January 1972

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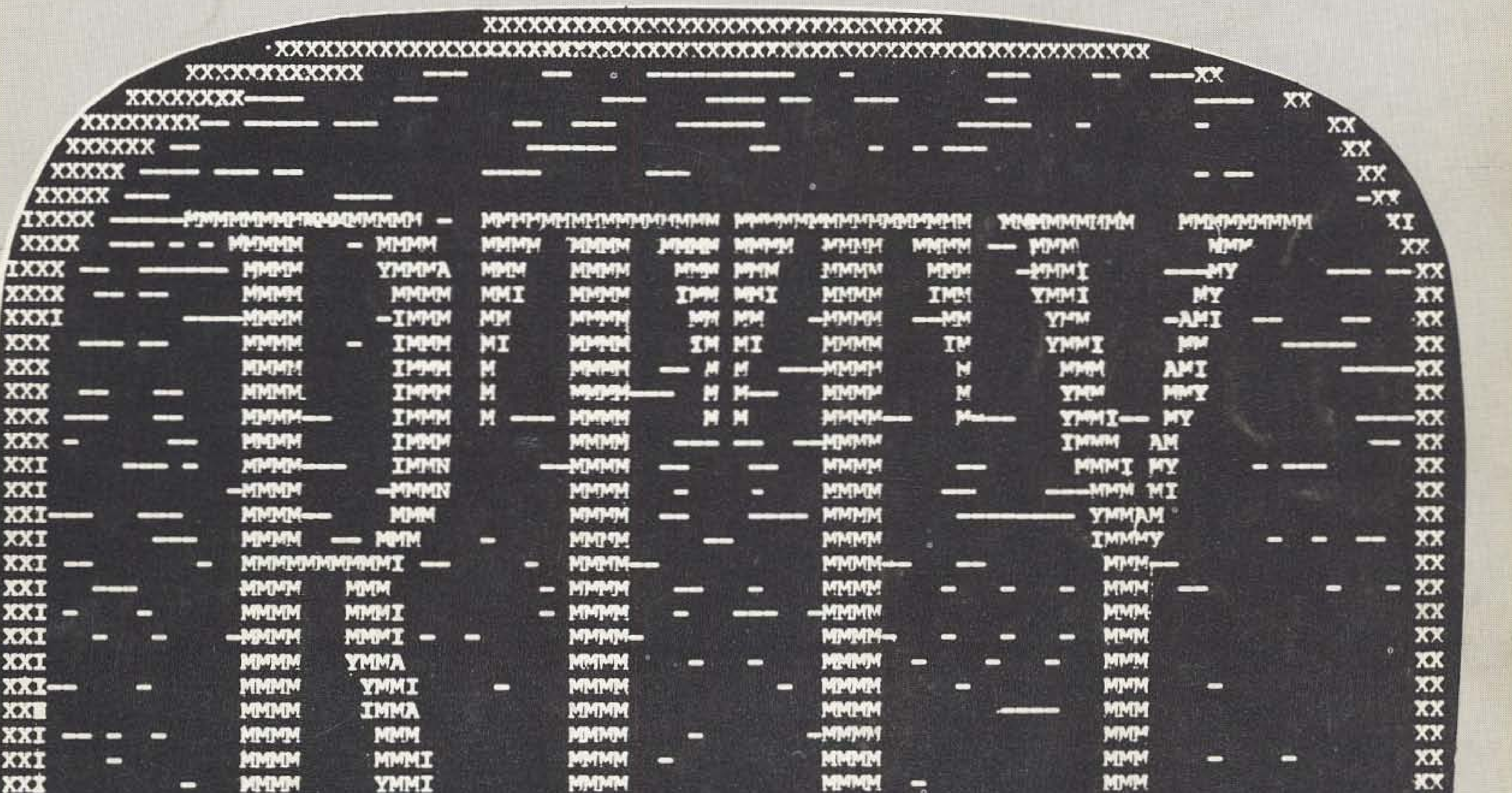
73 magazine

for radio amateurs



*73 Tests: Allied AX-190, Simpson Model A, IC-21, Regency Transcan, CT Power Amplifier

- 2M Antenna
- RTTY Art
- SSTV
- News
- IC Projects
- Perils of Skirting Ma Bell
- Novice
- Morse Code Controversy
- Only a bare hint of FM
- & More

009

2ND WORLDWIDE SSTV CONTEST BEGINS FEB. 5, 1972

$495 Robot SSTV monitor & free personalized SSTV tape* equips any licensed ham to enter.

Sponsored by CQ Elettronica Magazine, the contest is open to all licensed amateurs qualified to operate SSTV. Details are listed elsewhere in this magazine.

