIV epoxy diode 29¢; Polygon fiberglas spreader 7.50; KY65 code ID 5.95; write quote Midland, Regency; Clegg FM27B; Hallicrafters FPM300A; Drake, SBE, Standard, Eimac, Collins, CDE replacement parts. Shipping charges collect; warranty guaranteed. Mastercharge, BAC. Madison Electronics, 1508 McKinney, Houston, Texas 77002 (713)224-2668.

2 MTR. 8 CH. SCANNER $70; Heath Two'er $20; AX-190 80-10 Mtr. xstr. rcvr. $185; T-60 80-6M. AM/CW xmtr. $15; H. Ober, 20005 Roscoe Bl., Canoga Park CA 91306.

LAMPKIN MODEL 111 PPM Meter, mint condition, also RCA WG297 H.V. probe, first $50.00 M.O. takes both. J. Kaufman, 125 River, Alpena, Mich. 49707.

FOR SALE: COLLINS GEAR TO THE HIGHEST BIDDER, 32S3, 75S3, KWM-2A, 2-312B4, 30L1, 2 AC power supplies, in excellent condition, original owner. WA2KNC–Jack Aviv, 106 Glenn Avenue, Lakewood, NJ 08701.

DELMARVA HAMFEST August 19, 1973, Harrington Fairgrounds. Registration fee $2 advance, $3 at the gate. For information write Delmara Hamfest, Inc., Route 2, Box 90, Laurel, Delaware 19956.

CANADIANS – FREE 120 page Electronics Catalog. ETCO-B, 464 McGill, Montreal.

WARREN HAMFEST, Largest family style Hamfest in East. Sunday, August 19th, @ Famous Yankee Lake Park. Giant Fleamarket, Swimming, Picnicking – All Free. Details QSL W8VTD.

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TECH MANUALS for Govt surplus gear only $6.50 each: R-389/URR, R-390/URR, R-220/URR, R-274/FRR, TS-382DU/U, TT-63A/FGC, URM-25D, ALR-5, LP-5. W3IHD, 7218 Roanne Drive, Washington, DC 20021.

MODERNIZE FOR PEANUTS! Frame & display QSL's with 20 pocket plastic holders. Two for $1.00, seven for $3.00. Prepaid, guaranteed. Universally used and approved. Order now. TEPABCO, Box 198S, Gallatin, Tennessee 37066.

6 MTR 250 WATT base station, GE Preprog too big to ship, $75.00, Foster, Box 198 Star Route, Tijeras, NM 87059 (505)281-3975.

MIX PLEASURE WITH PLEASURE. 1973 Hamburg International Hamfest on Sept. 15 only 45 minutes from fabulous Niagara Falls. RV parking for weekend only $2.50 with hook-up. Details: Valerie Orgera K2KQC, 187 Main, Hamburg, N.Y. 14075.

ROSS and WHITE or Kyokuto Denshi 2 meter FM 10 watt transceiver. Internal tone burst with 4 tones. Crystals for 52/52, 76/76, 94/94, 04/64, 16/76, 22/82, 34/94, 37/97. See 73 Magazine 4/72. $225. 8 hour battery and charger $25. Heavy duty leather case for radio and battery $15. Tiny Tone touch tone kit $30. K6ESC, 20650 Lomita, Saratoga CA 95070 408-867-3912.

HOOSIER ELECTRONICS – Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Individual, personal service by experienced and active hams. Factory-authorized dealers for Drake, Regency, Standard, Clegg, Ten-Tec, Galaxy, Hy-Gain, CushCraft, Mosley, Ham-M, Hustler, electronic pocket calculators, plus many more. Orders for in-stock merchandise shipped the same day. Write or call today for our quote and try our personal friendly Hoosier service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana 47802. (812)-894-2397.

HT-220 two watt two channel with case – best offer over $75. Box 12, 73 Magazine, Peterborough NH 03458.

RESISTORS: A-B, Stackpole, most values, .¼W, 5% 5¢. Signetics N7441B $1.15. List SASE, Texas residents 5% tax. I.C.S. Company, Box 622, Bellaire, Texas 77401.

SSTV FOCUS/DEFLECTION COIL KIT for K7YZZ 1¼" Plumbicon type camera circuit (re., 73 Magazine, Sept. 72) complete with reprint article, $19.95 postpaid in U.S. and Canada. Also fast scan 1¼" coil kits as well as many other SSTV kits, parts and plans. See regular ad elsewhere in magazine. Write or phone for free catalog. ATV RESEARCH, 1301 N. Broadway, Dept. 73C, Dakota City, Nebr. 68731.

COMPLETE 36 page QSL catalog, 3rd edition. New "SPARKLING" QSLs. Hundreds of cuts, ten report forms, thirteen colored stocks, 25¢. Ten sample QSL cards. Corneilson's Quality QSLs, 321 Warren St., N. Babylon, N.Y. 11704.

WANTED-HF SSB xceiver/ac-dc p.s., 2m Fm xceiver, Ht-200 or equivalent. HAVE mint R-390/A with spares, cables, case, tech. man. etc. for trade. Make offer. T.L. Fleming (WB5DRR) Apt. "C" 5919 W. 19th St., Little Rock, Arkansas 72204.

MUST SELL for college expenses. DAVCO DR-30 high performance solid state receiver. Cost $400, asking $200. OMEGA DA full-feature IC keyer with built-in double paddle. Cost $85, asking $40. Both are in very good condition. Andrew Beary, WA3DQS, Box 526, 5115 Margaret Morrison Street, Pittsburgh, PA 15213.

GIANT N.E. CONVENTION sponsored by FEMARA Sept. 29 & 30 at Dunfey's Hyannis Resort on Cape Cod. Huge flea market, seminars, FM, SSTV, NEDXCC, AMSAT, YL trips, 2 pools, golf, beaches, sailing. Early bird registration still only $3 from W1ZQQ, 17 Barnes Avenue, E. Boston, Mass. 02128. Special early bird hotel discount available.

WANTED: Motorola HT-220. WA2FAS, 24 Gardenia Drive, Maple Shade, New Jersey 08052.

SELL: E.E. and other technical books. SASE for list. Roger A. Baim WB9BDP, 2753 W. Coyle, Chicago, Ill. 60645.

HP416A RATIOMETER $125. Gertsch RT-5R Ratiotransformer like new $100, Beckmen 7250 BR counter $35.00. Frequency Standard – late model NAVY-URQ-9, 5, 1, .001 MHz output, 110 VAC or 24 VDC emergency input. Similar in specs to a Sultzer 5 with SP supply $1000. Will consider trade for surplus video equipment. Norman Gillaspie, Box 2124, Monterey CA 93940. 1-408-375-7424.

YOUR CALL LETTERS. Two sets, for windshield and rear glass. Smart white letters with red outline. Easily installed pressure sensitive decals. $1.00, postage paid, anywhere. Satisfaction guaranteed. Lake Jordan Artists, Slapout AL 36092.

GLADDING 25 2M-FM transceiver. Late model with new audio, microphone. Includes AC supply. $180. WA7SJN Bill Nelson, 4414A Larch, Mountain Home AFB Idaho 83648.

90-DAY GUARANTEE on all these Fully Reconditioned receivers: Drake 2-C/2-CQS $219, Hallicrafters SX-99 $79, SX-101 $129, SX-101 Mark-3A $139, Hammarlund HQ-100 $99, HQ-100AC $129, HQ-110C $119, HQ-110AC $139, HQ-170AC $189. More arriving daily. Write: Burghardt Amateur Center, Box 73A, Watertown, S.D. 57201.

TAKE YOUR PICK from this wide selection of SSB Transceivers, all fully reconditioned with 90-day Guarantee: Drake TR-3 $369, TR-4, $419, Eico 753 with both AC/DC $159, Galaxy GT-550A/AC-400/SC-550A $499, Kenwood TS-511S/PS-511S $429, SBE SB-34 $269, Swan 175 with both AC/DC $129, 240/117AC $219, 350/117XC $249, 350C $279, 500/117XC $419, WRL Duo-Bander 84 with AC or DC $129. More arriving daily. Write: Burghardt Amateur Center, Box 73A, Watertown, S.D. 57201.

TEKTRONIX 545 'SCOPE, complete but not working, $150 or trade. Send SASE for details. 6' x 19" equipment rack, $25 or trade. Other stuff. Jim Einolf, 1222 N. Capitol Ave., Lansing, MI. 48906.

WOODSTOCK GRAVITATIONAL SOCIETY is dedicated to the encouragement of discussion and publication of serious scientific proposals concerning gravitational and related phenomena. For further information write: Woodstock Gravitational Society, 10 Hasbrouck Lane, Box 157, Woodstock, New York 12498.

WANTED: HQ-129, Sky Champion, Comet Pro, RME-69, calibrator for NC-300 – in good condition, preferably in mint condition, by cheapskate collector of historical ham gear. Why let your widow throw out that old 30's receiver – sell it to Department HQ-129, 73 Magazine, Peterborough NH 03458 for bottom dollar. Please state absolute minimum you'll take.

RECORDER, EA-AW, 115V 60HZ, input 1-MADC, manual and some accessories $70.00; Sound powered handsets, new $5.00. W1IIB, C. Wallace, 8 Elaine St., Hampton, N.H. 03842.

NAME YOUR DEAL! Following items offered either "Fully reconditioned with 90-day guarantee" or "Working condition – AS-IS (price in parenthesis): Viking II's $35($25), Viking II with 122 VFO $79($59), Valiants $99($89), Rangers $85($75), excellent Ranger II $129($119), Globe LA-1 Linear $55($45), Johnson Courier Linear $85($75), National NC-173 $59($49), Heath TX-1 $59($49), Gonset IV $99($85), Johnson 6-N2 Converter $25($20), Heath SB-10 $50($40). Write: Burghardt Amateur Center, Box 73A, Watertown, S.D. 57201.

SSTV MONITOR TUBES 5 to 12 inch P7 P14 also ok, electromagnetic and electrostatic FOCUS types. 12.50 to 28.00. 25¢ stamps for specs, prices. Other surplus. Lotz, 750 Florida Blvd., New Orleans, La. 70124.

AMATEUR EXTRAS only – Wallet size miniature of your license. Send original (which will be returned) + $3. Box 60045; Chicago, Illinois 60660.

HI-FI MOTORCYCLE HELMETS Concealed speakers, left side mini jack. Complete with made up cable and plugs that fit TR-22 and most tape decks or CB's, fiberglass, most colors, gold and green flake $58.00. Amateur net $36.00 postpaid in US, Saint Communications, RR1, Box 402, Idaho Springs, Colorado 80452.

NEW PRODUCTS *(cont. from p. 20)*

associated transistor to appear on the monitor! The lines were sharp, the resistor values were absolutely readable and, Holy Moses, the idea hit us what a great way this is to trade schematics over the air . . .

Pictures were even better. Since enlargements were no longer needed for a good slow scan image, a gold mine of material opens up with every batch of snapshots from the brand X photo processor in town.

The micro photography kit is available for $12.00 postpaid from *Bob Pinder K8NTE, 1277 Cricklewood SW, Wyoming MI 49509.*

Wayne demonstrates the use of a 2m fire hat containing ISC's small modules. Is that transmitter putting out an FM signal or Alpha waves?

73 LOWERS SUBSCRIPTION RATES 37¢

Would you believe that there are some of us who remember when 73 Magazine was only 37¢ a copy? (How time does fly!)

At the present time our subscriptions are increasing over 1,000 per month and we're beginning to realize that *1973* is *our* year (obviously).

In order to further accelerate this trend, we're rolling back the calendar . . . yes, back to 1960 . . . and 37¢ a copy. We realize that we cannot get rich this way, but who cares when you an make so many subscribers happy!

Now . . . for a limited time only . . . (until we regain our senses) . . . you can subscribe to 73 for only 37¢ a copy on a 3-year subscription. That's only $13.32 for 3 years.

Subscribe *NOW* and have it end in '76. That's the spirit!

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You can sign up as an Undercover Agent 0073 and get 100 of these subscription applications – for only $1 (to cover the cost of handling).

Most of the operators you contact would enjoy reading 73, if they knew about it. Your QSLs will help spread the word – and bring you a commission to boot.

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JUNE 1973

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73 BOOKS

Slow Scan Television Handbook, by Don C. Miller, W9NTP and Ralph Taggart WB8DQT.

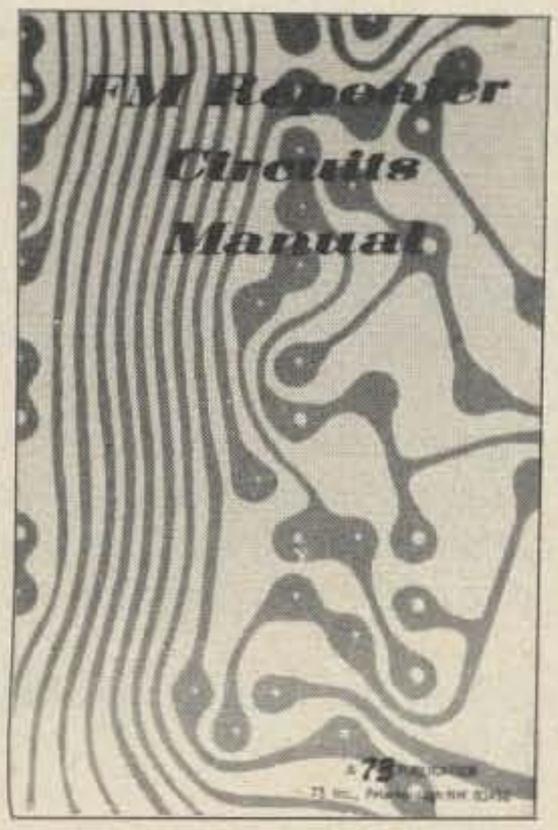
This excellent book tells all about it, from its history and basics to the present state-of-the-art techniques. Contains chapters on circuits, monitors, cameras, color SSTV, test equipment, and much more. 272 pages, softbound **$5,** hardbound **$7.**

Digital Control of Repeaters, by Tom Yocom, WAØZHT.

Here's a book for the FM'er who wants to design and build a digital repeater control system. Contains sections on repeaters, basic logic functions, logic circuit design, control systems, support circuits, mobile installations, touch-tone, plus special section on a "mini" repeater control system. 224 pages, softbound **$5;** hardbound **$7.**

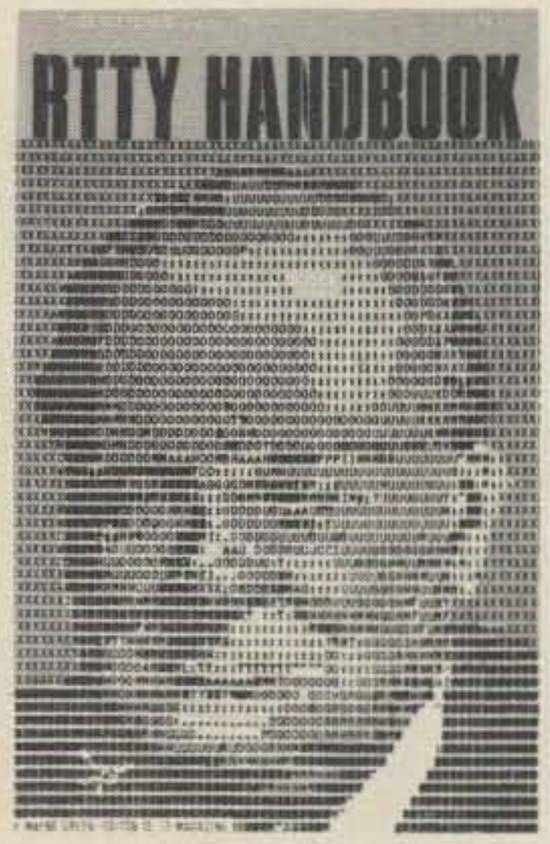
FM Repeater Circuits Manual, by Ken Sessions

Contains almost every conceivable circuit that might be needed for use with a repeater. All circuits explained in detail and easily understood. All aspects covered, from the operator to the antenna. Also contains chapters on setting up a mobile station and many other articles for the use of the VHF and UHF enthusiasts. 305 pages, softbound, **$5.** Hardbound, **$7.**



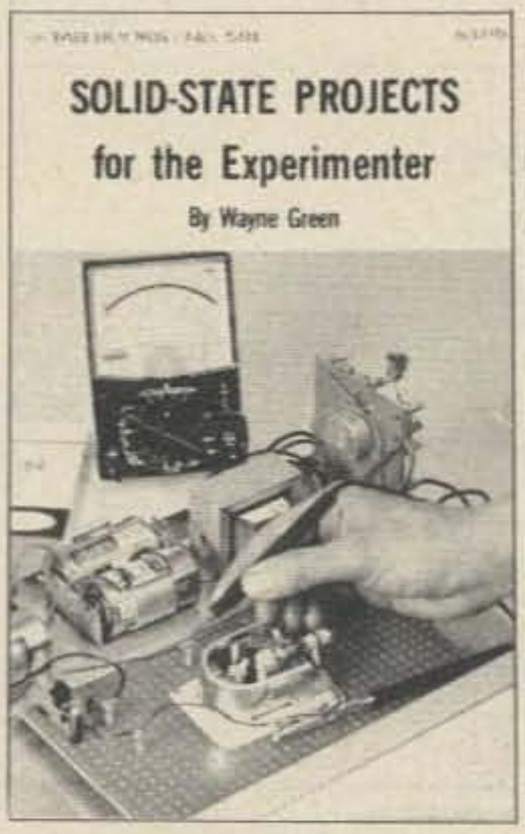
RTTY Handbook, Wayne Green, Editor.

A comprehensive book covering all areas of radio teletype, from getting started with the basic principles, what equipment to procure and how to make it work. The only up-to-date book available on the subject. Well written, easy to read and understand. 320 pages, softbound. **$6.**



Solid State Projects Wayne Green, Editor.

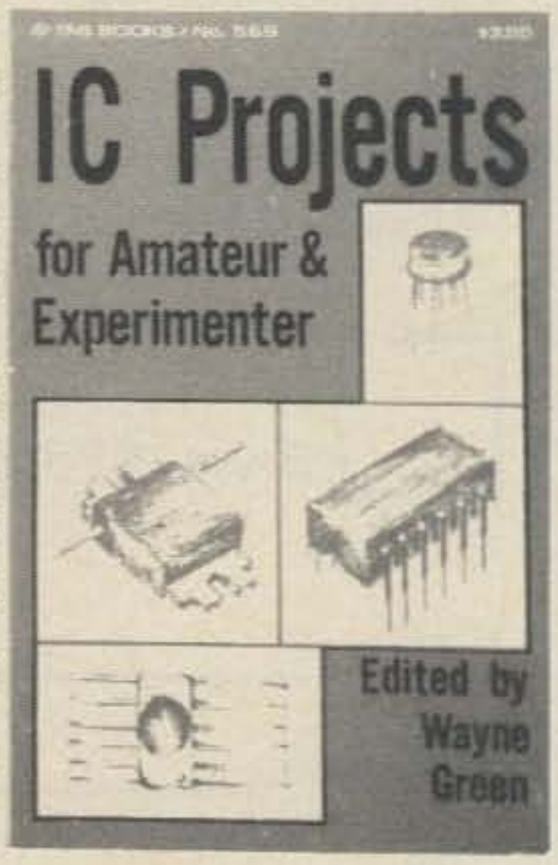
Here are more than 60 projects of interest to anyone in electronics. The devices range from a simple transistor tester to an electronic counter — and from a capacity meter to a ham TV receiver. The idea of this collection is not only to provide you with interesting and practical projects to build, but also to help you become more intimately acquainted with such modern components as ICs, varactors and zeners. 224 pages, softbound. **$4.**



IC Projects, Wayne Green, Editor.

The transistor replaced the tubes in the 1960's, and soldering guns replaced the 100 watt soldering irons — but today in the 1970's, integrated circuits and soldering pencils are replacing transistors. This book tells how to understand and use ICs, with numerous construction projects.

For the ultra-modern home brewer. 189 pages, softbound. **$4.**



Extra Class 73 Study Guide Special

As you probably know, it is virtually impossible to do well in any contest unless you have an Extra Class license. Also with the DX stations mostly in the Extra Class bands, you don't have much chance of working the hard ones unless you have your Extra.

Before the 73 Extra Class Study Guide this was a problem. There just wasn't any book that adequately prepared you for this difficult exam. Since studying the 73 book makes passing the technical part a snap, there is absolutely no reason whatsoever for you to be a second class citizen on the ham bands. Why not go FIRST CLASS and enjoy all the privileges?

In addition to your regular license and upon application to the FCC (with no charge), all Extra Class ops are entitled to a large Extra Class certificate, suitable for framing. Why not display one of these in your shack?

We have sold all our softbound ($5) copies of this excellent book and have a limited number of hardbound copies left. The hardbound regularly sells for $7, but for a limited time we are reducing this book to $5. Why not order today and start enjoying more of amateur radio?

de **W1GRO**

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Why take a chance?

Call your secretary and get him on the stick – accept no excuses. Let's get this show on the road.

UNUSUAL OCCUPATIONS

While out in California I met an amateur who has been working with a medical unit experimenting with pressure chambers and they had discovered that people put in an oxygen atmosphere under pressure would undergo some interesting changes – like getting younger – hair beginning to grow back on balding heads – things like that.

Since amateurs are into virtually everything that is going on scientifically, perhaps through the pages of 73 we can get some hints on interesting developments that are shaping up which we might not otherwise hear about. Unless the readers of 73 are a lot more reactionary than I give them credit for, they share my interest in new ideas – and are looking for fascinating new things to talk about on the air. How many times can you tell people you are using a dipole antenna, anyway?

Somewhere I read that an ionized atmosphere is conducive to better work and to better thinking. Some experiments had been made with having a highly charged metal sheet along the ceiling – and people didn't get tired nearly as fast. This obviously could be done with a television high voltage supply and some aluminum foil – has anyone any data on this?

What about Kirilian photography? Has any reader experimented with this as yet? Please let us know!

I've talked with quite a few readers who have worked with orgone and orgone accumulators – so how about some data on this for us? Come on, let's get some weirdo junk into 73 for a change (will that be a change?) – and let's try to make it far out enough so that W5 down there will be so dumbfounded he will make the first contact of his life without telling what rig he is using.

BIG AND LITTLE HAND UNITS

There is no question that the Motorola HTs are beautfiful gadgets. They are small – light – and rugged. But they are more geared to the commercial market than the hams by virtue of their small size.

The slightly larger hand units such as the Standard 146A and the Ken KP-202 use small parts, but not *extremely* small parts. The cost difference is substantial both for original manufacture and for replacement. Those micro parts are expensive to buy and incredibly difficult to change, thus making the larger hand units much less expensive to make and to service.

The initial expense of the HTs has been kept down by Motorola units which were rejected from commercial applications being made available to ham builders for repairs – but this doesn't help on later repairs as much.

OCEANUS

Ace Goodwin W1GRO, our circulation manager, keeps his eyes open for new ideas and it was he who called the existence of Oceanus to my attention. In an article in Yankee magazine – a magazine published in the next town to Peterborough – the concept of a new country, belonging to all mankind, and dedicated to the protection and development of the oceans of the world, was revealed.

The "territory" of Oceanus consists of all of the seas of the world beyond the three mile limit from the land countries. Thus Oceanus is by far the largest country in area in the world – many times over. The constitution of Oceanus is quite parallel to that of the United States and the idea is that it will be governed by the nations of the world for the benefit of all mankind, rather than by a small group for their own profit.

My attention was first attracted by the idea of a new country. You know what happens to a DXer when you wave even the possibility of a new country at him. And you may have a faint idea of what happens to a DXpeditioner when you even hint at a brand new country for him to operate from!

Once my attention had been attained, I got to thinking about the idea of Oceanus. I got to thinking that somehow over the centuries the governments of the world have looked upon the oceans as not being territory and thus not being owned by anyone or any government. There have been some problems raised due to fishing rights, radio broadcasting, and things like that – but the idea of the oceans of the world being territory doesn't seem to have evolved.

Obviously this idea of the oceans as non-territory is about to break down. More and more use is being made of the seas and the land under them. We already have offshore oil drilling over three miles out. And with the techniques of undersea exploration expanding rapidly, the day when we have undersea mines, gardens, and perhaps fish ranches is within grasp of the imagination.

We can all wait for the biggest nations of the world to start claiming the oceans – five miles – fifty miles – 200 miles – 2000 miles. The wealth of the oceans is beyond estimation so there will be quite a fight. It would seem obvious that the smaller nations of the world would lose out and the bigger nations would become bigger – and exploitation would be the name of the game.

Thus the idea of setting up the oceans of the world as a new country, run by the nations of the world, seemed like an idea that had arrived at the right time. The initial work to be done by the new nation would be to start cleaning up pollution and preventing it in every way possible.

My first move was to get in touch with Admiral Welles, the chief executive of Oceanus, at the home base of Oceanus in Manset, Maine. We talked on the phone a couple of times and then got together for a long talk and brainstorming session.

The basic problem with establishing a new country such as this is in getting it recognized. Obviously the U.S. is going to be extremely reluctant to recognize Oceanus since such a recognition would tend to diminish the possible future claims of the country for large areas of the oceans. Since the smaller countries of the world and, in particular, the land-locked countries have the most to gain from getting a piece of the oceans – or at least in making sure that the oceans don't just go outright to the big nations – these countries will be approached first.

Another tack which could help to establish the validity of the country would be via the United Nations. The virtual control of the U.N. by a handful of large nations means that Oceanus wouldn't have a prayer by a frontal approach. But how about through the ITU section of the UN? Suppose we first set up Oceanus as a separate country with a radio prefix which is registered with the ITU? The ITU naturally will not want to extend recognition to a country that is not otherwise recognized; yet on the other hand they are most anxious to keep radio call prefixes under control and registered according to their system.

We shall see. One of the first moves I made was to send a letter to the ITU on behalf of Oceanus telling them that the government of Oceanus would like to issue call letters in the block O1AA to OØZZ. This series has not yet been

allocated as far as I know. The calls would be used only within the limits of Oceanus aboard vessels of Oceanus registry. It was proposed that the ITU zone numbers would be added after the call letters of the station as an indication of the area of Oceanus within which the station was being operated.

Oceanus has been set up in such a way that the citizens of any country of the world may apply for dual citizenship. Citizenship in Oceanus will in no way affect citizenship in the U.S. or any other country. Vessels may be registered with Oceanus and still keep their registry anywhere else.

Along the same line it is proposed to issue amateur radio licenses valid for operation in Oceanus on Oceanus registered vessels to amateurs of any country. There will be no licenses issued to anyone not holding a valid amateur license in another country.

As far as I know there is no precedent of U.S. citizens establishing a brand new country, so the government agencies of the U.S. don't know just how to deal with the problem. They can't go by the rule book when there are no rules.

In order to get started on the recognition of Oceanus Admiral Welles has appointed me as Chancellor of Telecommunications. The FCC has already warned me that as the representative of a foreign government they may have to take away my ham ticket – and while I don't want to lose that, that certainly would be a recognition of Oceanus. It's a merry-go-round. If they refuse to accept Oceanus then they can't harass me – if they do get after me then they have granted official status to Oceanus. Perhaps, so to speak, I can push the car from the running board to get it started and then jump off when it gets going.

Once in motion, Oceanus should move along briskly. What with small taxes on users of the country such as ships and cables – fines for ecological despoilers – licenses for developers, it could be quite a thing in 20 years.

COLLINS COMEBACK?

Collins is again beginning to think in terms of a reactivated amateur sales effort. An official of Collins recently explained that engineers and technicians had, on several occasions, gotten new ham products ready for production, only to have the plans cancelled by erstwhile prexy Art Collins.

The S-line and KWM gear are still popular, despite the design being the oldest on the market today. The reliability built into Collins equipment cannot be denied – it runs through thick and thin – and is ideal for expeditions where reliability is the key factor.

The recent reports of Collins making deals in Japan for production of ham gear in that country have been confirmed, though the plans are apparently to produce it only for sale in Japan, and not for export to the U.S.

The financial traumas of a couple of years have been eased and Collins stock has been gradually gaining ground. It dropped from about $115 a share in 1967 to about 10% of that figure – and is now back up to around $25 a share. There is still a lot of debt, but the present management has set a good record and the prospects are bright.

ONE MEG

Some scoundrel has been whispering that Wayne Green is trying to change repeaters to one meg spacing. Utter rot and baloney. Wayne Green honestly doesn't give a damn whether repeaters are 600, 601, 990, 1 meg or 1200 kHz.

It is a fact that I do feel that everyone should have his day in court, and that extends to the one meggers as well as the conservatives who are fundamentally opposed to any and all change.

In reviewing the situation nationwide, there appears to be some patterns emerging. I think that, if we are going to be honest, we have to agree that there are some parts of the country that have different problems to face than others. Amateurs in the mountainous and hilly areas find simplex virtually useless and FM operation in these places has tended to emphasize repeaters. Amateurs in flat land have developed much more simplex and the number of simplex channels in use in these areas is a function of the number of active FMers. This holds particularly true for the larger urban areas, most of which are in flat country. If you are going to get picky with me over this, let me explain that Los Angeles is truly flat land, but with some mountains to hold up repeaters and remote base stations, just as New York has tall buildings for the same purpose.

With 14 repeater channels in the 146 MHz segment of the band and 13 more channels in the 147 MHz segment, all but the most densely populated areas have enough channels to serve them. In fact, only in the Los Angeles and New York areas has any great problem arisen as far as needing more than the 27 FM repeater channels. Thus, the one meg problem would seem to be a matter of interest only to amateurs in those two areas and be of no more than academic interest to the rest of us fortunate enough not to live in the giant beehives.

Frankly I see no need to think about or discuss the one meg situation outside of those two cities. I think we may see a lot more one meg activity in those cities if the repeater groups in those areas do not head off the problem by getti together. In fact, Los Angeles has gotten together and no one meg talk has ensued – which might be a rather broad hint to the New York repeater groups.

FM and repeaters has developed oddly in New York. We have the phenomenon of one giant repeater, a few medium size repeater groups, and a host of splinter groups. The move of WR2AAA to a one meg split may change his pattern – and it would certainly appear that any change would be for the better. If WA2SUR/WR2AAA were to get many more users the timer would have to be put back to 15 seconds and the slight shreds of human conversation that occasionally have been emerging from it would be stilled.

If all the Greater New York groups can suffer the ego deflation of getting together on a regular basis to hash out their problems, it is possible that a lot of the frustration and resentment which has been building could be cooled. We might find that some redistribution of activity could be made so that all of the 27 repeater channels could be used by a little bit more equally sized groups. Should seven fellows be able to hold a public repeater channel for themselves in New York? Should a small group in one part of the city be able to set up on a channel and demand that everyone else keep off?

Now that 220 is beginning to open – with good inexpensive gear and even repeaters coming available – it is possible that the New York repeater groups might interest some smaller groups that just don't want anyone else to talk with them to open up their 2m channels and move to 220.

If the New York repeater groups ever did get together the way the Southern California groups did, they might be able to consolidate and arrange things so some or even all of the splinter channel repeaters could find a home on one of the standard 27 public channels.

It is always possible that a study of the simplex channels – there are 13 of them in the 146–148 MHz segments – would show that there are more than are needed and that some one meg or 990 MHz repeaters could be set up to use a few of these channels. Hopefully this extreme ac-

(continued on page 108)

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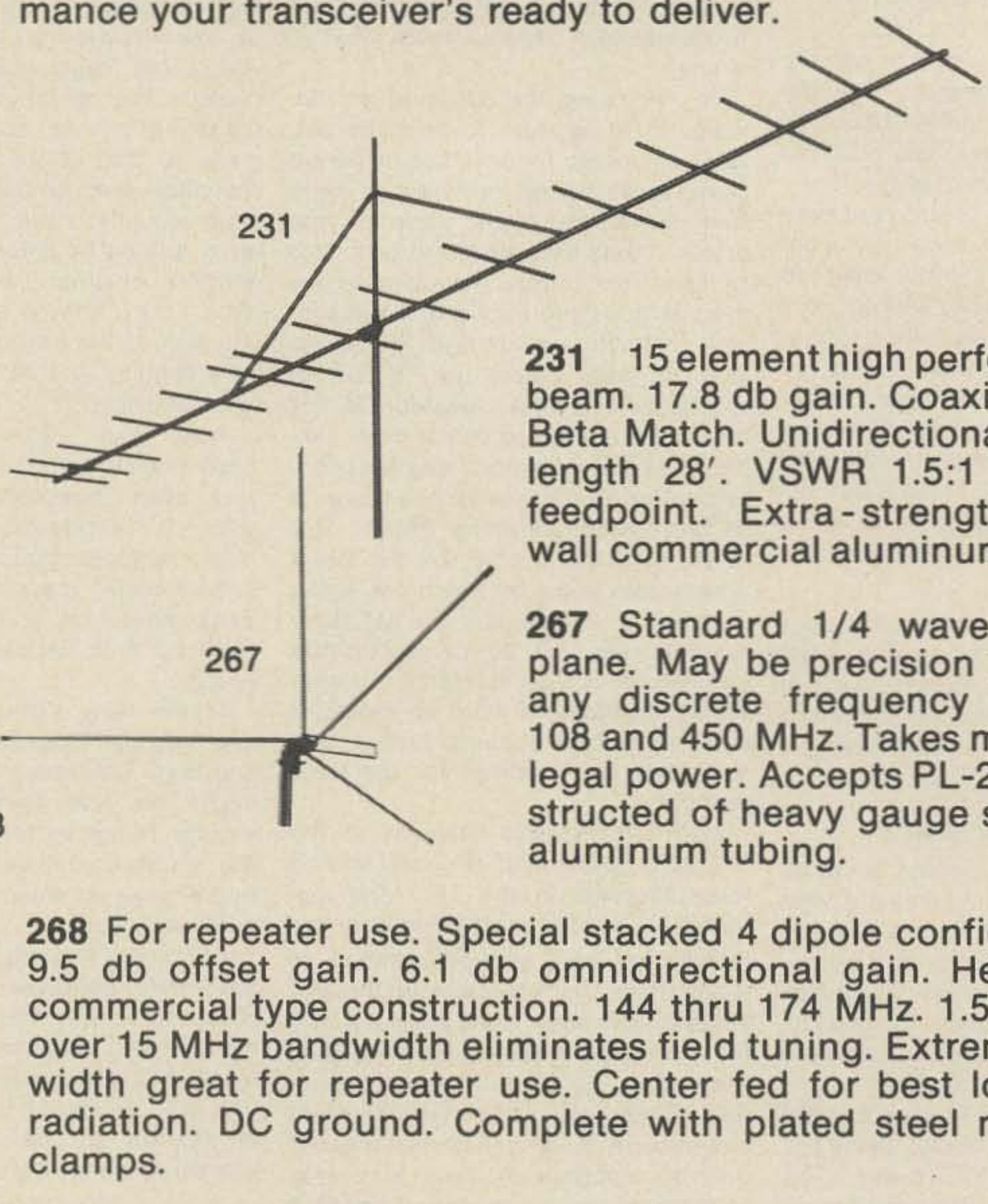

231 15 element high performance beam. 17.8 db gain. Coaxial balun. Beta Match. Unidirectional. Boom length 28'. VSWR 1.5:1 52 ohm feedpoint. Extra-strength heavy wall commercial aluminum tubing.

267 Standard 1/4 wave ground plane. May be precision tuned to any discrete frequency between 108 and 450 MHz. Takes maximum legal power. Accepts PL-259. Constructed of heavy gauge seamless aluminum tubing.

268 For repeater use. Special stacked 4 dipole configuration. 9.5 db offset gain. 6.1 db omnidirectional gain. Heavy wall commercial type construction. 144 thru 174 MHz. 1.5:1 VSWR over 15 MHz bandwidth eliminates field tuning. Extreme bandwidth great for repeater use. Center fed for best low angle radiation. DC ground. Complete with plated steel mounting clamps.

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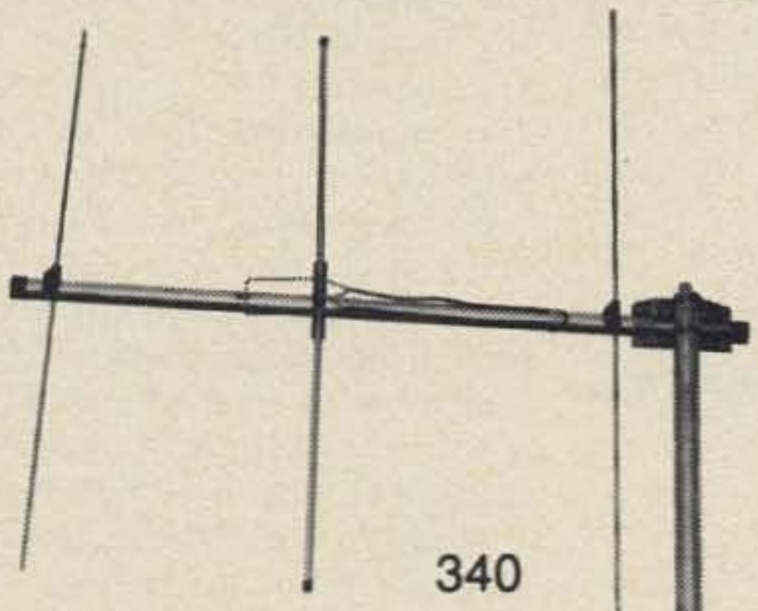
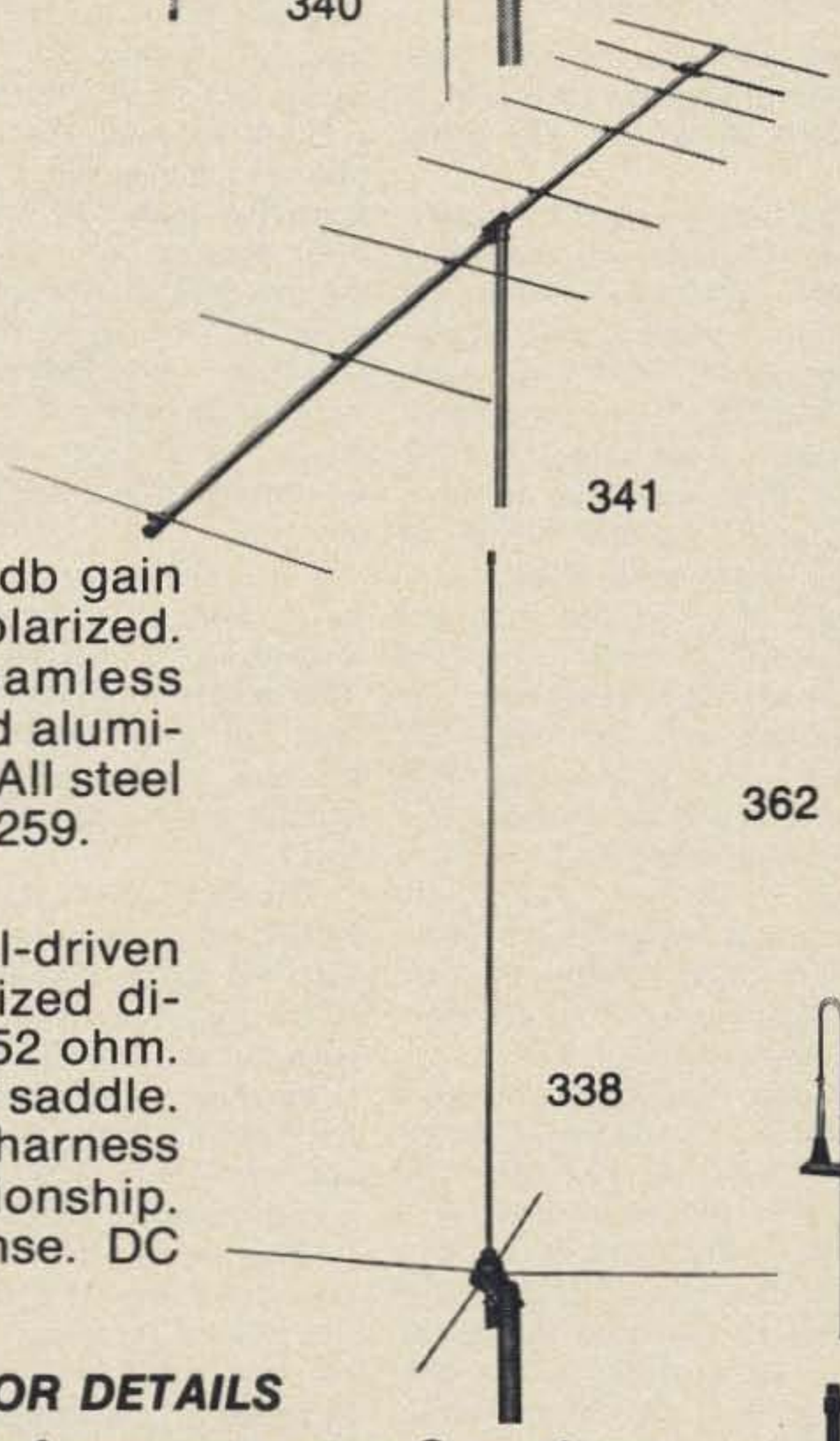
Antennas with real PUNCH!

340 3 element high performance beam. 9 db gain. Coaxial balun. Special VHF Beta Match configuration. Unidirectional pattern. VSWR 1.5:1. 52 ohm impedance. Heavy gauge aluminum tubing and tough aluminum rod construction.



340

341 8 element high performance beam. 14.5 db gain. Coaxial balun. VHF Beta Match. Unidirectional. Boom length 14'. VSWR 1.5:1. 52 ohm feedpoint. Heavy gauge commercial type aluminum construction.



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338 Colinear ground plane. 3.4 db gain omnidirectionally. Vertically polarized. 52 ohm match. Radiator of seamless aluminum tubing; radials of solid aluminum rod. VSWR less than 1.5:1. All steel parts iridite treated. Accepts PL-259.

362

362 SJ2S4 high performance all-driven stacked array. 4 vertically polarized dipoles. 6.2 omnidirectional gain. 52 ohm. May be mounted on mast or roof saddle. Unique phasing and matching harness for perfect parallel phase relationship. Center fed. Broad band response. DC ground.

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tion would be taken by smaller groups rather than by bigger ones, so visiting amateurs would still be able to call in on the regular channels, and have a chance of talking with most of the FMers.

The FCC, in setting repeaters up to use the 146–148 segment of the band, apparently had in mind that most of the simplex, if not all of it, would move below 146 into the 145 MHz segment. Many amateurs feel that perhaps they know more about FM than the FCC and they are going to stick to 146.52 for the primary simplex channel. Note aside: the IC-22 transceiver received for test came through with 52/52 simplex crystals installed! Perhaps we're getting somewhere at long last.

How about it, New York?

BUSMAN'S HOLIDAY

And what does the editor of an amateur radio magazine do over a rainy weekend? What else – he hams it up.

Just before the new repeater regulations hit last October our managing editor Keith – W7DXX/1 – had the 73 Radio Club repeater hooked up so users could access 10m and work some sideband DX. Then, for reasons which are totally inscrutable, the FCC decreed that there could be no more interconnecting of 2m and 10 rigs, so the 10m link had to be disabled.

That was a pity, for the extended groundwave on 10m made it possible for amateurs almost anywhere in New England to talk over the WA1KGO 2m repeater – and vice versa. With 10m a near total disaster area due to a constipation of sun spots, the activity was a shot in the arm. And there certainly is no shortage of 2m channels in the forseeable future – so no one was being hurt and there were benefits to everyone involved.

With the new regulations you can't interconnect 2m to the lower bands, but you still can use 222 MHz and above for this devious purpose, so I set out to see what I could do along this line. By the end of the weekend I had managed to surmount an impressive number of obstacles – like connectors that look like they should work, but don't – test equipment that has to be fixed – the works. But the result was a system which permits me to talk over my low band sideband station via 444 MHz, from a hand unit or the car – and from anywhere within several miles! What a blast that is!

There are some licensing details that will have to be followed up before more people can use the system – but we'll get there. The new regs make it a lot more difficult to have fun, but it is still possible. Why the FCC should decide to throw unnecessary roadblocks up like that is anyone's guess.

Now, let's see – how can we go about changing frequency or swinging that beam via the link? Hmmm.

TIMING OUT

One of the unfortunate aspects of FM repeaters is the inexorable time out feature. Sure, there are times of the day when this is necessary to keep one long-winded chap from driving a multitude of mobile ops up the wall with frustration. But there are also times of the day – or night – when it doesn't make a darned bit of difference if someone starts talking about something of interest instead of merely affirming the fact that some sort of tenuous contact is indeed possible.

Now, to make this even worse, the accursed time out feature, an invention of commercial FM repeaters which was set up as protection against a faulty repeater and not as a limitation on rag chewing, since such is not normally a part of that service, has been brought into amateur radio by the commercial two-way ops who did most of the groundwork on ham rapeaters – and right on into the new regulations, where it is just as unneeded as many other of the ridiculous limitations that have been put upon us.

Put it this way: why must a repeater in Sitka, Alaska time out a rag chewer at 4 a.m. after three minutes? This is what the rules have made into law. For that matter, why should a repeater in mid-Manhattan be forced to shut down after three minutes at 4 a.m.?

The fact is that repeaters which are heavily used have, for the most part, installed timers to keep transmissions short. Repeaters which are rarely used have, for the most part, ignored timers since they are of absolutely no value to them. Isn't this a more reasonable approach than a blanket law which applies to every repeater all the time?

One aspect of FM repeater operation that turns off a lot of operators is the lack of meaningful conversations. I'll grant that these are difficult to come by on the low bands too, but at least there you can talk for a while when you get into something you enjoy and you don't find that you timed out somewhere in the middle of the conversation.

Timers do a lot to enforce non-contact type of contacts. These are the contacts where nothing whatever is exchanged other than the information that a contact has been made. Try and explain the fun of that to your non-ham friends and see if you can do it without their becoming incredulous and thinking that you must be complete idiot.

You will probably have to explain quickly that this fantastic communication system is not a total waste of time and money – it does occasionally function in the public interest for reporting accidents or dry gas tanks of hams who have been paying more attention to "monitoring" the channel than to their cars. It does sound nice and official – and important – to announce that W2NSD/1 is monitoring the channel. Big deal.

It is probably unfair to make anyone feel guilty for spending their amateur radio life in the pursuit of communicationless communications via FM repeaters when we have those vast hordes of DXers looking for pileups for the purpose of a signal report and a QSL. More communicationless communications.

Here we are with one of the best communications systems in the world – a means whereby people can talk directly with people anywhere in the world – and we hardly ever use it for communications at all.

Put that in your damned timer and smoke it.

SELECTIVE CALLING

While the fishing expedition of most blind calls is fun – you never know who will answer your CQ on the low bands – or the equivalent of a CQ on FM – there must be something to be said for being able to get in touch with one specific friend when you want to.

A selective calling system could be made to work – within limits – on the lower bands. Interference and skip conditions might make most systems a lot less than dependable, but then this is amateur radio, not commercial and we are in it for the fun involved, so most of us can probably accept less than perfection.

On FM and via repeaters a calling system could be quite dependable. I'd like to see some articles on simple calling systems for use with FM. There are enough small manufacturers around looking for likely products so I think that any relatively simple system might be attractive enough for them to build with a royalty arrangement to the inventor.

While some of us are able to work with a repeater monitor going constantly in the background, I think that most of us can't. I know that I would like to have some sort of calling system so my friends could alert me that they wanted to talk with me via

one or more repeaters – some system which would not depend upon my having to monitor or on the chance that I might happen to call in at the same time as my friend happened to be listening.

A two tone system is probably simple enough for both encoding and decoding to work successfully. All we need is the hardware design and we might get the idea off the ground.

The "go" signal could turn on the speaker – or ring my chimes – or, in the car, sound the horn.

How about it?

WHAT ABOUT PRIVATE REPEATERS?

The small groups that operate private repeaters have problems, no doubt about it. For the most part they try to keep their channels quiet, but as more and more Clegg 27B's proliferate, secrecy is difficult to maintain. The Comcraft transceivers are even worse, for they tune the whole band, and they tune it with one flip of the wrist. It takes a bit of doing to scan the whole two megs with the Clegg and this could preserve very small repeater groups from widespread detection.

Once a public repeater comes on the private repeater channel, there is little the private group can do but shrug resignedly and look for some other open pair. The number of crystals involved can be substantial – particularly if, as is usually the case, the principles of the operation are heavily into Motorola gear. You don't buy those crystals for $3.75. By the time you've bought crystals for a couple of mobile rigs, a couple of base stations, and a couple of hand units, you have run up a big bill. Well, perhaps that is the price of snobbery and exclusivity, and it should be taken in stride.

In areas where there are free repeater channels, the privates can move – but what about New York, where everything is full? Should the private group fight to hold a public channel for their restricted use – or should they bow to numbers and move on up to 220?

Some groups are apparently thinking of going the route of the remote base, where all members of the group are listed as remote operators. This would have the advantage of the group being able to move entirely out of the repeater band and down below 146.0 MHz. If they were all General or above in license, they could even use the 144–145 MHz segment of the band, which has faded away in most areas of the country to almost total disuse.