*By taking advantage of our current offer of a free personalized SSTV tape with the purchase of a Robot Model 70 monitor (as described in our last month's ad), you will have a video SSTV signal you can transmit without having to own a SSTV camera.

So for the price of the Robot monitor alone ($495) you will have all the equipment necessary to enter the second WORLD WIDE SSTV CONTEST!

ROBOT MODEL 70 MONITOR	**$495**
ROBOT MODEL 80 CAMERA	**$465**
25mm fl.9 lens	**$ 30**

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See the complete line of Robot SSTV equipment at your local Robot dealer listed below.

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73 magazine
for radio amateurs

#136 JANUARY 1972

FEATURES

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Amateur Radio

JANUARY MCMLXXII Monthly Ha

FAMILY HELPED BY AMATEURS

SON STRICKEN IN GERMANY

(Reprinted from the Williamsport Sun-Gazette) Mr. and Mrs. William J. Shannon recently learned that kindness can extend for thousands of miles.

On Sept. 1, the Shannons got a cable from their son, John, saying he was ill in Heidelberg Polyclinic Hospital, Heidelberg, Germany. He had been on vacation in Europe. He is head of the music dept. at Wyoming Seminary, near Wilkes-Barre.

Mrs. Shannon called the hospital, but was told that no John Shannon was listed.

"We were really worried," recalled Mrs. Shannon. "John wouldn't have cabled unless he was seriously ill."

The Shannons tried to contact their son by cablegram but with no success.

Finally they went to the Red Cross, but that attempt also failed. The Red Cross suggested however, that Mr. and Mrs. Shannon try to contact Germany by ham radio.

Mrs. Shannon's brother, Robert Stout W3NEN, put them in touch with Donell Godfrey K3QFW, the past president of the West Branch Amateur Radio Club.

"Mr. Godfrey is the hero of this story," said Mrs. Shannon." He's the one who helped us get into contact with someone who knew about our son."

On his radio, Don contacted Guenther Herzog in Hemer, Germany, about 250 miles from Heidelberg.

Fortunately, Herzog had a friend who was on the staff at the Heidelberg Hospital. Herzog learned that John Shannon was indeed in the hospital and seriously ill with a strange type of virus.

"They aren't sure what type of virus John has," his mother continued, "but one doctor in Austria said he could have gotten it from eating bad meat or ice cream."

Herzog offered his home to John when he leaves the hospital if he needs rest before returning home.

The Shannon's eldest daughter, Carol, an airline stewardess, flew to Germany to see her brother. "The doctors said that seeing her was the best medicine," the mother said.

Carol called her parents last night and told them John was much better. She plans to bring him home soon. It will probably be a while, however, until he returns to teaching.

Mrs. Shannon was much relieved today after the trying experience. "It seems like a small world," she said, "when people like Mr. Godfrey and Mr. Herzog will go out of their way to help you."

JOHN GORE SCHOLARSHIP AWARDED

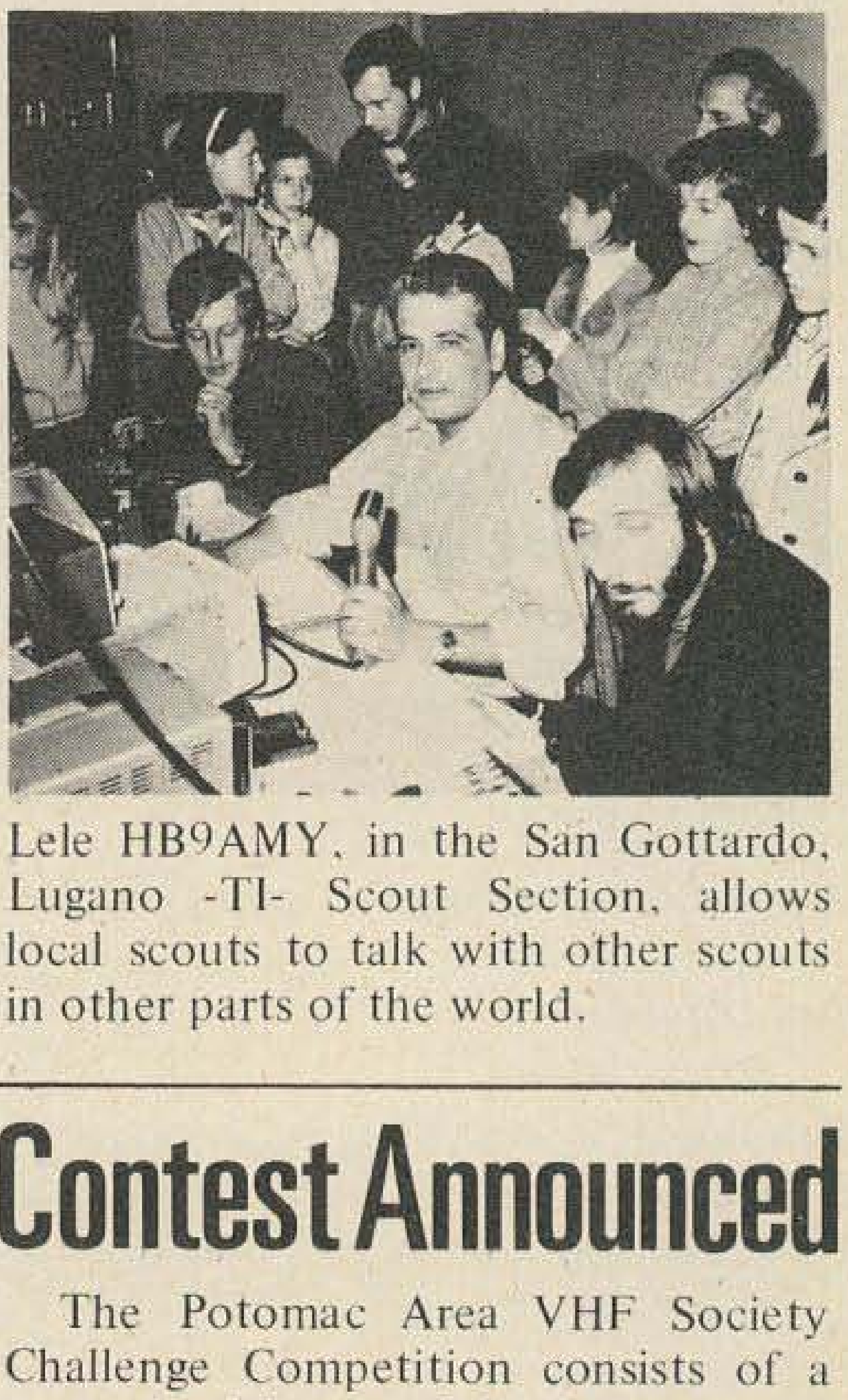
Alan Scott WB2TCZ, of Paint Post, New York, was this year's recipient of the John Gore Memorial Scholarship. Judged to be the most scholarly and deserving of applicants nationwide, on September 23rd, Scott was awarded the $500 scholarship. John Gore was an outstanding past president of the Foundation for Amateur Radio, a group of twenty-seven radio clubs in the Washington, D.C. area.

Alan Scott is an electrical engineering student at the University of Cincinnati, has been on the Dean's list several times, and participates in a co-op program with the Naval Research and Development Center in Carderock, Md.

Information about this scholarship will be available in *73* in a few months.

Swiss Scouts In JAMBOREE

Recent participants in the Jamboree On The Air held in October.



Lele HB9AMY, in the San Gottardo, Lugano -TI- Scout Section, allows local scouts to talk with other scouts in other parts of the world.

Contest Announced

The Potomac Area VHF Society Challenge Competition consists of a contest with any club that dares to compete in the January VHF Sweepstakes. Take your club aggregate score, divide by number of members, multiply by percentage of members participating. Clubs must have six or more members and have been in existence since 1/1/71. At least fifty per cent of the members must have been in the club before 7/1/71. Honor system will be used in computing scores. Highest scoring club by this system, other than PAVHFS, will receive an engraved trophy. Any club scoring higher than contest sponsor will receive a handsome certificate. All mail handled by K3LNZ.

IN WORCESTER, MASSACHUSETTS:

FM SYMPOSIUM FEB. 12th

A full-fledged hassle and exposition is in the works for mid-February in the Worcester (Mass.) area. If you have any interest in FM, two meters, ham fist-fights, looks at the newest developments in ham gear, and such, you might consider braving the wintry winds of central Massachusetts and heading for a full day of enervation at the First New England FM Symposium.