WHO'S WHO

The recent glut of controversial regulations wafting to us from the FCC has raised tempers and resentment. It has also cause no little frustration. We've been thinking in terms of the amateur division of the FCC as being the last word – and now that the last word is unacceptable to a lot of people, the question arises, where do we turn next?

The next step is the Chairman of the FCC, Dean Burch. Unfortunately this apparently is an illusory next step, for letters sent to Mr. Burch end up right back on the desk in the amateur division, with no hunt that Mr. Bruch has even seen them. This is obviously no good.

Well, since writing to Chairman Burch is a dead end, let's look up the ladder a bit more and see who is there. The FCC is managed by the Communications Unit of the Commerce Committee of the Senate. This is the committee that does the hiring and firing. Let's take a look at this committee and see if we have some help available from there.

Warren I. Magnuson (D-Wash.) is the Chairman of the Commerce Committee. Amateurs in Washington could do a lot worse than write or call Senator Magnuson and express their views of what has happened to the FCC amateur division.

Senator John O. Pastore (D-RI) is the Chairman of the Communications Unit and directs the activities of the radio industry in the U.S. Rhose Island amateurs please take note!

Possibly the one key man for us all is Senator Howard Baker Jr. (Tenn.) who runs the amateur and CB division of the FCC. Tennessee amateurs should certainly let their man know what they think of the recent turn of FCC events. The rest of us can drop Senator Baker a letter and explain our problems to him and ask for his help. We can also ask our own senators to call Senator Baker and pass along our hopes that there will be some substantial changes in the FCC amateur division which will result in an increase in sensitivity to our needs.

You might scour the bands for Tennessee stations and, when you find them, impress on them the importance of their sitting right down and writing to Senator Baker.

Ten Tec is in Tennessee and if you happen to be in touch with them you might suggest that as an important manufacturer in Senator Baker's state, they get in touch with the senator and impress on him that many amateurs feel that the FCC amateur division no longer has respect for amateurs and that this could lead to another CB-type situation if continued.

NEW FCC COMMISSIONER

The single, sole, only Commissioner to sign the perfidious repeater docket – in my estimation the most destructive piece of FCC rulemaking in the history of amateur radio – will be replaced this month by a new man. Nicholas Johnson, an LBJ appointee to the Commission, is being replaced by David Bradshaw, a Chicago lawyer, a member of John Connally's Democrats for Nixon, and son-in-law of W. Clement Stone, one of President Nixon's most lavish campaign supporters.

Surely at least some of our readers either knows Mr. Bradshaw or knows someone who knows him well enough to get some word to him of the desperate plight of amateur radio. I will fly anywhere any time to explain what has happened and the disastrous results which are coming from it to an FCC Commissioner or a member of the senate committee running the FCC.

EVERETT NEW ASSISTANT CHIEF

Richard H. Everett, who has been a legal advisor for the amateur and CB section of the FCC, has been named Assistant Chief of the Amateur and Citizens Division. Dick has been with the Commission since 1956, when he joined it as a Law Enforcement Officer. He moved to the amateur section in 1963.

QSL CONTEST

73 is offering fame, and a hint of fortune, to the winners of the monthly QSL contest. The winners will be selected every month on the basis of the attractiveness and unusualness of the cards. Get those neurones popping out there and come up with some different QSL's.

CLICHE CONTEST

Our shut-in readers are requested to take pad and pencil in hand, and start tuning the ham bands, making note of every ham cliche they hear. Let's make this art form legitimate by listing all of the most trite phrases in 73. Send your lists to *Trite, 73 Magazine, Peterborough NH 03458.*

Ops out of hearing range of KGQ-1979, the CB-type repeater near Newington, Connecticut, may be able to get a very complete list of the most timeworn and sickening of old ham expressions by asking the next Connecticut low band station he contacts to rebroadcast KGQ-1979 for a few minutes. You'll hear the real McCoy!

. . .Wayne

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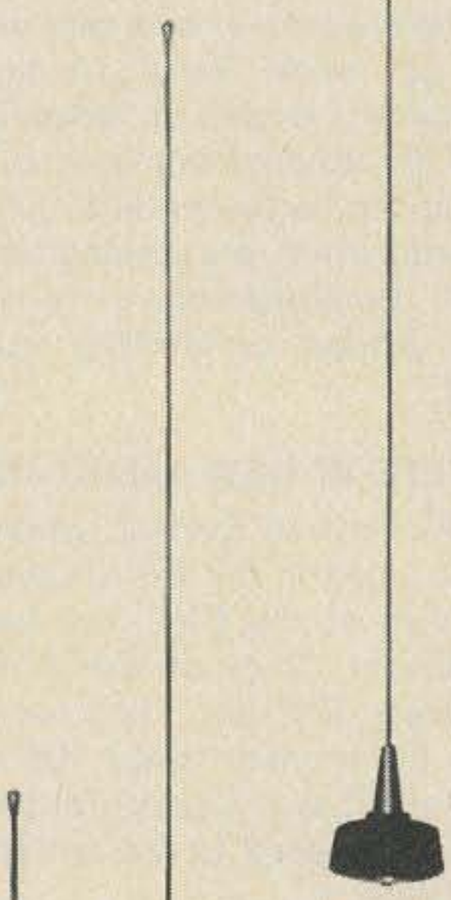

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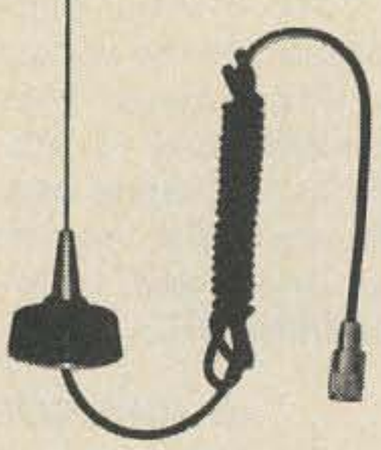
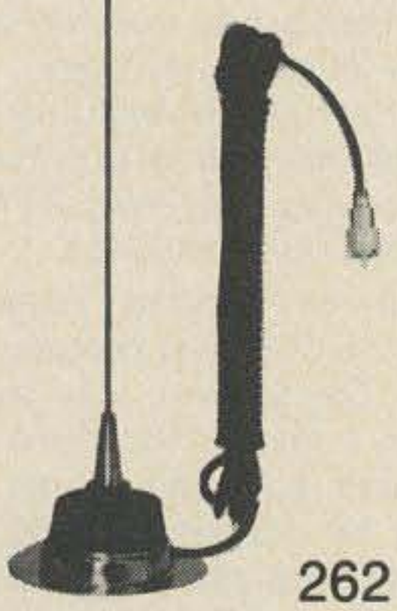
260 Commercial duty 1/4 wave, claw mounted roof top whip. Precision tunable to any discrete frequency 108 thru 470 MHz. 17-7 ph stainless steel whip.



261

261 Same as above. Furnished complete with 18′ of coax and connector.



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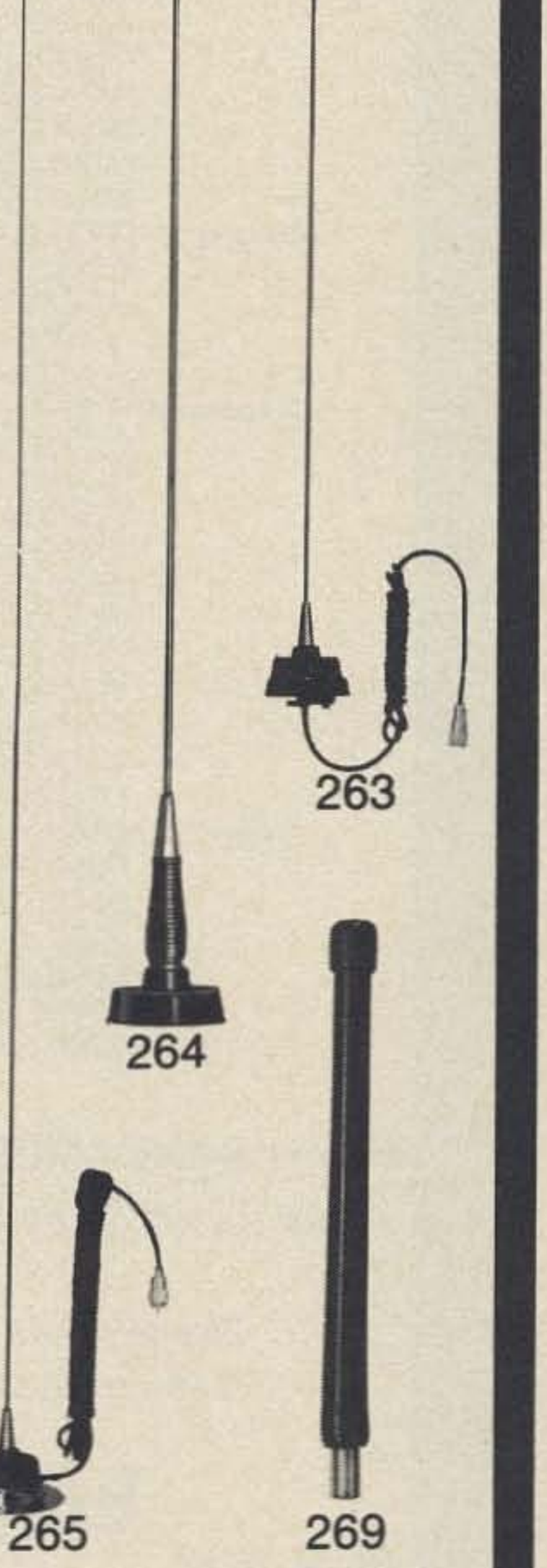

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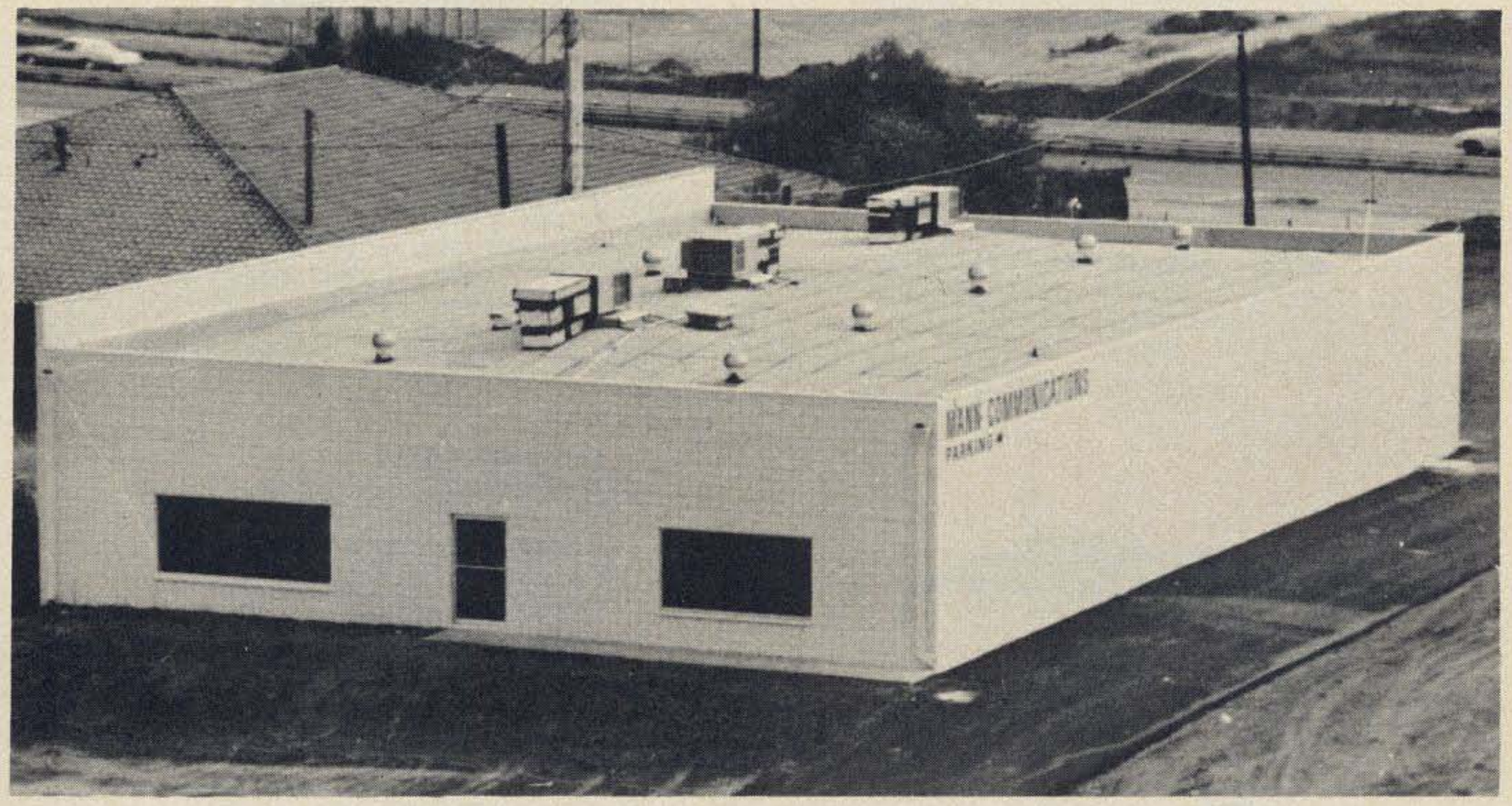

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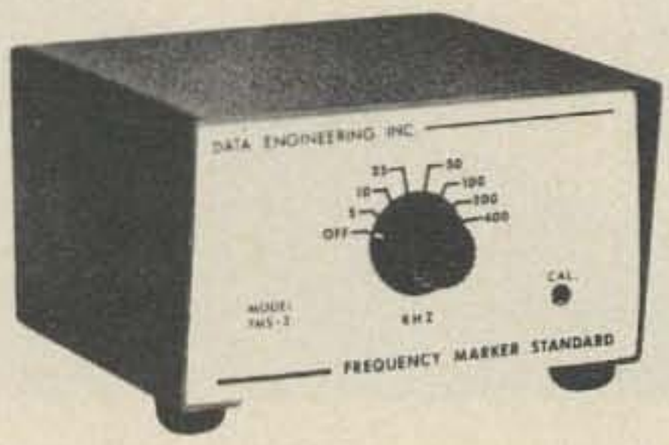

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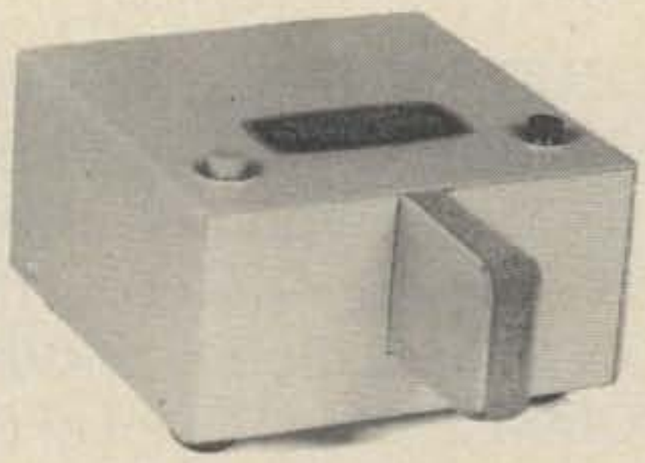

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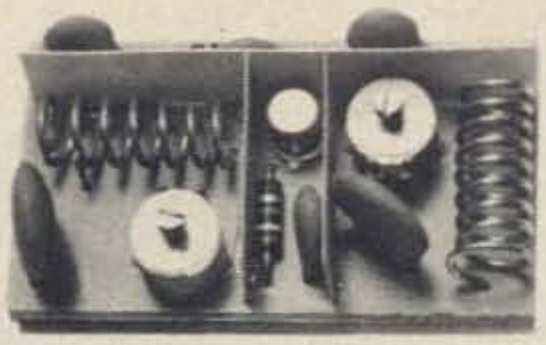
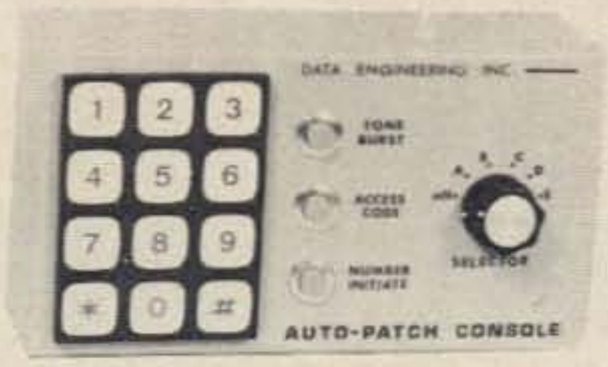


2-METER PREAMP

. . . . . $9.50 Kit
. . . . . $12.50 Wired
20 dB Gain, 2.5 N.F. 12V dc, Size 1" x 1¾" x ½". Diode protected MOSFET. 90-day guarantee. Sh. wt. 4 oz. Major Components Separately Shielded.



AUTO-PATCH CONSOLE

This mobile or home console includes all the features you need for complete auto-patch operation. A Touch-Tone Pad; an automatic dialer for sending one access code plus five Touch-Tone phone numbers; a single/dual tone burst encoder adjusted to your choice of frequency above 500 Hz, and a built in motor. Complete PTT operation with one second transmitter hold.

APC-4K Kit **$84.50**
APC-4A Wired **$98.50**

VHF FREQUENCY STANDARD – FMS-5

Cal. receive and transmit crystals in 10, 6, 2 and 1¼ meter FM bands. Markers for all FM channels. Check deviation. Precision 12 MHz crystal. No unwanted markers. Osc. and output buffered. Sh. wt. 2 lbs. (Less Batteries) . . $44.50
Kit **$37.50**

REPEATER ID

Highly stable oscillator for automatic timing. AC or DC operation. ROM pro vides for more than 25 characters, more than necessary for DC "any call" RPT. AUX is auto matically added to ID if desired when main power is lost. Toneburst opera tion available.

ID-101K Kit $49.95
ID-101 Wired/Tested $69.95
ID-101R assembled in 1½" rack cabinet $109.00

TONE ENCODER

Eight pre-adjusted tones. Duration and Output adjustable, PLL circuitry for extreme stability. Choice of continuous or tone burst operation. Tone burst operation requires no batteries. Easy to install. Includes three special single or dual tones.

TE8-K Kit **$31.95**
Wired **$39.95**

TOUCH-TONE PAD

In less than 15 minutes you can convert your portable transceiver to Touch-Tone operation.

TTP-1K Wired $34.50
TTP-4 MiniKit $44.50

PAD-PULSER

Now you can also obtain pulsed operation from your Touch Tone Pad. Convert Touch-Tone frequencies to decimal pulses at 2805 Hertz with just a flip of the switch. Option can be added to TTP-2/K, TTD-4/K and APC-4/K.

PP-12K Kit $22.95
PP-12 Wired $29.95

TOUCH-TONE DIALER

The electronic touch-tone dialer for home and car. It's safer and more accurate to use than a pad. Memory includes Access Code plus five phone numbers. Numbers easily updated. Built-in monitor. Complete PTT operation with transmitter hold.

TTD-4K
. . . . . WIRED . . $49.00

TONE DECODER

Versatile single/dual tone decoder. PLL circuitry for extreme stability. 1 amp output relay can be reset automatically or manually. Monitor position. Adjus table sensitivity. Internal strap selects single or dual tone operation.

TD-2K Kit $31.95
TD-2 Wired $39.95

5—year guarantees. **Send for Catalog**

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Data Engineering, Inc. 5554 Port Royal Road

Ravensworth Industrial Park, Springfield VA 22151

2 Rigs in one!

THE COMCRAFT CTR-144

$489.95

Made in U.S.A.

The First AM-FM Solid-State Transceiver For Two Meters

No longer is it necessary to choose between AM and FM on two meters. Now you can have both in one compact unit. Join the gang on the new FM repeaters yet still be able to "rag chew" with old friends either AM or FM anywhere in the two meter band.

compare these features...

TRANSMITTER:

- Built-in VFO (Frequency converted for stability)
- AM and FM both crystal and VFO
- Four transmit crystal positions (8 MHz)
- 12 watt input AM and FM
- High level transmitter modulation on AM
- Bandpass coupled transmitter requiring only final tune and load
- Three internal transmit crystal sockets with trimmers for netting
- One transmitter crystal socket on the front panel
- Deviation limiting
- 146.94 MHz crystal included

RECEIVER:

- Double conversion
- Crystal controlled first conversion
- MOS FET receiver front-end
- Integrated circuit limiter and discriminator for FM
- Envelope detector and series gate noise clipper for AM
- Built-in squelch for both AM and FM

WORK MORE REPEATERS WITH THE COMCRAFT "REPEATER TWEETER"

Model CTB-5 TONE BURST GENERATOR

5 TONES

The new Comcraft CTB-5 tone burst generator allows the FM operator to use repeaters requiring a single tone. The CTB-5 meets the standards of most repeater groups and has 5 selectable tones, 1800, 1950, 2100, 2250 and 2400 Hz, each of which is frequency adjustable. Also, adjustments are provided for deviation and duration. The CTB-5 plugs into the mic jack of your transceiver and the mic is then plugged into the CTB-5, no other connections needed. The CTB-5 puts out a ½ second burst each time the transmitter is keyed, push-to-talk or otherwise. Connectors furnished are ¼ inch phone plug and socket with PTT circuit.

The CTB-5 is designed to work with most* transceivers using relay switching, with only a change of connectors.

The CTB-5 is attractively designed with a brushed aluminum front panel and a die cast blue case.

Dimensions: H 3" X W 2.6" X D 2.5"

*Not for use with transistorized mics.

Price: $34.95 shipped postpaid

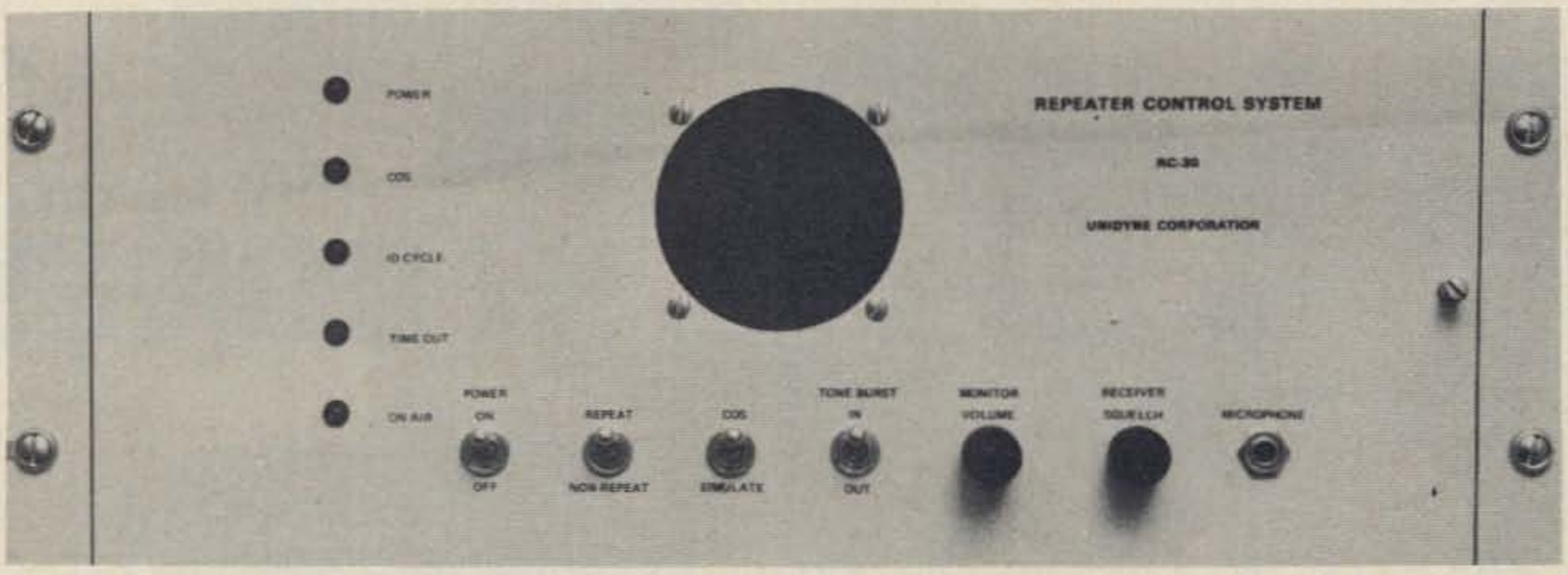
California Residents add 5% for Sales Tax
Warranty: 90 days parts and labor.
The CTB-5 is available at selected amateur dealers and factory direct from:

COMCRAFT COMPANY

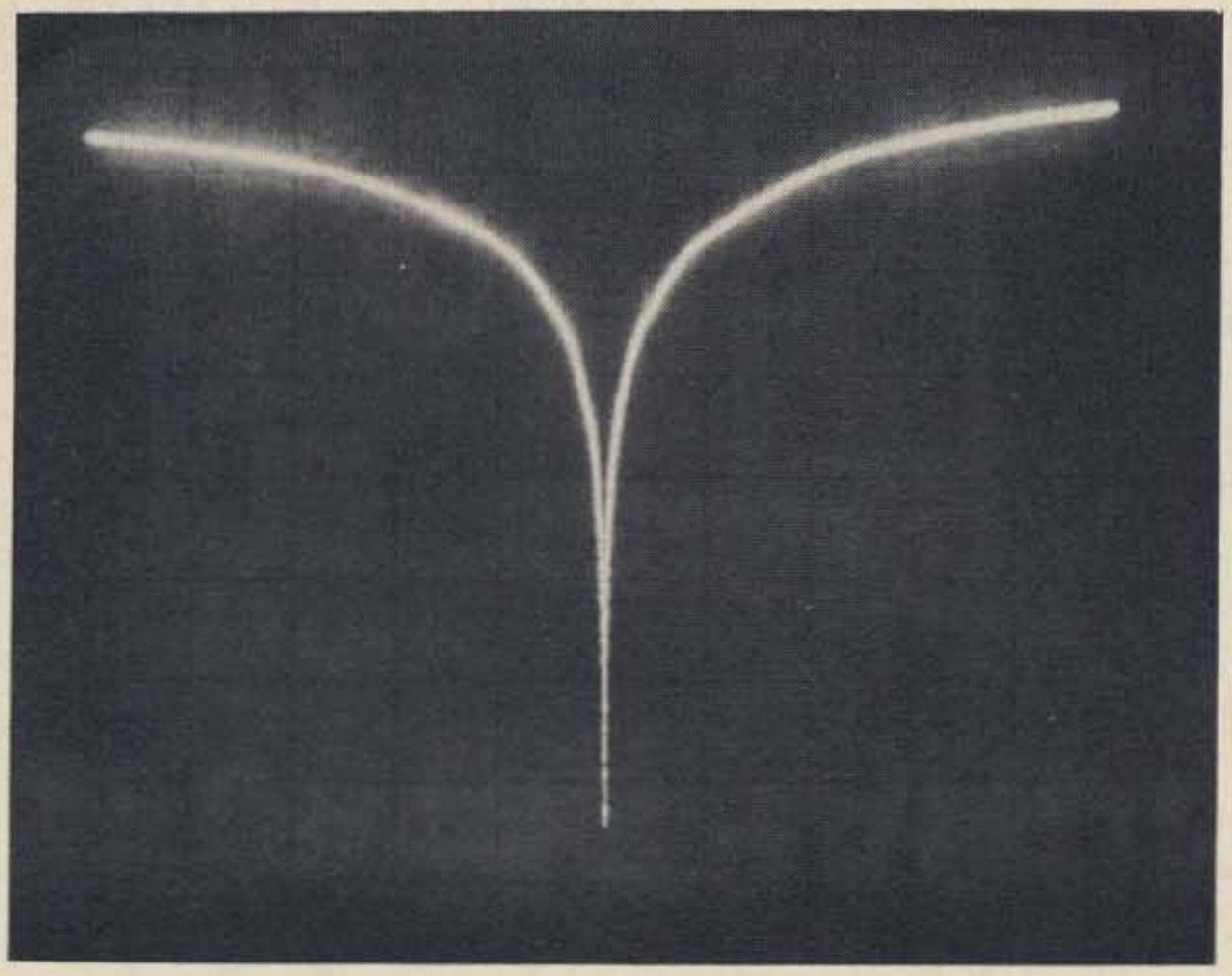
P.O. BOX 266—GOLETA, CALIF. 93017

Write for more information or use READER SERVICE

THE REPEATER PRINCIPLE



CONFORMS TO LATEST FCC RULES • SOLID STATE REPEATER CONTROL SYSTEM • COMPATIBLE WITH ANY RECEIVER, TRANSMITTER, POWER, FREQUENCY AND ID SYSTEM • 3 MINUTE TIME OUT • 5 SECOND DELAY DROP OUT • CARRIER OPERATED SENSOR • ID CONTROL • AUDIO INTEGRATION • OPTIONAL TONE BURST DECODER WITH AUDIO NOTCH FILTER • TELEPHONE REMOTE CONTROL • TONE DECODER VHF LINK REMOTE CONTROL • LOGGING CONTROL • 120 VOLT AC OPERATION WITH AUTOMATIC 12 VOLT DC SWITCHOVER • CYCLING TRICKLE CHARGER • FUNCTION STATUS DISPLAY LIGHTS AND CONTROLS • BUILT IN MONITOR AND SPEAKER • REMOTE RECEIVER SQUELCH • ALL FUNCTIONS ON PRINTED CIRCUIT CARDS • ADD NEW FUNCTIONS AT ANY TIME WITH BUILDING BLOCK CONCEPT • FLEXIBLE SYSTEMS FOR HIGHLY VERSATILE REPEATER STATION •



TONE BURST DECODER NOTCH FILTER SHOWING OVER 70 DB ATTENUATION AT 1950 HZ

UNIDYNE CORPORATION

3224 Peachtree Road, N.E., Atlanta, GA 30305

"You asked for it"

A low-cost 12-channel, 220 MHz FM mobile transceiver

MIDLAND 13-509

10 watts RF output power

Covers 220-225 MHz—crystals supplied for 223.0 MHz

SUGGESTED PRICE $219.95

Amateur users everywhere asked for it—Midland listened! And we've brought our years of experience as a top name in communication equipment to the amateur field with this new 220 MHz transceiver. Check the features: instantaneous final protection circuit prevents damage from excessive VSWR. Complete multiple FET front end coupled with high Q resonator filter, ceramic filters in IF gives excellent selectivity, sensitivity and bandpass characteristics. King-size back-lighted S/RF meter and channel selector. Variable squelch, volume controls. Low power switch for short range (1-watt output). ADL circuit. Individual frequency trimmers for each receive and transmit crystal. Accessory connector for tone burst and discriminator meter. With mounting hardware and dynamic microphone.

Write for Midland's full-line amateur radio brochure: P.O. Box 19032, Kansas City, MO 64141

DEALERS: Inquire about an exclusive Midland amateur radio area franchise

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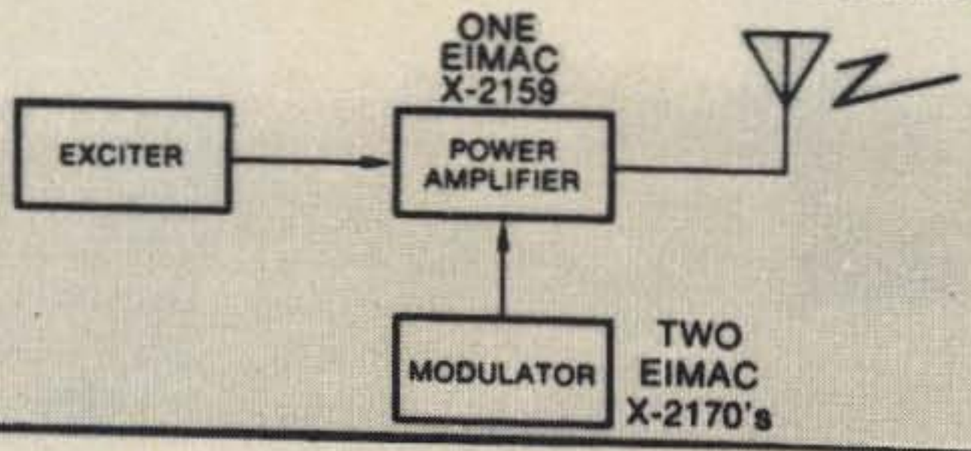
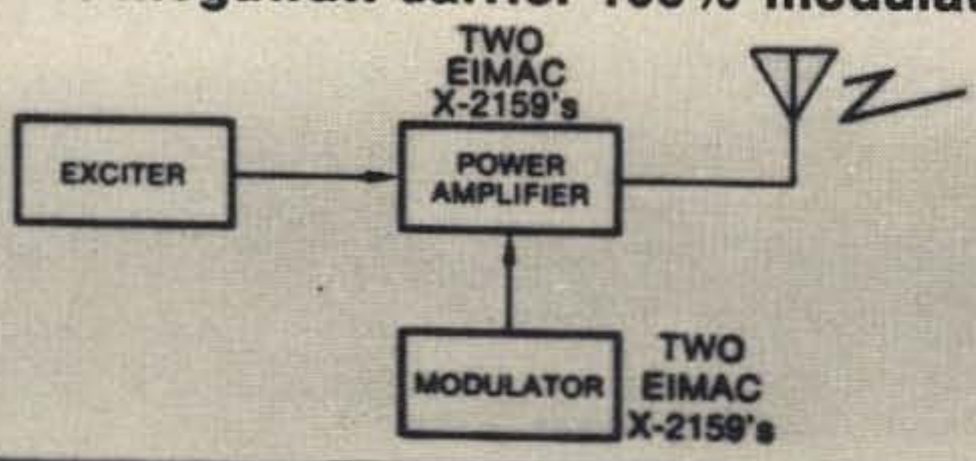
10,400,000 Watts!

EIMAC super-power tetrodes provide transmitter "building blocks" up to 10.4 megawatts, 100% modulated.

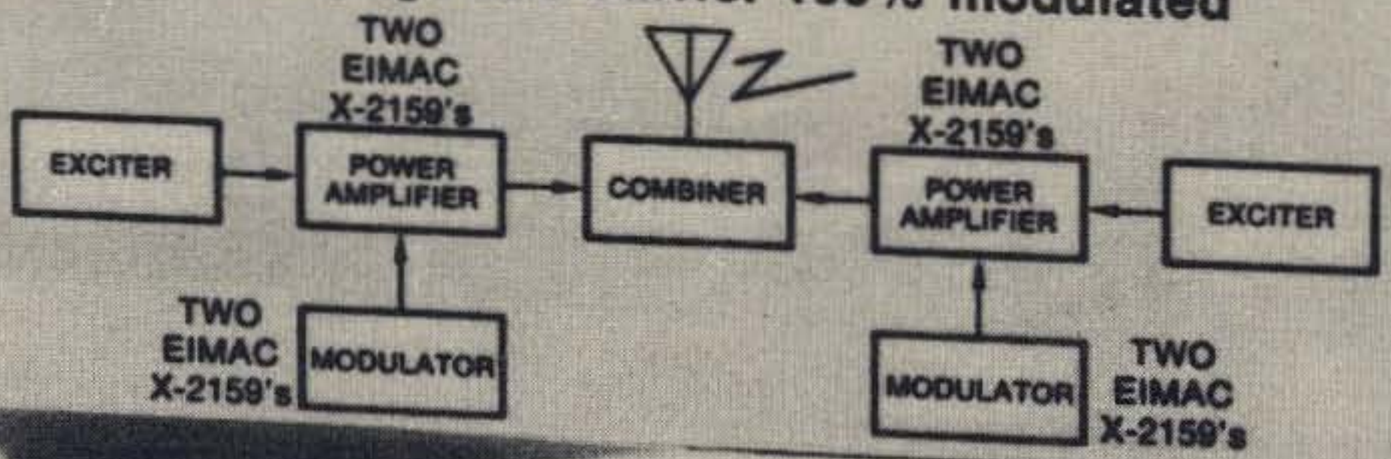
1.3 megawatt carrier 100% modulated



2.6 megawatt carrier 100% modulated



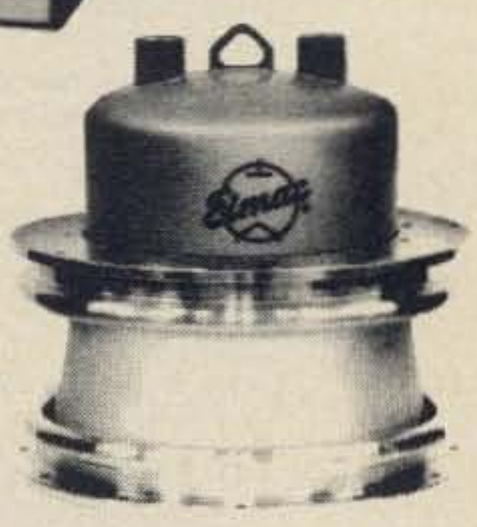
5.2 megawatt carrier 100% modulated



Draw your own 10.4 megawatt transmitter here.

X-2159

For information on the X-2159 and X-2170 super-power tetrodes, contact the EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070. Or any of the more than 30 Varian /EIMAC Tube and Device Group Sales Offices throughout the world.



X-2170

Eimac® division varian

THE SATISFIERS

INOUE'S 2-METER FM GEAR

IC-22	IC-21
22 Ch.	24 Ch.
1/10 W.	1/10 W.

IMAGINE:

On the NEW IC-22 . . . you'll get . . .
22 Channel Unit for just $289.00!

- . . . 5 channels supplied
- . . . large built-in speaker
- . . . separate light indicators on squelch break & Xmitt
- . . . quick release mobile mount included
- . . . green back lighting on front panel
- . . . super compact . . . 23/32"X6"X8½" 4.5 lbs.
- . . . matching regulated, filtered ac supply available.

On both the 21 and 22 . . . .

Cross channel interference is virtually eliminated with 5 helical resonators in the RF amplifier coupled with 2 i.f. filters to virtually eliminate intermod.

The difference of a truly hot RCVR with INOUE's MOS FET front end providing better than .4μV/20db sensitivity.

With the IC-21 you'll enjoy . . .
24 Channel Base-Mobile Unit for $389.

- . . . 7 channels supplied
- . . . dual voltage power supplies — 110/220vac power supply and a regulated dc supply.
- . . . p.a. tuning control — allows the power output to be optimized over a wide frequency separation.
- . . . r.i.t. control — offsets the receiver frequency to bring in signals which are not properly calibrated.
- . . . s.w.r. bridge — built right into the front panel is an accurate s.w.r. bridge for 2-meter work. An invaluable aid for vhf antenna experiments.
- . . . discriminator meter — front panel meter allows you to accurately tell if you or other stations in the QSO are on frequency.
- . . . netting switch — this feature allows the IC-21 to listen to itself for calibration purposes.
- . . . modual construction — quicker servicing if needed.
- . . . optional rcv. vfo, plug it in and find out what's going on over the rest of the band.

WARRANTY & SERVICING: When you buy from the **AUTHORIZED INOUE** team listed below, you will get the kind of warranty and servicing you can count on, that's backed up — by the factory.

See the complete INOUE line at the authorized ICOM dealers listed below.

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ICOM FM Sales
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Hollywood, California 90028
213-462-1504

Sequoia Stereo
773 8th St.
Arcata, California 95521
707-822-0328

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South San Francisco, California 94080
415-871-7500

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Blacks Radio Company
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Oklahoma City, Oklahoma 73105
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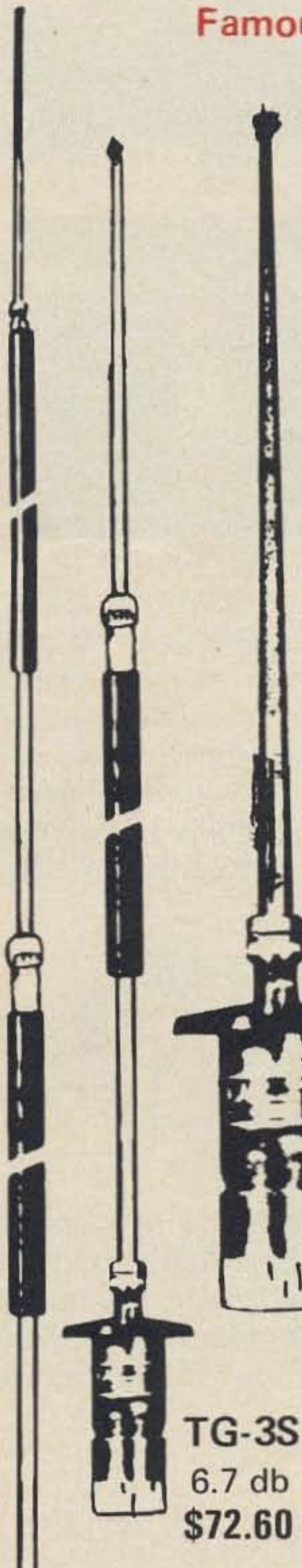
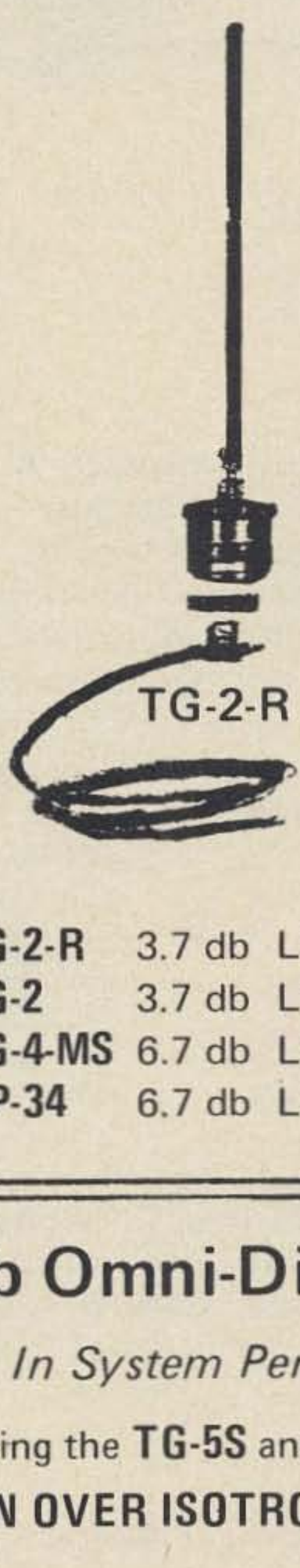
144 to 160 MHz



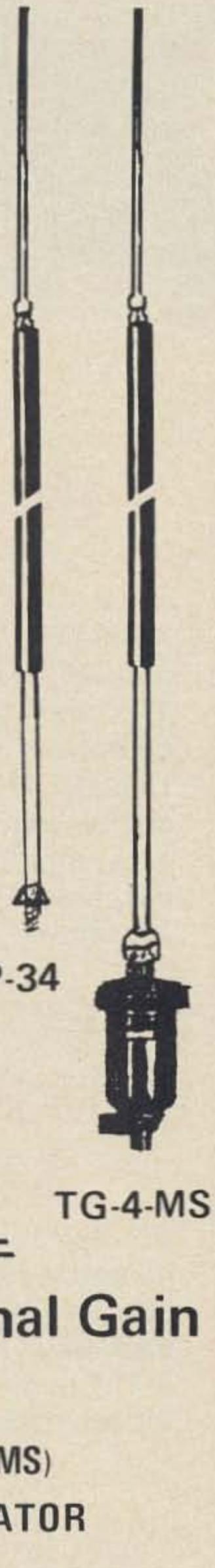
TG-3
3.7 db
$38.75

TG-3S
6.7 db
$72.60

TG-5S
8.2 db
$104.50



TG-2-R **TG-2**



MP-34

TG-4-MS

TG-2-R	3.7 db	List	**$33.00**
TG-2	3.7 db	List	**$22.05**
TG-4-MS	6.7 db	List	**$55.00**
MP-34	6.7 db	List	**$34.65**

14.9 db Omni-Directional Gain

In System Performance

(Using the **TG-5S** and the **TG-4-MS**)

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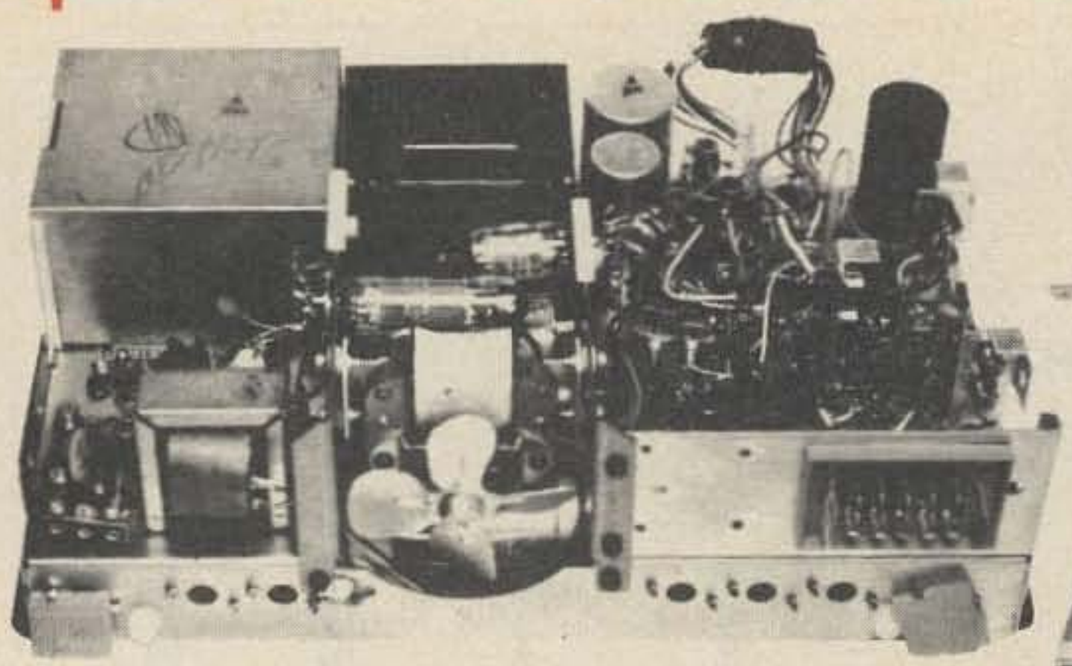
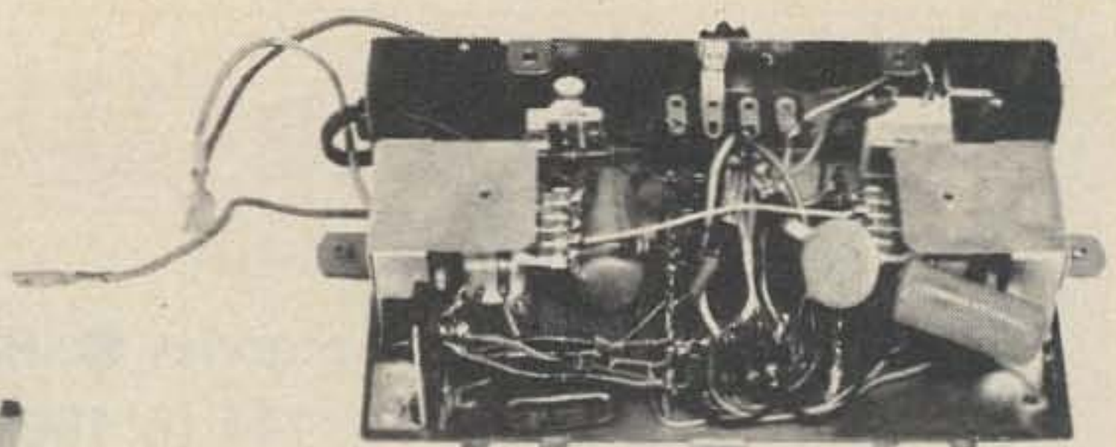
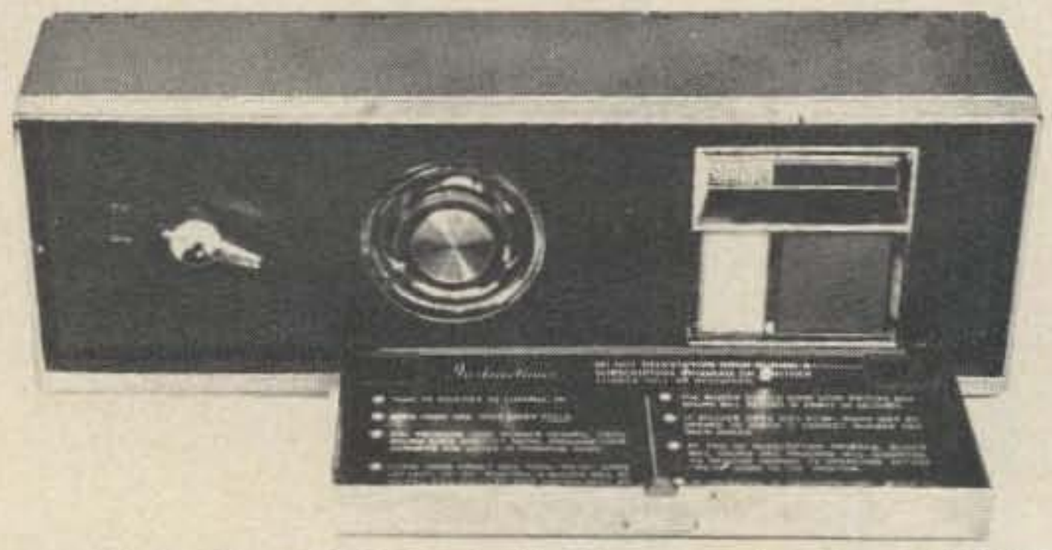
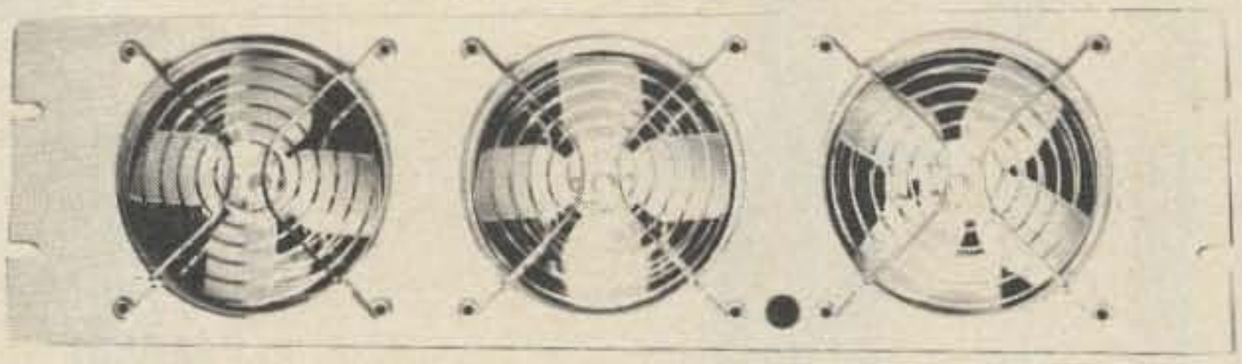






PAY TV ASSEMBLY $15.00

A "Super Value" for the gadgeteer. A complete Pay TV installation made for ZENITH and all in original packing (3 cartons – wgt 36 lbs) and all unused. Operates on regular 115 volt 60 cycle power. A wealth of parts, easily removed due to long leads on components, most over one inch long. The 3 units consist of Translator, Adapter, Decoder. Transistors, tubes, solid state bridge power supply, geared clock motor, 35mm geared transport, time recorder, solenoid, relays, hundreds of small parts such as resistors, caps, etc. Our estimate as to cost to Zenith, approx $1,000 per set. Schematics with each purchase. One set of 3 units $15.00 wgt of 36 lbs. Special . . . 3 sets $35 wgt of 106 lbs. All unused, original boxed.



COOLING FAN BARRAGE $12.00

For the photo enthusiast, electronic industry, people cooler, etc. Brand new assembly made by HOWARD Industries, 3 fans per panel, 115 volt 60 cycle. Each fan good for 100 cfm and have blade guards both sides of each fan. To reverse flow of air, mount panel backwards. All brand new, ready to use. Silver gray panel finish. Standard 19 inch panel, 5 1/4 inches high. $12 per panel of 3 fans or 2 panels of 6 fans for only $20. Ship wgt 7 lbs per panel.

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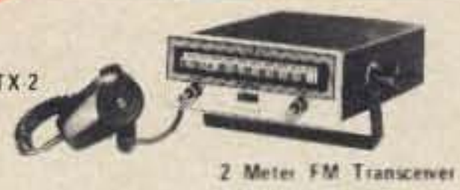
THESE ARE FACTORY REJECTS TAKEN OFF THE LINE FOR REWORKING BUT THEN THE FACTORY CLOSED. We have UNUSED Solid State AM-FM radios with built in AC supply, extra outlets for tape, mike, or turntable. We furnish the schematic. These units made for console installation. Each with minor defects but we can furnish most any part found defective.

Meshna

Postage extra on above. **MESHNA PO Bx 62 E. Lynn Mass. 01904**

GTX-2



2 Meter FM Transceiver

(1) GTX-2 (with built-in DC PS) and 94-94 $249.95
(2) AC POWER SUPPLY $49.95
(3) 2 Extra crystals of your choice $12.00
REGULAR $311.90

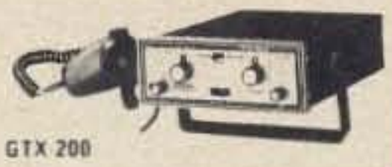
OUR SPECIAL PACKAGE PRICE! $249.95

10 watts output GTX-10

- Simple Conversion to 30 Watt Output

(1) GTX-10 (with built-in DC PS) and 94/34 $199.95
(2) AC POWER SUPPLY $34.95
(3) 2 Extra xtals your choice (stock list) $12.00
REGULAR $246.90

OUR SPECIAL PACKAGE PRICE $199.95
Please add $10.00 Substituting HAMPAK for AC on GTX-10 Package. With HAMPAK and AC–$232.00



GTX-200

100 channel combinations, features independent selection of transmit and receive frequencies and switch for pre-selected pairing.

(1) GTX-200 (with built-in DC PS) and 94-94 $259.95
(2) AC POWER SUPPLY $49.95
(3) 2 Extra xtals your choice (stock list) $12.00
REGULAR $321.90

OUR SPECIAL PACKAGE PRICE: $259.95

HamPak

Battery pack for GTX-10 portable operation. Uses 10 D cells (not included).

$39.95

(includes portable antenna, carrying handle & mike clip)

★ FLASH ★ FLASH ★ FLASH ★

Look at what you get for NO REPEAT NO EXTRA CHARGE. The GTX-2 and GTX-200 have a super-sensitive Dual-Gate Mos Fet pre-amplifier BUILT IN the receiver front end for superb, less than .25 microvolt sensitivity. THE BEST receiver now even better!

30 WATTS OUTPUT. ALL SOLID STATE (no tubes). TRUE FM (not Phase modulation) for superb audio quality 10 channels with 146.94/146.94 included. Three pole low pass filter on both transmit and receive. 1 watt low power position. Provision for tone encoder. Simple internal strapping provision allows multi-channel use of any crystal. (GTX-2 and GTX-10) Microphone and mobile mounting bracket supplied. G-10 glass boards. (GTX-2 and GTX-10) Professional level construction by distinguished Avionics Mfg. – General Aviation Electronics, Inc. The finest amateur FM transceiver available at any price. Size: 9 x 6 1/2 x 2 1/2. Weight 5 lbs. Current Drain: Receive: .09 amps. Transmit: High 5.0 amps, Low 1.7 amps.

Genave

100% AMERICAN MADE

Marine/Master-25w

2-Way VHF-FM Marine Radio Telephone

(1) 3 dB gain lay-down gleaming white fiberglass antenna
(2) 6 dB gain lay-down gleaming white fiberglass antenna
(3) 9 dB gain lay-down gleaming white fiberglass antenna
(4) 3 dB sailboat antenna, mounting hardware and 60' of marine white cable
(5) Channels 68, 26, 28, 12

PLEASE WRITE FOR OUR SPECIAL PACKAGE PRICES!

Full 25 watts power. ALL SOLID STATE (no tubes) reliability. 10 channels with 6 1/2 pairs of crystals installed for calling and distress, weather, ship-to-ship, ship to coast and public and port operations. Self contained, compact. Pre-tuned. Vinyl covered unit is splash proof – impact, humidity and fungus resistant. Can be mounted in panel, on bulkhead, on or below table top with universal mounting bracket included.

JUST CONNECT TWO WIRES and YOU'RE ready to OPERATE!

COMING SOON!!!! Genave Touch-Tone Pad, Genave Repeater *and* MUCH MORE.

REGENCY, CLEGG, MIDLAND, SBE, INOUE, GLADDING, MIIDA, CUSH CRAFT, DATA ENG., BIRD, OLIVER SWAN (KLM), TEEC SSTV, HY-GAIN, SAVOY, SIGNAL/ONE, B&K, LEADER, MITS KENWOOD, TEMPO, TEN TEC, DX ENG., MINI-PRODUCTS, SWAN, ETC., IN STOCK – PLEASE WRITE FOR QUOTE.

Digipet-60 Frequency Counter

See Nov. '72 CQ Review

1 KHz-60 MHz (130-160 MHz with optional converter) Reg. $299

A frequency counter with a range of 1 kHz to 60 MHz (or 130-160 MHz when used with our Digipet-160 converter). With a resolution of 1 kHz or 1 Hz (at 1 ms or 1 s gate times). It can be operated on either ac or dc, with complete overload protection. Plus a stability aging rate of 1 part in 10^6 week. And the whole unit is a mere 7" deep by 2 1/2" high! Superb precision quality at LESS THAN KIT PRICES. Call or write for literature and trade in or our LOW INTRODUCTORY PRICE. 1 year warranty.

Also MIIDA PRECISION AUTORANGING DIGITAL VOLT METERS (reg. $319) LESS THAN KIT PRICES. Compare before you buy! 1 YEAR WARRANTY

CLEGG FM-27Bs
(Reg. $479.95)
Write for special deal!
With Clegg AC
(Reg. $559.00)
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Regency, Midland, Gladding 25, SBE,
etc., also in stock.
Please write for quote.

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Service Manual
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$29.00 ppd.

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T-599.....$395.00
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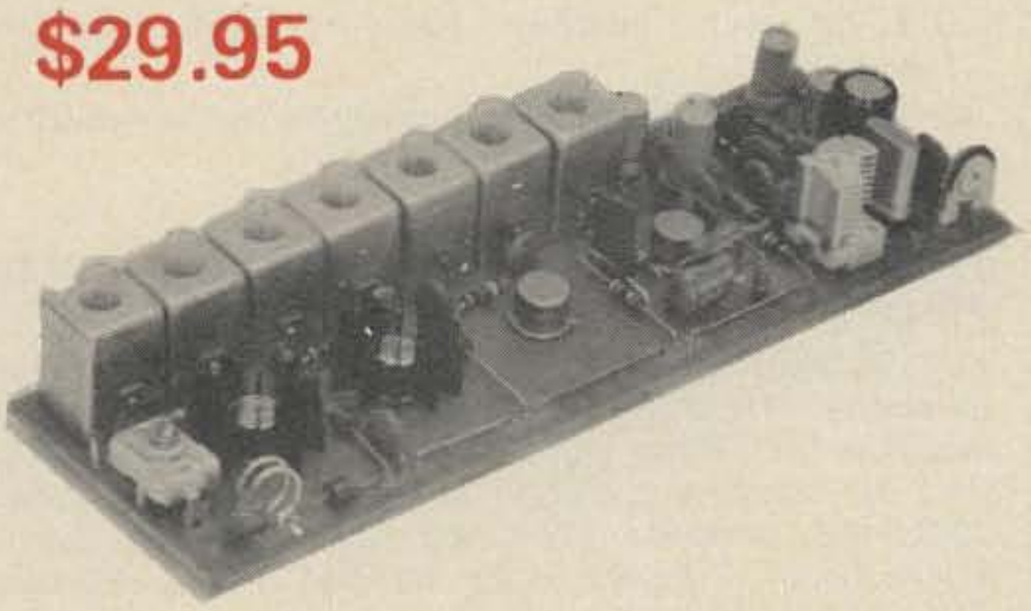
144–220 TRANSMITTER KIT

ANNOUNCING! A Breakthrough for the Homebrewer

COMPLETE WITH DRILLED BOARD

$29.95

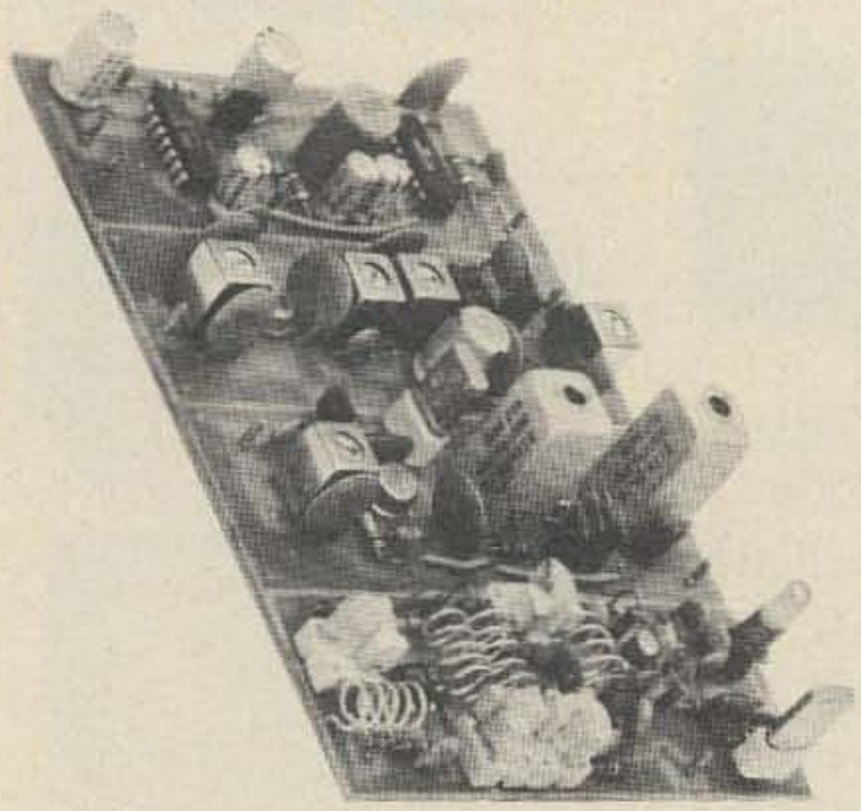


- TYPICALLY 1 1/2 WATTS OUTPUT AT 12.6 VOLTS (1 WATT ON 220)
- ADJUSTABLE DEVIATIONS TO 10 kHz
- AUDIO CLIPPING AND ACTIVE FILTER
- CRYSTAL NETTING TRIMMER
- DOUBLE TUNED RF STAGES FOR A CLEAN SIGNAL
- STANDARD 12 MHz CRYSTALS (14 MHz FOR 220)
- ZENER REGULATED OSCILLATOR
- PROVISIONS FOR METERING EACH RF STAGE
- PREDRILLED AND TINNED GLASS CIRCUIT BOARDS
- MEASURES ONLY 2" x 6"

A one watt exciter using four RF transistors, two diodes, and one integrated circuit. The RF transistors are operating well below their ratings allowing long keying periods without damage. The exciter may be used alone as a transmitter or with our PA-144 or 220 amplifier for a 15 watt station.

144–220 MODULAR RECEIVER KIT

COMPLETE WITH DRILLED BOARD



$59.95

- SENSITIVE NOISE OPERATIVE SQUELCH
- BETTER THAN .3 μV SENSITIVITY
- 15 Khz BAND WIDTH
- ONE WATT AUDIO OUTPUT
- DUAL CONVERSION 10.7 Mhz AND 455 Khz IFs
- ALL IC EXCEPT FOR FRONT END
- STANDARD 45 Mhz CRYSTALS
- OPTIONAL CERAMIC FILTER
- OPERATES FROM 12 VOLTS NEGATIVE GROUND

Measures only 4" x 6"

Order TX-144 or 220–$29.95; PA-144 or 220–$29.95; RX-144 or 220–$59.95.

Receiver with 7 Khz ceramic filter – $65.95. Include $1.00 postage and handling for each kit ordered. New York state residents add 6% sales tax.

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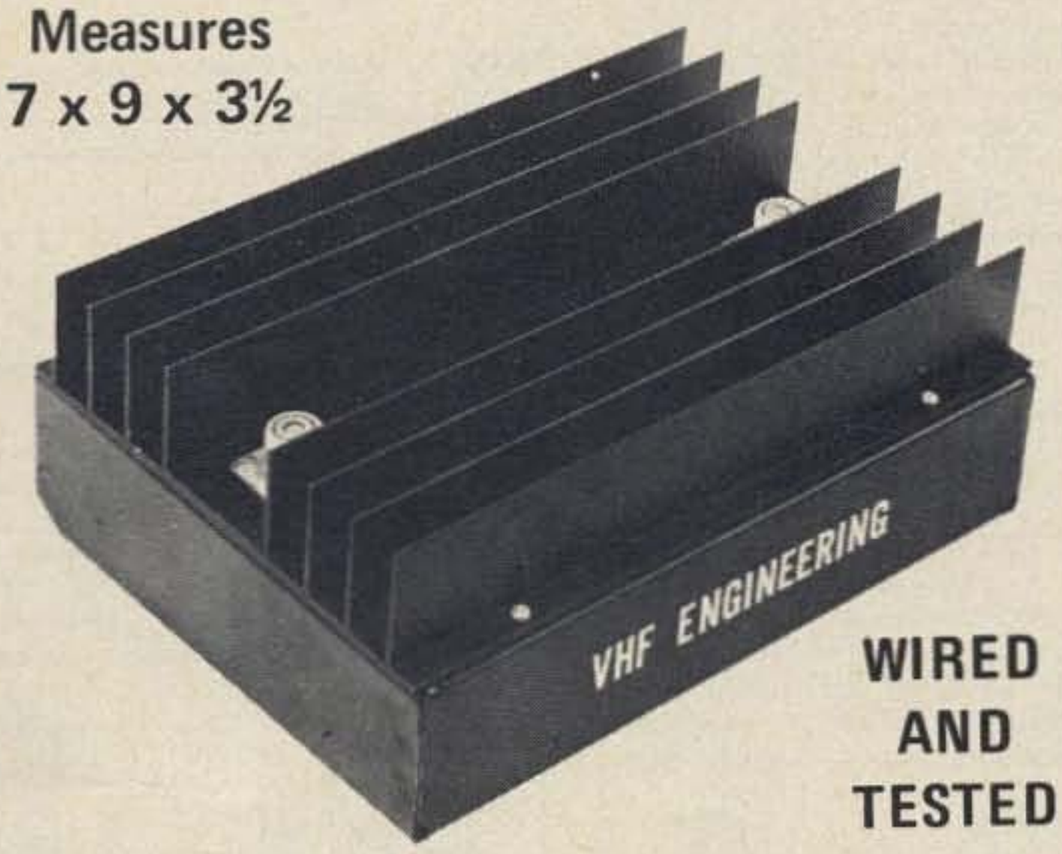
NEW POWER-BOOSTER

60—90 Watts

Measures
7 x 9 x 3½



WIRED AND TESTED

TWO MODELS

8005H 2—6 watts in 60-90 watts out
(60 watts from your standard)

8020H 10—25 watts in 60-90 watts out
(Increase the power of your REGENCY by over 400%)

8005H $159.95
8020H $129.95

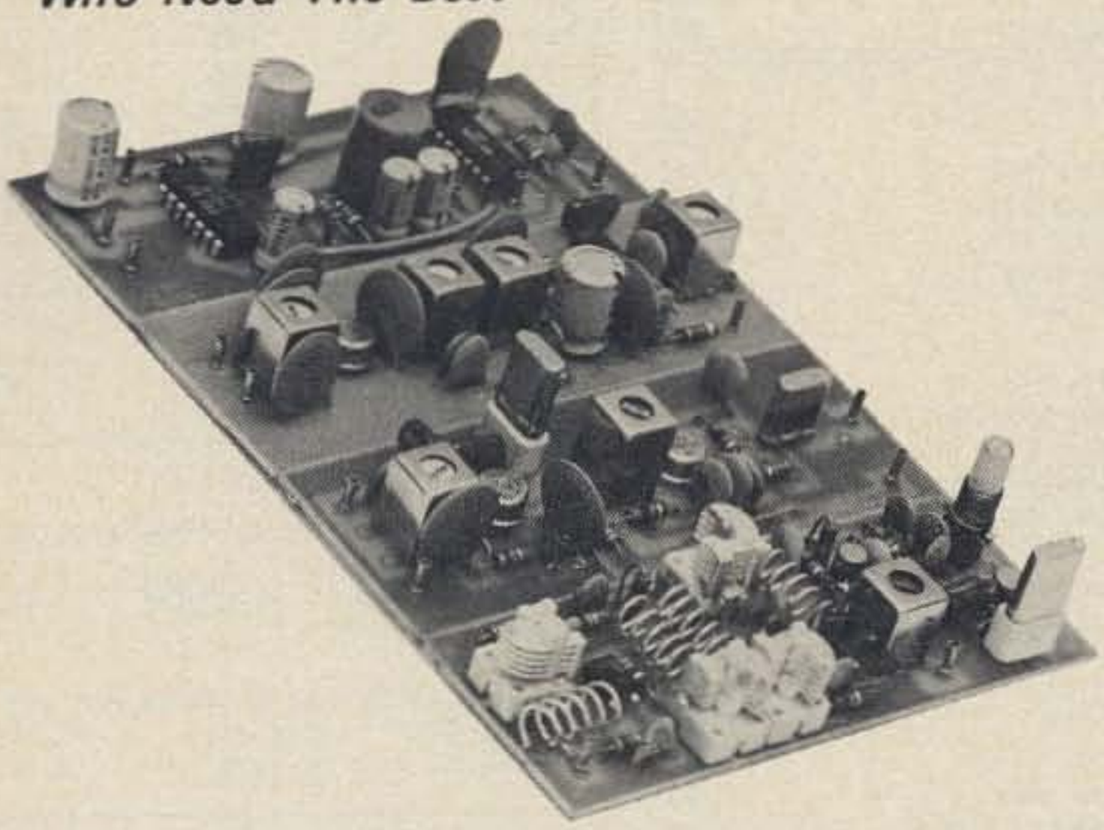
Not a kit, but a completely wired and tested power amplifier with automatic antenna switching. Uses NEW not surplus, balance emitter power transistors for missload protection. Large heat sink for cool operation. Less than 1 dB loss on receive. SO 239 connectors, nominal 50 ohm impedance.

NEW RX-144C KIT

$69.95

For Repeaters or Those Who Need The Best

With 10.7 Crystal Filter



- LOW CROSS MODULATION FRONT END
- 10.7 Mhz CRYSTAL FILTER
- COR OUTPUT FOR CONTROL
- 2 WATTS AUDIO OUTPUT
- LESS THAN .2μV SENSITIVITY
- MEASURES 4 x 6 x 1 inches

We are now in our new location . . . please note new address . . .

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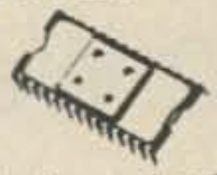
CT5005 CALCULATOR

This calculator chip has a full four function memory, which is controlled by four keys, +M (adds entry into memory), -M (subtract entry from memory), CM (clear memory--without clearing rest of registers), RM (read memory or use as entry).



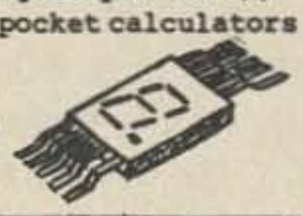
12 digit display and calc.
fixed decimal at 0,1,2,3,4, or 5
leading zero suppression
seven segment multiplexed output
true credit sign display
single 28 pin chip

Chip and data----------$14.95
Data only (refundable)-------- 1.00

MAN 3M

This low cost epoxy encapsulated LED is capable of displaying 10 digits, 9 distinct letters, and bears solid-state reliability, making it compatible with standard digital IC's. Its compact spacing(5 digits per inch), makes it ideal for pocket calculators

Each, only $3.00
Ten or more 2.50



5001 CALCULATOR

40 pin calculator chip will add, subtract, multiply, and divide. 12 digit display and calculate. Chain calculations. True credit balance sign output. Automatic overflow indication. Fixed decimal point at 0, 2, 3, or 4 Leading zero suppression. Complete data supplied with chip.

Chip and data, only $9.95
Data only (refundable) $1.00

LED SPECIAL

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3.50 for ten
29.95 for 100

SOCKETS

Dual-In-Line 14 pin 40¢ each
16 pin 45¢ each

High quality, gold plated

DM8880(Sperry DD700 202) 7 segment high voltage nixie driver, only $1.75

MC1013 ECL 85mc ff	$1.00
MC1023 ECL driver	2.00
MC1039 ECL-TTL interface	2.00
8850,9601-one shot multivibrator	1.00

741 SPECIAL

fully compensated operational amplifier with data sheet and page of application notes covering the basic circuits for op-amps.

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ten for 3.75

All IC's are new and fully tested leads are plated with gold or solder Orders for $5 or more will be shipped prepaid. Add 35¢ for handling and postage for smaller orders, residents in California add sales tax. IC orders are shipped within two workdays of receipt of order-kits are shipped within ten days of receipt of order. $10.00 minimum on C.O.D.'s(phone in).

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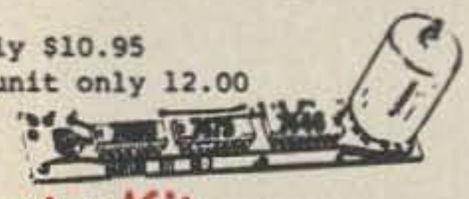
CD-2 Counter Kit

This kit provides a highly sophisticated display section module for clocks, counter or other numerical display needs. The unit is .8" wide and 4 3/8" long. A single 5 volt power source powers both the IC's and the display tube. It can attain typical count rates of up to 30 MHz and also has a lamp test, causing all seven segments to light. Kit includes a two sided(with plated through holes) fiberglass printed circuit board, a 7490, a 7475, a 7447, a DR2010 RCA Numitron display tube, complete instructions, and enough Molex pins for the IC's.....NOTE, boards can be supplied in a single panel of up to ten digits (with all interconnects) therefore, when ordering please specify wether you want them in single panels or in one multiple digit board Not specifying will result in shipping delay

Complete kit, only $10.95
Fully assembled unit only 12.00



CD-3 Counter Kit

Can be programmed to count to any modulus--2-9 for one kit, 2-99 for two kits, etc. Includes everything as in CD-2, two resistors, three diodes, but is without the 7475 quad-latch. Full instructions included----perfect for displaying seconds, minutes, hours, etc.

Complete kit, only $9.95
(supplied in single panels only)

8000 series TTL DIP

8200	4 bit comparator	$1.60
8210	8 line to 1 line selector	1.40
8220	parity generator/checker	1.00
8223	256 bit programmable ROM	7.50
8230	8 input multiplexer	2.00
8233	2 input 4 bit multiplexer	1.75
8242	4 bit comparator	1.15
8251	BCD to decimal decoder	1.00
8261	fast carry extender	2.00
8266	2 input 4 bit multiplexer	1.50
8270	4 bit PI, SI, SO	2.00
8271	4 bit shift register	2.00
8274	10 bit PI, SO register	3.00
8280	45MC presetable decade counter	1.35
8281	45MC presetable binary counter	1.15
8290	presetable decade counter 75MC	3.50
8292	presetable decade counter 10MC	1.15
8520	25MC divide by "N" 2 to 15	2.00
8551	tri state quad latch	2.50
8570	8 bit SI, PO	3.00
8590	8 bit PI, SO	2.00
8275	quad bistable latch	.90

LINEARS

NE531	op amp TO-5	$2.00
NE560	phase lock loop DIP	3.25
NE561	phase lock loop DIP	3.25
NE565	phase lock loop TO-5	3.25
NE566	function generator TO-5	4.00
NE567	tone decoder TO-5	4.00
NE5556	op amp DIP	1.00
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710	voltage comparator DIP	.50
711	dual comparator DIP	.40
723	precision voltage regulator DIP	1.00
747	dual 741 op amp DIP	1.00
748	op amp TO-5	1.00
LM100	positive DC regulator TO-5	1.00
LM302	op amp voltage follower TO-5	1.25
LM308	op amp TO-5	2.00
LM311	comparator TO-5	1.75
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LM309H	5V-200ma power supply TO-5	1.00
LM309K	5V-1A power supply module TO-3	2.00

Silicon diodes (signal) only,
1 foot (60) diodes $2.50

EPOXY TRANSISTORS

TO-5 and TO-18 mixed 1 ounce (40+)-----$1.00

1 amp Silicon Rectifier
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15 for $1.00

MOS by NATIONAL

Dynamic shift registers TO-5 only				
MM502	dual	50	BIT	$1.25
MM506	dual	100	BIT	1.75
MM5006	dual	100	BIT	1.50
MM5013		1024	BIT	2.25
MM5016		512	BIT	1.50
Static shift registers				
MM504	dual	16	BIT	1.50
MM505	dual	32	BIT	1.75
MM550	dual differential analog switch			2.50

CMOS

CD4001	quad 2-input	$ .75
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DR2010 by RCA

A popular Numitron digital display tube. This incandescent five volt seven segment device provides .6" high numeral which can be seen at a distance of 30 feet. The tube has a standard nine pin base (solderable) and a left hand decimal point.

$5.00 each
$4.00 each for 5 or more

7400 series DIP

7400	$ .35	74H53	.50
74H00	.50	7454	.35
7401	.35	74L54	.50
74H01	.50	74L55	.50
7403	.35	7460	.35
7404	.35	74L71	.30
74L04	.50	7472	.50
74H04	.50	74L72	.60
7405	.35	7473	.65
74H05	.50	74L73	.90
74H08	.50	7474	.65
7410	.35	74L74	.90
74L10	.50	74H74	.90
74H11	.60	7476	.70
7413	1.15	74L78	1.00
7420	.35	7480	.65
74L20	.50	7483	1.30
74H20	.50	7486	.80
74H22	.60	7489(8599)	3.50
7430	.35	7490	1.50
74L30	.50	7491	1.15
7440	.35	7492	1.15
74H40	.50	7493	1.15
7441	1.60	7495	1.25
7442	1.30	74L95	2.00
7446	1.75	74107	.70
7447	1.75	74121	1.60
7448	1.15	74123	2.00
7450	.35	74153	2.00
74H50	.50	74181	3.75
7451	.35	74192	2.50
74L51	.50	74193	1.50
74H51	.50	74195	1.10
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LED's

MV-50 red emitting 10-40ma@2V $.39

MV5020 red LED  .45

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3.5 amp 400V rectifier $1.25
8 amp 400V SCR IR 122D 1.00

Precision resistors-high quality parts manufactured by Dale, Corning Pyro film, Etc. These are all brand new with full length leads.

82	5%	Dale 6.5W WW	$ .15
18.2K	1%		.05
20.5K	1%		.05
22.5K	1%		.05
26.1K	1%		.05
36.1K	1%		.05
36.5K	1%		.05
40.2K	1%		.05
49.9K	.05%		.10

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IC-22 2 meter FM at only $279.00 net.

- *22 channel capability*
- *Ready to go on 146.94–.94, .34–.94, .16–.76, .76–.76, .52–.52.*
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- *Sensitivity better than 0.4 UV-20DB quieting ±8 KC ceramic IF filter*
- *COR light shows signal without audio being on.*
- *BIG 4" speaker*
- *Size – 6 1/8" wide, 8½" length, 2¼" high*
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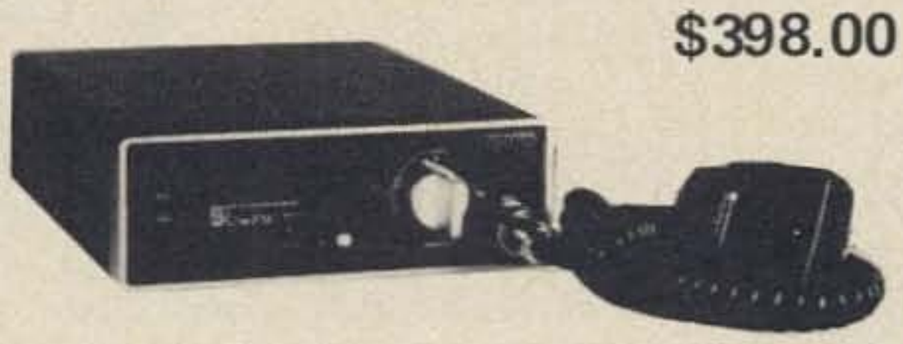

SB-144
$259.00

BUY NOW
and receive
your choice
of 2 extra sets
of crystals:

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or
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$399.00

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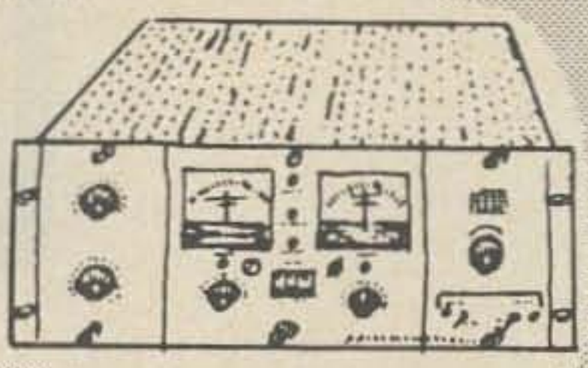
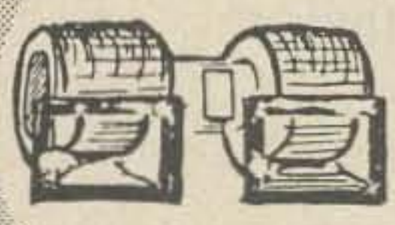
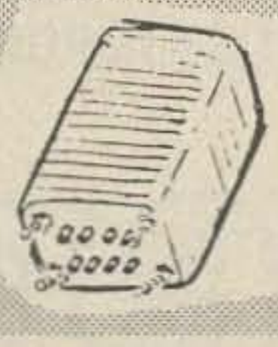
VLF Receiver transistorized 0.1–99.9 KHz Digital tuning, Electronic Eng. Co. 881-M. Used, Excel. 50 lbs. . **$185.00**



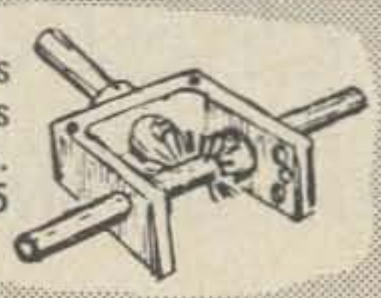


Blowers 110VAC Dual 2½" rotors new, 4 lbs **$2.95**
Dual 4" rotors, new, 9 lbs. **$6.95**
Dual 6" rotors, new, 20 lbs. **$12.95**

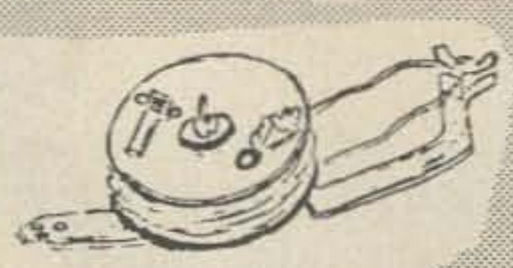


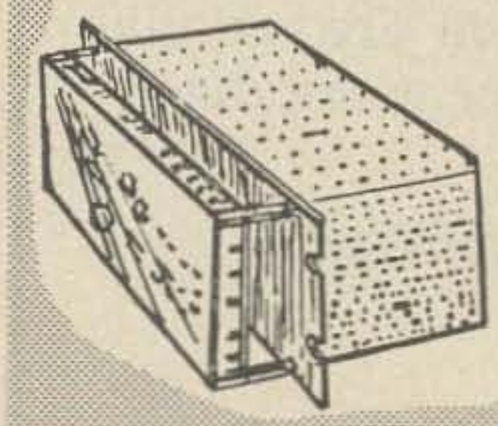
Power Xfmr. pri: 117V 60 Hz sec; 6.3V 1 amp 12.6V 1 amp, 700VCT 35 ma, wt. 2 lbs. ea. . . . . **$1.25,5/$5**

Tuning drive, rt. angle 3 shafts ¼" dia. x ¾" mfg. by James Millen. Unused with hdwre. wt. ½ lb. . . . . **$1.25, 5/$5**

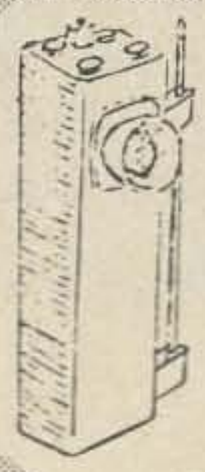


Antenna Reel RL-122/GRA-4 150' bare stranded copper cable, clamps ea. end mtd. on steel reel, 2 lbs. **$1.00**



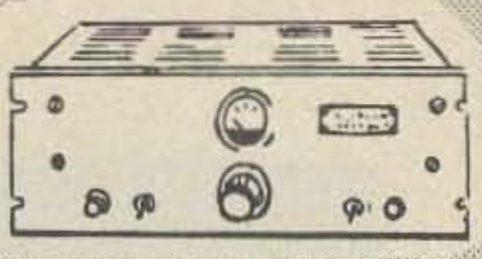


Power Supply, low voltage, modular, In: 105–125V 47–63 Hz, regulated outputs: 5, 15,–20, –30 VDC 1 amp. unused 6 lbs. **$24.95**

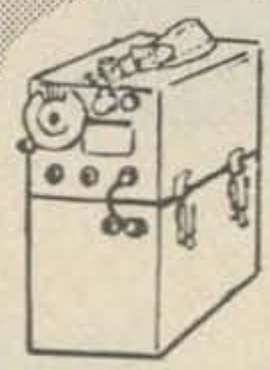


Handfone HT-1, by Hallicrafters, dual conv, transistorized AM single channel, xtal control, nom. 25–50 MHz, 3 lbs. used **$10**

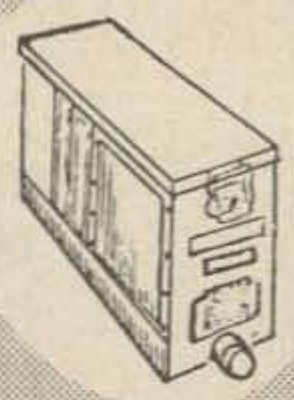
Limiting Amplifier AM-864/U, peak limiting, audio frequency amp, 5 tubes, tech man, 29 lbs, new **$11.95**



Headset-microphone, H-63 headset, 600 ohm, M51/UR waterproof carbon mic. 2 lbs. new **$3.95**

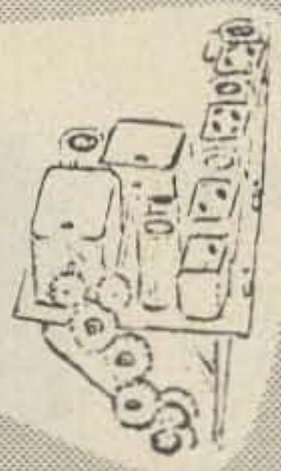


VHF Multiphone, AM 112–128 MHz, rec cont tunable, transmit on 6 xtal controlled channels, 13 tubes, less battery, ant. used, 8 lbs. **$14.95**

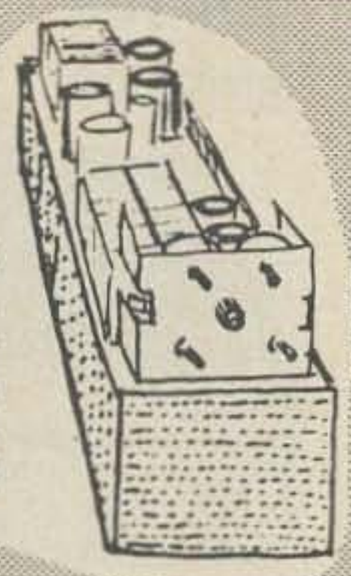


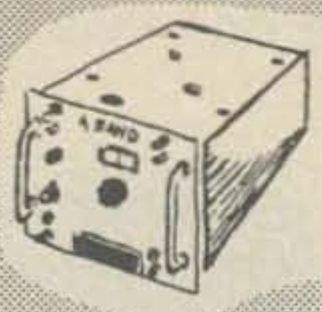
Receiver R-257/U, 25–50 MHz FM, single channel, dual conv., xtal control, 21 tubes with tech manual, 26 lbs unused **$7.95**

I.F. Oscillator, from T217/GR, combo of slug tuned coils and xtal switching covers 20–30 MHz in 100 steps, includes 6 tubes and 20 xtals in HC6/U holders, 6 lbs., used **$6.95**

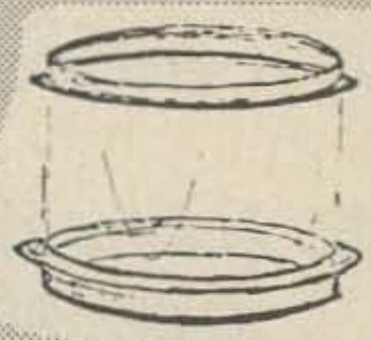


Electronic Vid Switch tubes 6AN5, 5687, 2/5814 20 transistors, zener regulated xfmr supply 6.3VAC in, –12 –35 +12VDC out, new. 10 lbs. **$4.50**





Amplifier-Converter AM 1179/GRC, 50–100 MHz continuously tunable, 30 MHz output use with rec. above, wt. 10 lbs, used **$16.95**



Electron Tube Support, large glass air jacket with aluminum support rings by Matchlett Labs, 7 lb 9 5/8"I.D.x7", new **$15**

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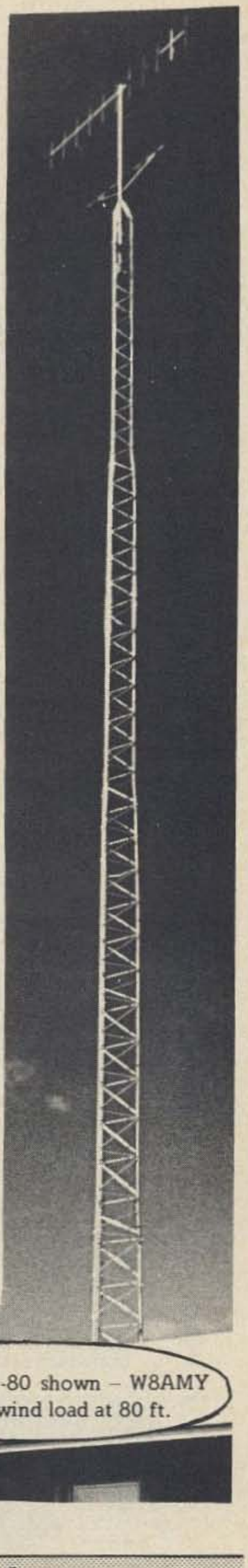
FREE STANDING ALUMINUM TOWER



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- Universal 11-40 Tower - **
- Universal B-18 Hinge-Up Base
- Universal R-11 Rotor Mount
- CDR AR22R Rotator *
- 100 ft. Rotor Cable
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Complete with one of the following antennas:

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Hy-Gain 203BA	Reg. $486. EDI $359.
Hy-Gain TH3-MK3	Reg. $491. EDI $364.
*TR44 Rotator & Cable – Add	$ 29.
*Ham-M Rotator & Cable – Add	$ 65.
**11-50 (50') Tower w/B22 Base – Add	$ 84.

Light Weight – In addition to its weight advantages aluminum offers maintenance free life time beauty. Eliminates painting and ugly rust inherent in steel towers.

. . . . . .

Strength – Important to your choice of a tower. Universal towers are tested for 80 m.p.h. winds and are designed to exceed that wind velocity.

. . . . . .

Easy Assembly – Child's play to assemble. You can easily assemble a tower on the ground and walk it up, or assemble it erect section by section.

. . . . . .

In addition to all of these advantages total cost of a Universal Aluminum Tower is less than similar steel towers extended over the life of the tower.

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Model 11-80 shown – W8AMY
11 sq. ft. wind load at 80 ft.

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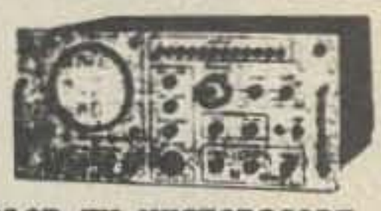
TEKTRONIX® TYPE 526 COLOR-TELEVISION VECTORSCOPE



526 COLOR TV VECTORSCOPE
To measure the hue and saturation of color transmissions.
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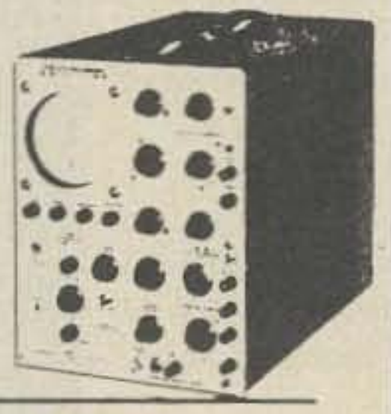
531	DC-15mc	$395.00
535	DC-15mc	$495.00
535A	DC-15mc	$550.00
RM35A	DC-15mc	$395.00
541	DC-30mc	$495.00
541A	DC-30mc	$550.00
543	DC-30mc	$495.00
545	DC-30mc	$595.00
545A	DC-30mc	$725.00

All scopes are quoted less Plug-ins.



PLUG IN UNITS

1A2	Dual Trace	$295.00
1L20	Spectrum Analyzer .	$995.00
53/54A	Pre Amp	$55.00
53/54B	High Gain	$65.00
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53C	Dual Trace	$165.00
53/54C	Dual Trace	$175.00
CA	Dual Trace	$195.00
D	Differential	$115.00
53/54E	Differential	$50.00
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53/54G	Differential	$85.00
G	Differential	$100.00
53/54H	High Gain	$90.00
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53/54K	Fast Rise DC	$65.00
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P	Rise Time Tester ..	$55.00
R	Transistor Rise Time	$150.00
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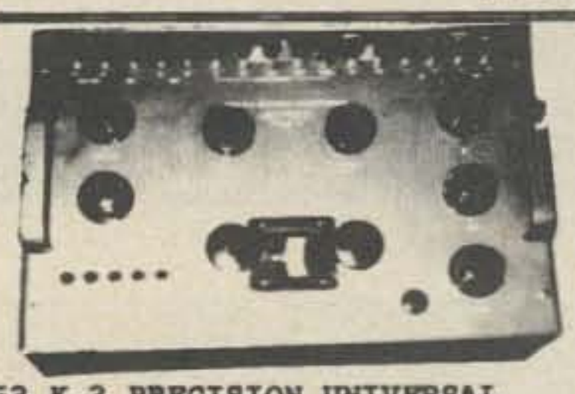

7553 K-3 PRECISION UNIVERSAL POTENTIOMETER
Guarded direct reading potentiometer for laboratory use. 0-1.611 volts in 3 ranges. .01% to .015% accuracy. $249.00

CAPACITORS – MICA

MFD	VOLTS	SIZE	PRICE
.000051	6KV	G1	$2.95
.00018	6KV	G1	3.95
.0002	6KV	G1	3.95
.00039	6KV	G1	4.50
.0005	6KV	G1	4.50
.00075	6KV	G1	4.50
.0039	6KV	G1	9.50
.00051	10KV	G2	8.50
.00015	20KV	G3	19.95

.001 mfd 25KV 18 Amp @ 1 mc.
1 Ceramic terminal
6½"x 6"x 4" footed.....$24.95

CAPACITORS – OIL FILLED

.2 mfd 50 KVDC
GE 14P126

1 Porcelian terminal
13" x 13½" x 5¼" $49.95

.25 mfd 20 KVDC
AEROVOX

2 Porcelian terminals
8" x 11" x 4" $19.50

1 mfd 10 KVDC Westinghouse

2 Porcelian terminals
8" x 9" x 4" $19.50

4 mfd 2000 VDC CP70E1EJ405K
2 Porcelian terminals
3 3/4" x 5" x 2¼" $3.50

.5 mfd 1500 VDC CP70B1EH504K
2 Rubber terminals
1 3/4" x 2 3/4" x 1" ..... $.75

1 mfd 1000 VDC Aerovox 1009D
2 Porcelian terminals
1 3/4" x 2 1/8" x 1 1/8" . $.90

8 mfd 600 VDC GE 23F1014
2 Rubber terminals
3 5/8" x 3¼" x 1¼" $1.55

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2 Bakelite terminals
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4 mfd 150 VDC
2 Side terminals
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2 Side terminals
2" x 1 3/4" x 3/4" $2.45

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DISC TRIMMER

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5.5 to 18mmf. Printed circuit mount.....75¢ ea.
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1000 mfd 500 VDC
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ERIE BROAD BAND EMI FILTERS

1200-095 10 amp 50V Threaded ← neck mtg. Lug term.
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1215-095 10 amp 50V Threaded → neck mtg. Lug term.
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COMPUTER GRADE ELECTROLYTIC CAPACITORS

MFD	VOLTS	MFR	PRICE EA
500	200	GEN. INSTR.	$1.00
1500	40	SPRAGUE-36D	.75
2400	25	G.E.-43F	.75
2500	200	MALLORY	1.50
5000	40	SPRAGUE-36D	1.25
19,000	25	G.E.-43F	2.00

INTERGRATED CIRCUIT SOCKET

AUGAT 314-AG1A 14 PIN DUAL IN LINE high profile .375 h. diallyl phthalate body meets mil M-14
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1N3209 Silicon Rectifier
100PRV 15A.....$.60
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15A TD-36 case...$1.20
Two 2N2082 Transistors mounted on heat sink.....$2.25

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Mototola MDA 962-4
10 amp 300V

.....$3.95 ea.
10 for $35.00

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STANCOR P-6011 115 VAC 60cy input
Secondary: 350-0-350VAC 70ma
5.0 VAC 3.0Amps C.T.
6.3 VAC 2.5 Amps C.T.
Mtg centers 2 7/8" x 3 3/8"
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SEC: 240/270 VAC @ 650 MA
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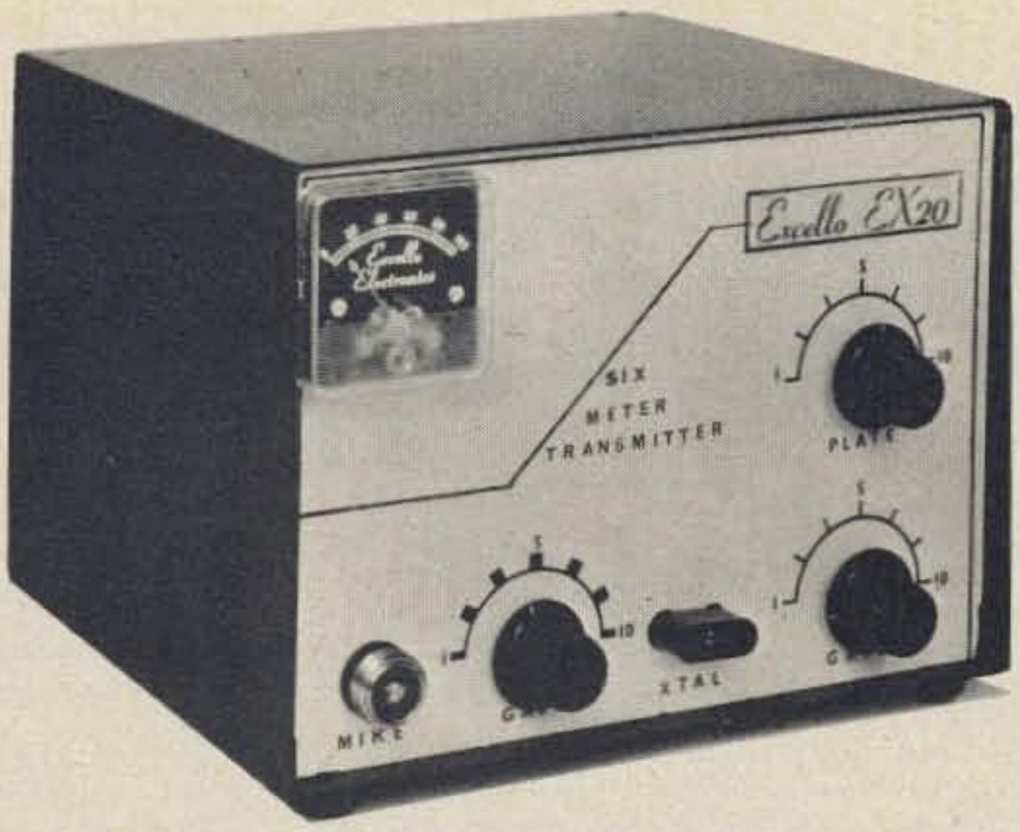

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115ac/12V@3 amps . . . $2.50

POWER AMP TRANSFORMER

Brand new compact, regular 115 V 60 cycle input. Output of 40 VCT at 4 amps plus another winding 6V at 2.5 amps. Fine business for Power Amps, Logic or Op Amp supply.

$5.50 each or 5 for $25.00

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Regular 115 volt 60 cycle input. 12 volt transformers are always in demand, these are brand new. **$1.50 each or 10 for $12.00**

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455 KC IF ASSEMBLY

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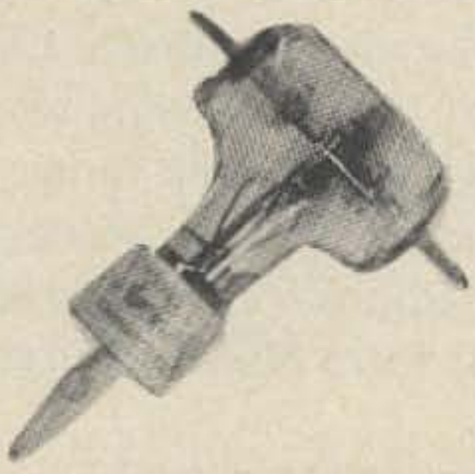
RF VACUUM SWITCH

Made for the ART-13 good for 100 watts RF, no doubt handles much more due to being underrated for the military . . . #71-17 3/2.00



7400 SERIES IC GRAB BAG

Mix of 7400 series DIP, unmarked untested.
Some schematics provided . . . . . 10 for 1.00
100 for 8.00
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IC SPECIAL – ONE MONTH ONLY

Our regular $15 IC board with approx. 140 DIP ICs on them, with ident sheet. For one month only we are pricing them at $6.50 per board to reduce our inventory. **#IC-S $6.50 0r 5 for $25**

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Brand new GE 2-sided glass epoxy G-10, the standard of the industry, bright and shiny new. 6 x 12, $1.00. 12 x 12, $1.50.

AM-FM RADIO $5.50

Due to the West Coast ship strike they came in too late for the customer. Now it's your bargain. Use it as is or build it into your own cabinet, desk, wall, etc. All built, ready to use, with AC supply. To make it portable all you do is power it with a couple of "D" cells. Fully assembled solid state chassis with AC power supply, less speakers. Covers full AM as well as FM broadcast. The price. . .an astounding meager $5.50

PISTON CAPS 1–8 μF 3 for $1.00

Unused Military surplus. For hi freq. work. List price over $3.00 each. We have 1 size only, 1–8 μF. No hardware.

#73-18 **3 for $1.00**

BATTERY ELIMINATOR–CHARGER

Plugs into 115 volt 60 cycle and puts out approx. 12 volts DC 100 mils. Sufficient to power most any small transistor radio and also useful for charging small dry cells and small ni-cad cells. Fully built, ready to use.

$1.00 each, 6 for $5.00

RF FERRITE CORE CHOKE

Hi-permeability, ultra midget style, coated for moisture resistance, color coded. Used in xmtrs, receivers, converters, TV-peaking. Brand new, worth 40¢ each. Assortment of 1.8, 27.0, 330 μH. Pack of 30, $12.00 value.

#A-71 30/$1.00 180/$5.00

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One of the later designs being released. Superb workmanship by HUGHES. Utilizes 3 pencil triodes worth over $46.00. Looks like a "natural" for 220 mc transmitter as it's on .264mc now. Simple to lower freq. W/tubes & schematic. Built-in power supply 400 cycle would have to be changed. Measures only 3x4x8 inches. Nice piece of scarce gear, easy to work on & first class condition.

4 lbs. . . . . #TA-40IC 15.00

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Slimline or Regular **$2.50 ea.**

ZM 1000 Neon **$1.75**

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MAN-3 1.7V Miniature **$3.50 ea. 10/$30**

GIANT ALPHA NUMERIC

B7971 **$1.00**

OIL CAPS 16 MFD 5000 VOLT

Rare find. $9.00 each 3/$25.00

NOISE ACTUATED SWITCH $1.35

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KEY BOARDS
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930	Dual 4 input NAND gate	similar to	7420
931	Clocked flip flop	"	74110
932	Dual 4 input Expand Buff	"	7440
933	Dual 4 input expander	"	7460
936	Hex Inverter	"	7405
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946	Quad 2 input gate	"	7400
962	Triple 3 input gate	"	7410

15¢ each. Buy $100 worth and deduct 10%.

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243 MC 2 way radio, hand held, measures only 3x4 inches. Used for survival in downed aircraft. Can be converted for other freqs. URC-11 $15 each 3 for $40.00

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64 bit ASC IICharacter Generator IC sets.
Vertical scan set includes SK0002 kit, two MM502 and one NH0013C.
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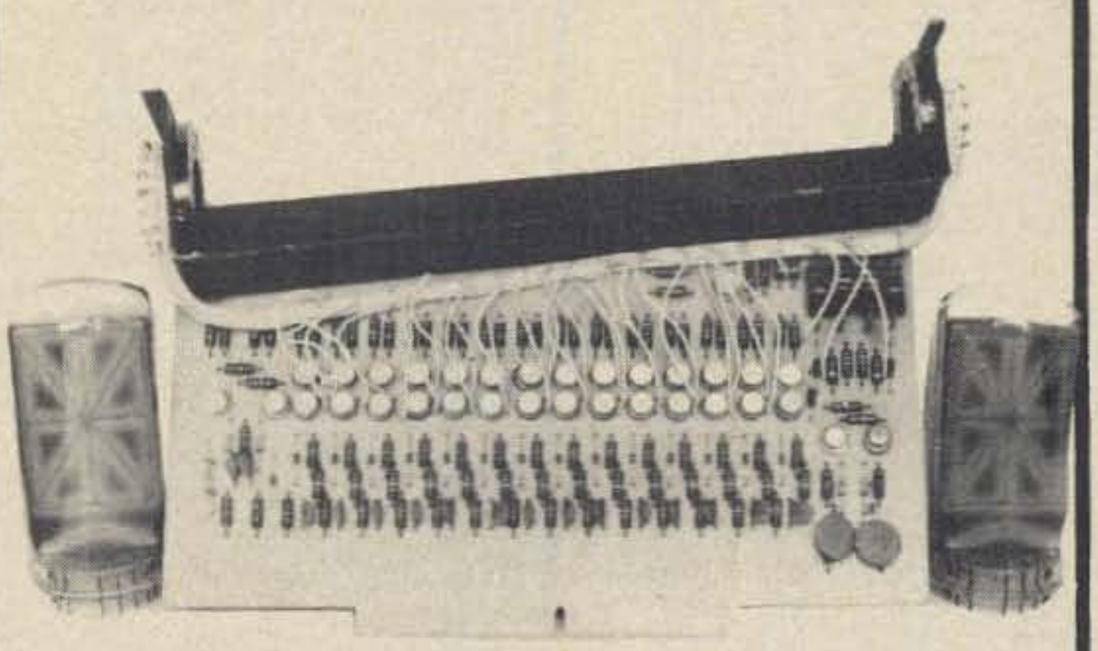
Make your own CRT readout or use it for hard copy.
Either set only $50 and includes 10 pages of info on character generators.



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Catalog Number	Any Quantity Per Item (Mix) 1-99	100-999	Multiples of 10 Per Item (Mix) 1000 up	100-990
7400	.34	.32	.30	.28
7401	.34	.32	.30	.28
7402	.34	.32	.30	.28
7403	.34	.32	.30	.28
7404	.36	.34	.32	.30
7405	.36	.34	.32	.30
7406	.56	.53	.50	.47
7407	.56	.53	.50	.47
7408	.38	.36	.34	.32
7409	.38	.36	.34	.32
7410	.34	.32	.30	.28
7411	.34	.32	.30	.28
7413	.60	.57	.54	.51
7416	.54	.51	.48	.45
7417	.54	.51	.48	.45
7418	.38	.36	.34	.32
7420	.34	.32	.30	.28
7421	.34	.32	.30	.28
7423	.84	.80	.76	.72
7425	.54	.51	.48	.45
7426	.40	.37	.34	.31
7430	.34	.32	.30	.28
7437	.56	.53	.50	.47
7438	.56	.53	.50	.47
7440	.34	.32	.30	.28
7441	1.73	1.64	1.55	1.46
7442	1.34	1.27	1.20	1.13
7443	1.34	1.27	1.20	1.13
7444	1.34	1.27	1.20	1.13
7445	1.71	1.62	1.53	1.44
7446	1.34	1.27	1.20	1.13
7447	1.30	1.23	1.16	1.09
7448	1.44	1.37	1.29	1.22
7450	.34	.32	.30	.28
7451	.34	.32	.30	.28
7453	.34	.32	.30	.28
7454	.34	.32	.30	.28
7459	.34	.32	.30	.28
7460	.34	.32	.30	.28
7470	.46	.43	.40	.37
7472	.40	.38	.36	.34
7473	.52	.49	.46	.43
7474	.52	.49	.46	.43
7475	.80	.76	.72	.68
7476	.58	.55	.52	.49
7480	.80	.76	.72	.68
7482	1.10	1.05	1.00	.95
7483	1.72	1.64	1.56	1.48
7485	1.58	1.51	1.44	1.37
7486	.60	.57	.54	.51
7490	.85	.80	.75	.70
7491	1.48	1.41	1.34	1.27
7492	.85	.80	.75	.70
7493	.85	.80	.75	.70
7494	1.32	1.26	1.20	1.14
7495	1.32	1.26	1.20	1.14
7496	1.32	1.26	1.20	1.14
74100	1.80	1.70	1.60	1.50
74104	.70	.67	.64	.61
74105	.70	.67	.64	.61
74107	.54	.51	.48	.45
74121	.60	.57	.54	.51
74122	.74	.71	.68	.65
74123	1.30	1.20	1.10	1.00
74141	1.75	1.66	1.57	1.48
74145	1.50	1.43	1.36	1.29
74150	2.00	1.85	1.70	1.55
74151	1.30	1.24	1.18	1.12
74153	1.70	1.60	1.50	1.40
74154	2.75	2.55	2.35	2.05
74155	1.56	1.49	1.42	1.35
74156	1.46	1.39	1.31	1.23
74157	1.56	1.48	1.39	1.31
74158	1.56	1.48	1.39	1.31
74160	2.20	2.10	2.00	1.90
74161	2.20	2.10	2.00	1.90
74162	2.20	2.10	2.00	1.90
74163	2.20	2.10	2.00	1.90
74164	2.20	2.10	2.00	1.90
74166	2.30	2.20	2.10	2.00
74175	2.00	1.90	1.80	1.70
74180	1.30	1.23	1.16	1.09
74181	5.20	4.90	4.60	4.30
74182	1.26	1.19	1.12	1.05
74192	2.10	2.00	1.90	1.80
74193	2.10	2.00	1.90	1.80
74198	3.10	2.95	2.80	2.65
74199	3.10	2.95	2.80	2.65
SCHOTTKY TTL				
74S00	.88	.84	.79	.75
74S01	.88	.84	.79	.75
74S03	.88	.84	.79	.75
74S04	1.00	.95	.90	.85
74S05	1.00	.95	.90	.85
74S08	.88	.84	.79	.75
74S09	.88	.84	.79	.75
74S10	.88	.84	.79	.75
74S15	.88	.84	.79	.75
74S20	.88	.84	.79	.75
74S21	.88	.84	.79	.75
74S22	.88	.84	.79	.75
74S40	1.00	.95	.90	.85
74S50	.88	.84	.79	.75
74S51	.88	.84	.79	.75
74S60	.88	.84	.79	.75
74S64	.88	.84	.79	.75
74S65	.88	.84	.79	.75
74S73	1.82	1.73	1.63	1.54
74S74	1.82	1.73	1.63	1.54
74S107	1.82	1.73	1.63	1.54
74S112	1.82	1.73	1.63	1.54
74S114	1.82	1.73	1.63	1.54
74S140	1.00	.95	.90	.85
LINEAR IC'S				
NE501A	2.99	2.82	2.66	2.49
NE526A	3.59	3.38	3.17	2.95
NE531V	3.81	3.58	3.36	3.14
NE536T	7.31	6.88	6.45	6.02
NE540T	2.40	2.25	2.10	1.95
SE540T	4.48	4.20	3.92	3.64
NE550A	1.30	1.23	1.16	1.09
NE555V	1.10	1.05	1.00	.95
N5556V	2.10	1.95	1.80	1.65
N5558V	1.00	.95	.90	.85
NE560B	3.57	3.36	3.15	2.94
NE561B	3.57	3.36	3.15	2.94
NE562B	3.57	3.36	3.15	2.94
NE565A	3.57	3.36	3.15	2.94
NE566V	3.57	3.36	3.15	2.94
NE567V	3.57	3.36	3.15	2.94
N5111A	.90	.86	.82	.78
N5595A	3.40	3.20	3.00	2.80
N5596A	1.87	1.77	1.66	1.56
709V	.50	.47	.44	.41
710A	.50	.47	.44	.41
711A	.55	.52	.49	.46
723A	1.00	.95	.90	.85
733A	1.90	1.80	1.70	1.60
741V	.55	.52	.49	.46
747A	1.10	1.04	.98	.92
748V	.60	.57	.54	.51
LM335	2.85	2.72	2.64	2.55
LM336	3.85	3.66	3.46	3.27
LM337	4.05	3.70	3.51	3.31
TRANSISTORS AND DIODES				
1N270	.15	.14	.13	.12
1N914	.10	.09	.08	.07
1N4001	.10	.09	.08	.07
1N4002	.11	.10	.09	.08
1N4003	.13	.12	.11	.10
1N4006	.15	.14	.13	.12
1N747A - thru 1N758A	.25	.22	.19	.16
2N3860	.25	.23	.21	.19

All IC's are supplied in 8–, 14–, or 24–pin DIP (Dual-in-line) plastic or ceramic package except for NE536, NE540, and SE540 which come in TO–5 package. Voltage Regulators LM335, LM336 and LM337 are supplied in TO–3 (Diamond) package.

We give FREE data sheets upon request, so ask for those data sheets that you NEED, even for those listed IC's that you are not buying.

LED 7-SEGMENT DISPLAY:

Solid State Systems has now expanded it's line of LED Displays and also reduced their cost. The following are now available from us at these prices.

	1–49	50–99	100–499	500–999	1,000 up
SSS-1	4.50	4.25	3.75	3.40	3.00
SSS-1C	4.75	4.50	4.00	3.65	3.25
SSS-2	4.50	4.25	3.75	3.40	3.00
SSS-3	7.75	7.50	7.00	6.75	6.50
SSS-4	7.75	7.50	7.00	6.75	6.50
SSS-7	3.50	3.25	3.00	2.75	2.50
SSS-9	3.50	3.25	3.00	2.75	2.50
Minitrons*	3.00	2.75	2.50	2.25	1.90

The SSS-7 and SSS-9 are the common .33 in character height 7-Segment and overflow display respectively, with decimal point on the left and wide angle viewing. The SSS-1 and SSS-2 have the same physical dimensions as the SSS-7 and SSS-9 with increased life and slightly lower current requirement. The SSS-1C is the same as the SSS-1 except it has a colon instead of a decimal point, making it ideal for use in a digital clock. The SSS-3 and SSS-4 are the new giant .77 in character height 7-Segment and overflow display respectively, with decimal point on the right and readability up to 40 feet. *Also included above is a new reduced price on our Incandescent 7-Segment Display.

Package of 8, 1/4 watt current limiting resistors ..... $0.30.

MOLEX IC SOCKET PINS: Use these economical pins instead of soldering your IC's to PC boards. Sold in continuous strips in multiples of 100 pins only.

100 for $1.00 — 200 for $1.80 — 300 for $2.60 — 400 for $3.40
500 for $4.20 — 600 for $5.00 — 700 for $5.80 — 800 for $6.60
900 for $7.40 — 1000 for $8.20 — each additional 1,000 $7.50

Dual-in-line SOCKETS. Brand new with gold plated pins.

		1–49	50–99	100–499	500–999	1,000 up
14 Pin	Solder	.50	.45	.40	.35	.25
16 Pin	Solder	.55	.50	.45	.40	.30
14 Pin	Wire Wrap	.55	.50	.45	.40	.30
16 Pin	Wire Wrap	.60	.55	.50	.45	.35
14 Pin	Closed-Entry Cap	.05	.05	.04	.04	.03
16 Pin	Closed-Entry Cap	.05	.05	.04	.04	.03

STANCOR TRANSFORMERS: Ideal for use with LM series.

P-8180, 25.2VCT, 1 amp $3.00
P-6134, 6.3VCT, 1.2 amp $2.75

HEAT SINKS: Wakefield series 680 circuit board coolers. 1¼" high with a dissipation up to 20 watts. Designed for use with TO–3 package.

	1–49	50–99	100–499	500–999	1000 up
Type 680–1.25A	1.20	1.10	1.00	.90	.80

ALLEN-BRADLEY MIL-GRADE (5-band) RESISTORS. Any of the 84 STANDARD 10% values from 2.7Ω to 22MΩ ⅛ or ½ WATT. EACH ..... $0.05.

CERAMIC DISC CAPACITORS. Type 5GA-1000WVDC:
5, 7.5, 10, 12, 15, 20, 22, 25, 27, 30, 33, 39, 50, 56, 68, 75, 82, 100, 120, 150, 180, 200, 220, 250, 270, 300, 330, 360, 390, 470, 500, 560, 680, 750, 820, 1000, 1200, 1500, 1800, 2000, 2200, 2500, 2700, 3000, 3300, 3900, 4700, 5000μμF.
EACH ..... $.10
0.01μF. EACH ..... $.11 — 0.02μF. EACH ..... $.12

LOW VOLTAGE DISCS, Type UK.

1.0μF, 3V ..... $.25 — 0.47μF, 3V ..... $.25 — 0.2μF, 10V ..... $.20
.1μF, 10V ..... $.12 — 2.2μF, 3V ..... $.30 — 0.01μF, 16V ..... $.10

ELECTROLYTIC CAPACITORS: All values are available in both, axial or upright (PC Board) mount. Please indicate your choice.

10μF, 15V ..... $.10 — 30μF, 35V ..... $.20 — 5μF, 50V ..... $.10
30μF, 15V ..... $.10 — 50μF, 35V ..... $.20 — 10μF, 50V ..... $.15
50μF, 15V ..... $.10 — 100μF, 35V ..... $.20 — 20μF, 50V ..... $.20
100μF, 15V ..... $.10 — 500μF, 35V ..... $.40 — 50μF, 50V ..... $.20
220μF, 15V ..... $.15 — 1000μF, 35V ..... $.50 — 100μF, 50V ..... $.20
500μF, 15V ..... $.20 — 1μF, 50V ..... $.10 — 200μF, 50V ..... $.40
1000μF, 15V ..... $.30 — 2μF, 50V ..... $.10 — 500μF, 50V ..... $.55
20μF, 25V ..... $.15 — 3μF, 50V ..... $.10

TERMS: Rated firms NET 30 days. Otherwise check or money order with order. BankAmericard and Mastercharge are welcome. All invoicing is now done by computer therefore, the following standard charges will automatically be added to your order.

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			SPECIAL CHARGES		
$ 0.00 - $ 4.99	add	$1.00	COD	$1.00	additional
$ 5.00 - $24.99	add	$0.75	Air Mail	$0.50	additional
$ 25.00 - $49.99	add	$0.50	Postal Insurance	$0.25	additional
$ 50.00 - $99.99	add	$0.25	Special Delivery	$0.75	additional
$100.00 and up	add	$0.00			

With this new system all shipments will be F.O.B. destination, via First Class or UPS (your choice). These charges include shipping, handling and insurance.

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EASILY CONVERTED FOR 420MC OPERATION
This equipment originally cost over $1000. You get all in original factory carton.

Dependable Two Way Communication more than 15 miles.

- FREQUENCY RANGE: About 435 to 500 Megacycles.
- TRANSMITTER hs 4 tubes: WE-316A, 2-6F6, 7F7.
- RECEIVER has 11 tubes: 2-955, 4-7H7, 2-7+6, 3-7F7.
- RECEIVER I.F.: 40 Megacycles.
- SIZE: 10½" x 12½" x 4½".

Makes wonderful mobile or fixed rig for 420 to 500 Mc.
Easily converted for phone or CW operation

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BC-645 Transceiver, Dynamotor and all accessories below, including conversion instructions for Citizens Band. **BRAND NEW, while stocks last.** **$26.95**

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PE-101C Dynamotor, 12-14 V (easily converted to 6 volts).
Mounting for PE-101C Dynamotor
UHF antenna assemblies (set of 2)
Complete set of 11 connectors
Control Box BC-646
Mounting for BC-646 ctr. box.

TRANSCEIVER ONLY $16.95

SCR-274-N, ARC-5 COMMAND SET HQ!

Freq. Range	Type Complete with Tubes	Exc. Used	Like New	BRAND NEW
RECEIVERS				
190-550 Kc	BC-453	$16.95	$23.50	—
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TRANSMITTERS	**Complete with Tubes**			
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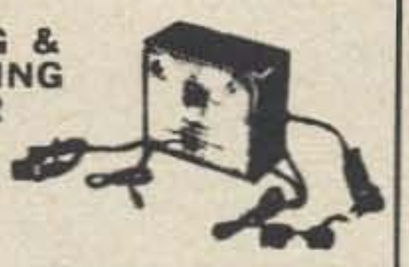

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Complete with tubes, NEW **$12.50**

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BC-604 FM TRANSMITTER 20 to 27.9 Mc. Output approx 30 watts. 10 crystal controlled channals. Complete with tubes.
NEW **$9.50**

BC-603 FM RECEIVER
Converted for 35–50 Mhz. 10 preset pushbutton channels or manual tuning. Complete with 10 tubes, checked out, like new..... **$39.50**

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DM-34 12V Power Supply, New ..... $ 4.45
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Set of 10 tubes for BC-603 Receiver ..... $ 5.95

AN/APR-4Y FM & AM RECEIVER

"FB" for Satellite Tracking!
High precision lab instrument, for monitoring and measuring frequency and relative signal strength, 38 to 4000 Mc. In 5 tuning ranges. For 110v 60 cycle AC. Built-in power supply. Original circuit diagram included. Checked out, Perfect.
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All tuning units available for above. Price upon request.

TG-34A CODE KEYER, self-contained, automatic, reproduces code practice signals from paper tape. 5 to 12 WPM Built-in speaker. Brand new with tech manual, takeup reel and AC line cord **$24.50**
Code practice tapes for above P.U.R.

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Designed for Marine & Aircraft installation. Also fine for home use. Continuous tuning from MN-28C Control box. Complete with 24 volt DC Dynamotor.
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Remote control commercial type navigational receiver

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ARC-5 VHF RECEIVER, TRANSMITTER, MODULATOR 100-156 Mhz

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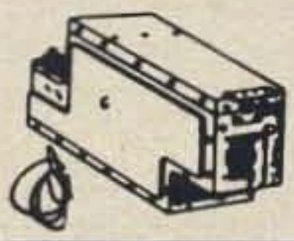

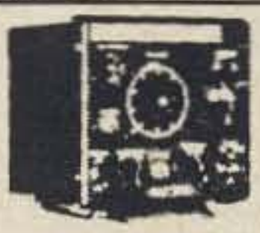

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Fine general purpose Navy unit 125 to 20,000 Hz. Operates on 12 or 14V dc. Complete with tubes, crystal calibration book. Checked out.
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BC-604 FM TRANSMITTER 20 to 27.9 Mc. Output approx. 30 watts. 10 crystal controlled channels. Complete with tubes.
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Designed to operate from 100 to 156 mc

CATHODE RAY TUBES All New in Original Carton
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3AP1*	$2.95	5MP1	$2.75
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By RCA or equal 2N3632. NPN, 23 watts, 3 amps, TO-60 case, with stud mtg. VCEV max 65.

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Code: 2 amp TO-5 case
6 Amp ½ x ½ x 3/16 sq

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LED 7-SEGMENT READOUTS

MAN-4 EQUAL 3.95

0-9 plus letters, Snaps in 14-pin DIP socket, ¾" x ¼" x ⅜". 5V 10ma, with decimal point. Like MAN-1

☐ Socket for above, 50c

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Includes SN7490, decade counter, SN7475 latch, SN7441 BCD decoder driver, 0-to-9 Nixie tube, instructions.

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Largest Selection TTL IC's

Brand New • "DIP" Packages Order by type number! Spec sheets on request "ONLY"

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☐ SN7417	.55
☐ SN7420	.30
☐ SN7421	.35
☐ SN7422	.35
☐ SN7426	.37
☐ SN7430	.30
☐ SN7432	.30
☐ SN7437	.60
☐ SN7438	.60
☐ SN7440	.30
☐ SN7441	1.40
☐ SN7442	1.25
☐ SN7443	1.35
☐ SN7444	1.35
☐ SN7445	1.35
☐ SN7446	1.65
☐ SN7447	1.65
☐ SN7448	1.50
☐ SN7450	.35
☐ SN7451	.35
☐ SN7453	.35
☐ SN7454	.50
☐ SN7455	.35
☐ SN7460	.35
☐ SN7464	.50
☐ SN7465	.50
☐ SN7470	.50
☐ SN7472	.50
☐ SN7473	.65
☐ SN7474	.65
☐ SN7475	1.30
☐ SN7476	.75
☐ SN7478	.95
☐ SN7480	.75
☐ SN7481	1.50
☐ SN7482	.95
☐ SN7483	1.50
☐ SN7485	1.41
☐ SN7486	.55
☐ SN7489	3.75
☐ SN7490	1.50
☐ SN7491	1.50
☐ SN7492	1.10
☐ SN7493	1.10
☐ SN7494	1.10
☐ SN7495	1.10
☐ SN7496	1.10
☐ SN74100	1.49
☐ SN74104	.55
☐ SN74105	.55
☐ SN74106	1.25
☐ SN74107	.60
☐ SN74108	1.25
☐ SN74112	1.25
☐ SN74113	1.25
☐ SN74114	1.25
☐ SN74121	.70
☐ SN74122	.75
☐ SN74123	1.20
☐ SN74140	.50
☐ SN74145	1.40
☐ SN74151	1.25
☐ SN74153	1.60
☐ SN74154	2.10
☐ SN74155	1.55
☐ SN74156	1.55
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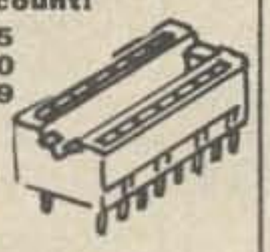

WIRE-WRAP INTEGRATED CIRCUIT SOCKETS ☐ 79¢ each

☐ 14-Pin
☐ 16-Pin 3 for $2.00

NATIONAL 'OP' AMPS

BUY ANY 3 — TAKE 10%

Type	Description	
☐ LM-300	Super 723 V. reg.	$1.49
☐ LM-301	Hi-performance amp	.49
☐ LM-302	Voltage follower	1.49
☐ LM-304	Neg. V. reg.	1.49
☐ LM-305	Pos. V. reg.	1.49
☐ LM-307	Super 741	.59
☐ LM-308	Super gain op amp	1.50
☐ LM-309H	5V 200 mil V. reg.	1.50
☐ LM-309K	5V 1-amp V. reg.*	2.25
☐ LM-311	Comparator	1.50
☐ LM-320	Minus 5V 1-amp V.R.*	2.95
☐ LM-320	Minus 15V 1-amp V.R.*	2.95
☐ LM-350	Dual peripheral driver	.59
☐ LM-370	AGC squelch op amp	1.49
☐ LM-371	R-F, I-F, op amp	.69
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*TO-3 case, — others TO-5

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☐ 536	FET input op amp (TO-5)	3.95
☐ 537	Precision 741 (TO-5)	2.50
☐ 540	70W pwr driver amp (TO-5)	2.04
☐ 550	Precision 723 voltage reg. (DIP)	1.17
☐ 555	Timer 2 uSeconds to 1-hr (A)	1.00
☐ 556	5 Times faster than 741C	2.50
☐ 558	Dual 741 (mini DIP)	.88
☐ 560	Phase lock loops (DIP)	3.25
☐ 561	Phase lock loops (DIP)	3.25
☐ 562	Phase lock loops (DIP)	3.25
☐ 565	Phase lock loops (A)	3.25
☐ 566	Function generator (A)	3.25
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☐ 595	Four quadrant multiplier	3.10
☐ 702C	Hi-grain, DC amp (TO-5)	.44
☐ 703C	RF-IF, amp, 14 ckts (TO-5)	1.00
☐ 709C	Operational amp (A)	.44
☐ 709CV	Op amp (mini DIP)	.49
☐ 710C	Differential amp (A)	.44
☐ 711C	Dual diff. comp (A)	.44
☐ 723C	Voltage regulator (A)	.95
☐ 741C	Frequency compensator 709 (A)	.49
☐ 741CV	Freq. comp 709 (Mini DIP)	.49
☐ 747C	Dual 741C (A)	1.25
☐ 748C	Freq. adj. 741C (A)	.44
☐ 748CV	Freq. adj. 741C (mini DIP)	.49
☐ 709-709	Dual 709C (DIP)	1.00
☐ 739-739	Dual stereo preamp	1.98
☐ 741-741	Dual 741C (A)	1.00
☐ 75450	Dual peripheral driver (DIP)	.69

(A) TO-5 or DIP dual in line pak

Buy 3 or more, 10% discount

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☐ 5U4	$1.49
☐ 5R4	3.95
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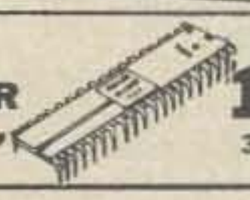

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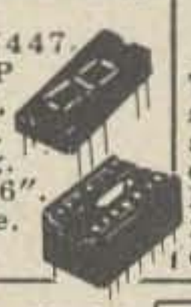

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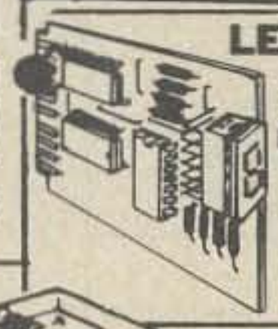
This display is excellent for small portable electronics, such as DVM's, calculators, etc. Equivalent to Monsanto MAN 3A. Operates from 5V, 20 milliamperes, with 47 ohm dropping resistor.



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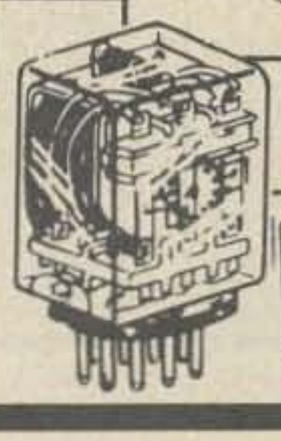

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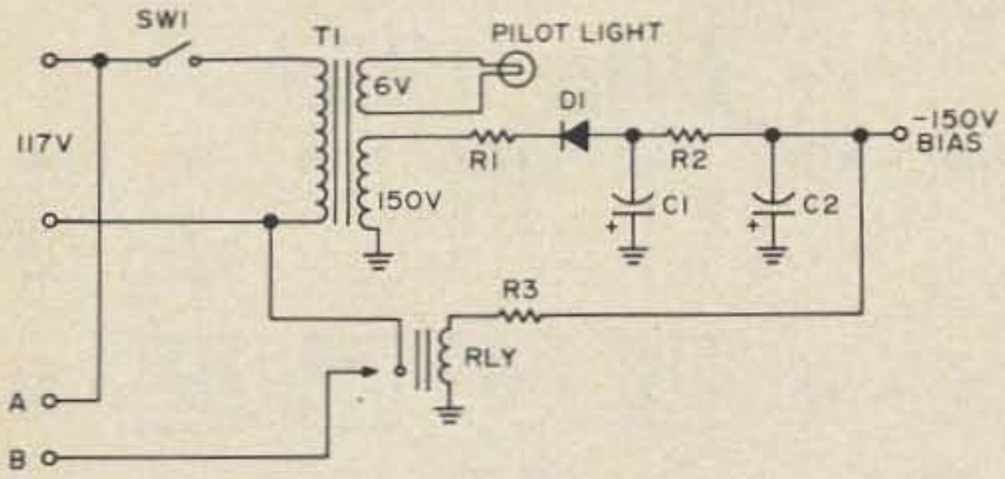
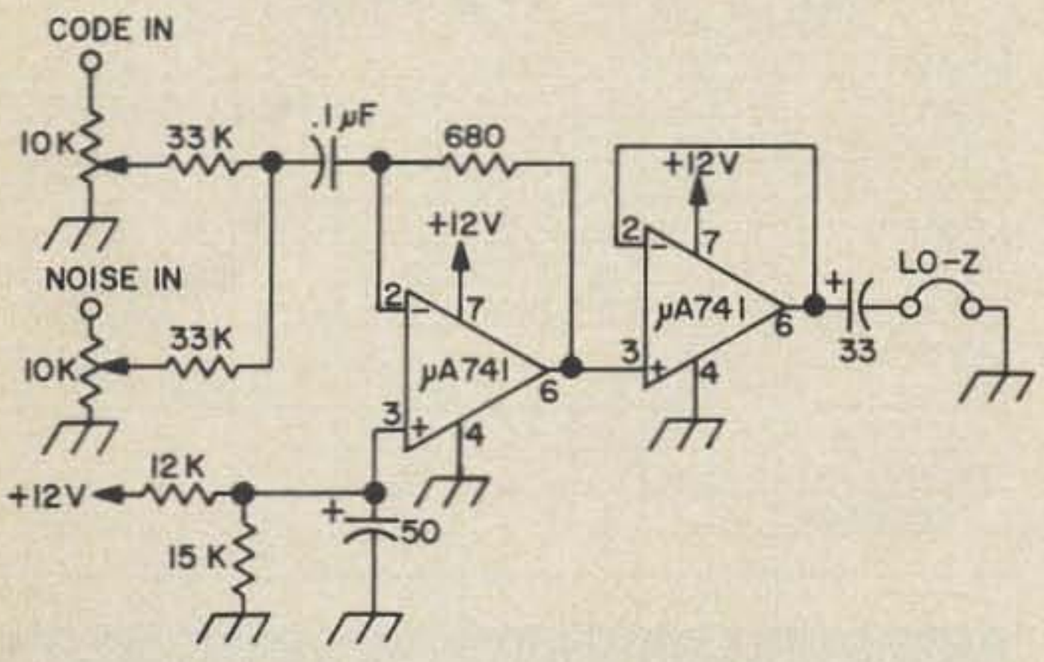
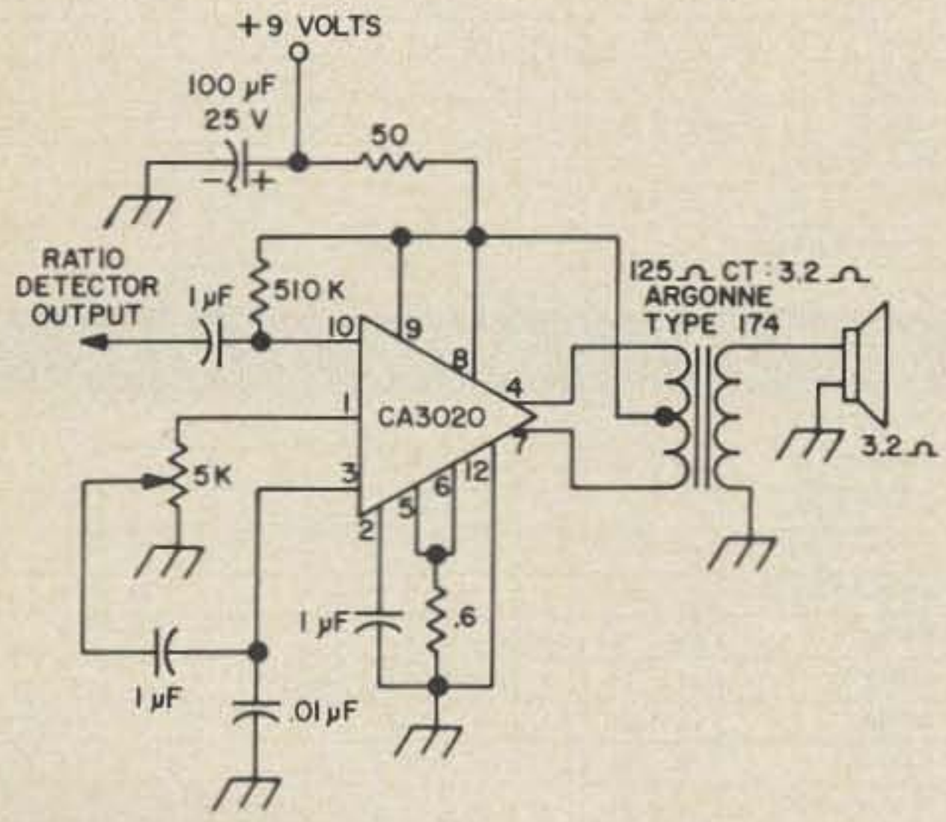
A FEW CIRCUITS...



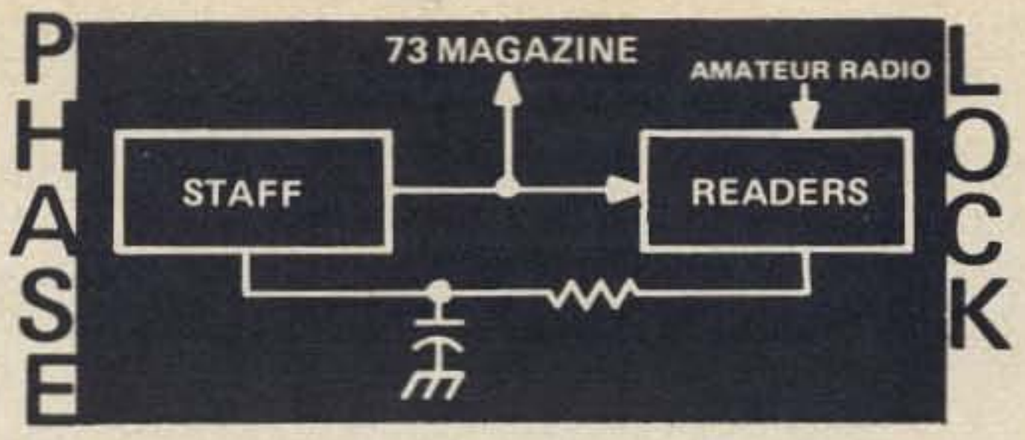
A protection circuit that will turn off the high voltage power supply in a linear amplifier when bias voltage fails. D1, 400 piv ½A; R1, 10Ω 1W; R2, 1K 2W; R3 depends on relay voltage; C1 and C2, 4 μF 200V. Points A + B go to the 117V primary of the high voltage transformer. The relay should have adequate contact ratings to handle the transformer current.



A code practice audio mixer. Feed code into one input and random CW noise from the Novice bands into the other while adjusting the controls for a realistic sound.



A simple audio amplifier that is suitable for a compact FM receiver. It can also be built entirely self-contained in a minibox with speaker and battery for experimental purposes. From RCA Linear Integrated Circuits manual.



In this issue, do you think there is a need for more

	Yes	No
Simple construction projects	☐	☐
Complex construction projects	☐	☐
General interest articles	☐	☐
Humor articles	☐	☐
Specialized columns	☐	☐
Operating news	☐	☐

Comment (a):

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June 1973

SUN	MON	TUES	WED	THUR	FRI	SAT
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

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	7A	7A	7A
ARGENTINA	14	14	14	7	7	7	14	14	14	14A	14A	14A
AUSTRALIA	14	14	7A	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	14A	14A
ENGLAND	14	7A	7	7	7	7	14	14A	14A	14	14	14
HAWAII	14	14	7A	7	7	7	7	7	7	14	14	14
INDIA	14	7B	7B	7B	7B	7B	7B	14	14	14	14	14
JAPAN	14	14	7	7	7	7	7	7	7	7	7A	14
MEXICO	14	14	14	7	7	7	7	7A	7A	14	14	14
PHILIPPINES	14	7A	7B	7B	7B	7B	7	7	7	7	7A	14
PUERTO RICO	14	7A	7	7	7	7	7	7	14	14	14	14
SOUTH AFRICA	7B	7	7	7	7B	14	14	14	14A	14	7B	7B
U. S. S. R.	7A	7	7	7	7	7	7A	14	14	14	14	7A
WEST COAST	14	14	7	7	7	7	7	7	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	7A	7A	7	7	7	7	7	7	7A	7A	14
ARGENTINA	14	14	14	7A	7	7	7	14	14	14	14A	14A
AUSTRALIA	14	14	14	7	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	14	7	7	7	7	14	14	14	14A	14A
ENGLAND	14	14	7	7	7	7	7	7	14	14A	14	14
HAWAII	14	14A	14	7A	7	7	7	7	14	14	14	14
INDIA	14	7A	7B	7B	7B	7B	7B	7	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7	7	7	7	14
MEXICO	14	14	7	7	7	7	7	7	7	7A	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7	7A	14
PUERTO RICO	14	14	14	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7B	7	7	7	7B	7B	14	14	14	14	7B	7B
U. S. S. R.	7A	7	7	7	7	7	7	7	14	14	14	7A

WESTERN UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	7	7	7	14
ARGENTINA	14	14	14	14	7	7	7	14	14	14	14A	14A
AUSTRALIA	21	21	21	14	14	7	7	7	7	7	14	14
CANAL ZONE	14	14	14	7	7	7	7	14	14	14	14	14
ENGLAND	14	14	7	7	7	7	7	7	14	14	14	14
HAWAII	14A	14A	14A	14	14	14	7	7	14	14	14	14
INDIA	14	14	14	7B	7B	7B	7B	7	7	7	7	14
JAPAN	14	14	14	14	14	7	7	7	7	14	14	14
MEXICO	14	14	7	7	7	7	7	7A	7A	14	14	14
PHILIPPINES	14	14	14	14	14	7B	7	7	7	7	14	14
PUERTO RICO	14	14	14	7	7	7	7	7A	14	14	14	14
SOUTH AFRICA	7	7	7	7	7B	7B	7B	7B	7A	14	7B	7
U. S. S. R.	7A	7	7	7	7	7	7	7	14	14	7A	7A
EAST COAST	14	14	7	7	7	7	7	7	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

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73 magazine
for radio amateurs

"WHERE THE ACTION IS!"

— David Bradley, Pres., Linear Systems

FCC FM DOWNERS

Though details are lacking, the FCC has just announced that remote base operators may not operate mobile — thus essentially putting a halt to remote base operation. This "interpretation" of the rules will put off a great many of the most innovative and progressive of amateur groups — further bringing to a halt the advances of amateur radio. Lew McCoy W1ICP of *QST* read the announcement at the Dayton Hamvention, calling the new rules "asinine."

In a second bombshell the Commission announced a new guideline for repeater license applications — not more than six control operators per repeater! This means that on the average each operator must be responsible for 28 hours of monitoring per week! This appears to be another harassing move on the part of the Commission to try and force repeaters off the air.

Prose Walker sure must have it in for repeaters and experimenters — he could hardly make it more difficult for them.

NEW CB PROJECT

As a fitting follow-up to the two recent CB projects published in *73*, the first with tuning CB rigs and the second with a remote tuning oscillator — in this issue we have a beautiful addition to any CB station. . .see page 12.

ANTENNA SPECIAL

This issue of *73* features antennas — including a miniature 40/80m antenna, a triband quad, the inside scoop on reflected power, double coaxial antenna, etc.

FCC REGULATIONS

Starting in this issue *73 Magazine* will publish the up-to-date FCC amateur regulations. These regs have been changing so rapidly of late that few amateurs have a copy of the latest Part 97. A recent poll of amateurs indicated that less than 5% of them had copies of the complete FCC regs and since a knowledge of them is not only required but is important in these days of rapid changes, *73* is going to publish them.

READERS PROTECTED

Currently advertising is not being accepted from quite a few companies pending answers to serious questions involving orders being delayed beyond reason, equipment that is junky, unsupported performance claims, imminent bankruptcy, and things like that. We have no intention of getting sued by naming names — but if you see some company advertise and then suddenly no more ads — be wary. Two FM, two antenna, and two surplus outfits have been dropped in the last few months. These are all advertising elsewhere, by the way, so watch out!

THE AVIS COMPLEX?

It really Hertz to be number two, but the *73* staff is a game bunch,and everyone is working diligently toward getting out of second place in ham circulation. The ad department has already broken through into number one spot and we're gung-ho to try and pass our aged rival, *QST*, in circulation. If having more articles and more news will do it, perhaps we're on our way.

65% MORE ADS IN 73

More ads than what? Well, during the last six months *73* has run more pages of ads than any other ham magazine . . . and by a wide margin. Big deal, you say? Okay, it *is* a big deal — for not only does this mean a lot more money to make *73* a bigger magazine, it also means that if you are looking for something (and you should be), you will have a much better chance of finding it in *73* than anywhere else — so check in *73 first.* Now, about that 65% you've been asking about — that's how many more ads *73* has had than your favorite and ours, *QST*.

FCC INSTRUCTIONS

Never has the FCC generated such an unbelievable mess — outside of their crowning achievement, the citizens band. The latest FCC release to "help" FMers through the wonderland of repeater and control station applications is on page 46.

CLUB OFFER

Tests of the new *73* club offer have demonstrated it to be one of the best club treasury fillers ever invented! The deal is so spectacular that rarely does even one club member pass it up — see page 4.

BEST SSTV BOOK

It is also the *only* slow scan book published. Read all about this incredible book that you will hate yourself if you don't get it right away on page 102.

REPEATER ATLAS

If you travel more than a few miles from home you will want to take one of the *Atlas of FM Repeaters of the World* with you. If you don't travel more than a few miles from home, get on the stick! More dope on that atlas on page 82.

AUTHOR'S BONANZA

The better the articles the better the ham magazine — this is the concept at *73* and the result is that the editors try very hard to attract the best of authors.

Among the attractions that keep the top authors writing for *73* are the best pay rate for articles in the industry — the pay for the articles is made upon *acceptance,* not months or even years after publication (or even never) — the author has every opportunity to check and recheck his article as it is being prepared for publication — and finally, the author gets by far the widest possible readership for his article.

We're working on a scheme to have some little extras for our authors who specialize in good construction projects — stuff like IC's — soldering irons — all kinds of small parts — jacks — plugs — connectors — like that. It's the little parts that mount up in the long run for builders — you don't find 5¢ jacks much anymore — and miniature switches can run a dollar!

You know, there are so many nice things to build these days, that a hardened experimenter hardly knows which way to turn. The new ICs invite QRP rigs, instant receivers, timers, identifiers, clocks, contest code memory units, car alarms, stuff.