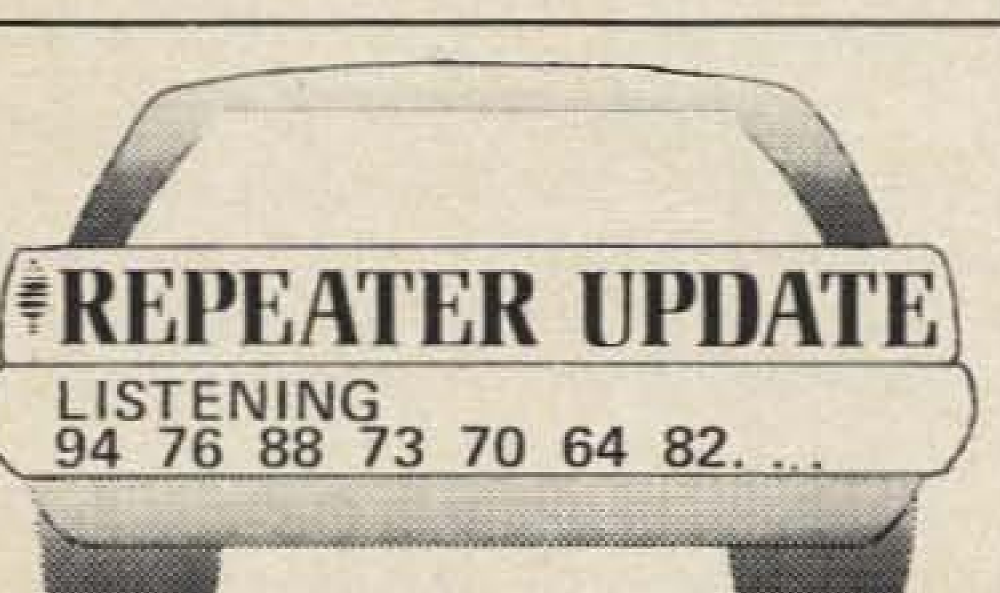
The need for some sort of general conflab of the 40-plus repeater groups in New England reached the level where even 73, which has taken little note of this new-fangled flash-in-the-pan FM fad, felt constrained to follow the lead of its publishing compatriots and make a fast buck while the pickin's are thick.

The Symposium will attempt to get the 40 groups face to face in the hope that a frequency coordinating board can be named to plot the progress of repeater allocations in New England. Arguments will be heard on closed vs open repeaters, television and RTTY repeaters, touchtone vs tone burst entry and control, big vs little repeaters, repeater tie-ins, and plans will be discussed for expanding repeater operations to other bands such as 75m, 40m, 20m, 10m, 6m, and even 220 and up!

Watch the February issue of 73 for final details on place and program. The program will start at 10 am and last through until late that night. Talk-in will be through any of the dozen or so nearby repeaters or on 94 direct. Listen 19-79 WA1KGO, 37-97 WA1KRJ, 25-76 K1MNS, 34-94 K1AIU, 34-94 WA1KGR, 25-79 WA1KGZ, 22-82 W1HWK, 28-88 K1AOI, 01-64 WA1KGS, 04-91 K1FFK, 10-70 WA1KFZ, etc.

NEW FREQUENCY SYNTHESIZER IN THE WORKS

Vanguard Labs is hard at work on their frequency synthesizer for FM and you should see announcements soon for a transmitter model with output on 6, 12 and 18 MHz for two meter transceivers and hitting every 10 kHz for around $100. This one will operate over a ±10°C temperature range. André will have one for −10 to +70°C for around $150.



AZ	K7ZMA/7	Hyden Peak, Hualpia Mtn. 8400', nr Kingman AZ	34–94
CA	WA6CHZ	Los Angeles	145.15–49
CO	WAØ SNO	Pueblo	34–94
			28–88
CT	WA1KGB	Farmington	37–97
IL	WB9HWS	Change from 22–70 to: 2000 Hz tone	04–64
		Change QTH to Western Springs	
IN	K9JSI	LaPorte	22–82
IN	W9CFJ	Michigan City	31–97
MA	K1AIU	Framingham	34–94
MA	WA1KEQ	Cape Cod	07–67
MA	WA1MHN	Somerville	34–94
ME	W1QXR	Bangor	34–94
MD	K3BEQ	Cheverly	01–61
MD	WA3PVP	Wheaton	07–67
			223.30–224.30
		Autopatch	448.3–449.3
MI	WB3CRK	Detroit	449.0–444.0
MI	W8MAI	Benton Harbor	22–82
MN		Duluth	34–94
NH	WA1KGO	Peterborough	19–79
NY	WB2BLQ	Yonkers 4 APL	31–91
NY	WA2PDJ	Change from 52–76 to	146.445–147.36
NY	WA2UZE	Huntington	52–76
NY	W2WJS	Bayside	41–64
OH	WA8WMH	Butler Co.	37–97
OK	WA5YUH	Durant	34–94
OR		King Mtn.	34–94
OR		Mary's Peak	34–94
PA	W3BN	Change from 52.525–640 to	52.575–680
PA	W3OI	Allentown	34–94
PA	WA3QCE	Pittsburg – logging info first 15 sec. 1st transmission	34–86
PA	K3UQD	Delete from list	
PA	WA3WJU?	Scranton	34–94
SC	WB4QGK	Charleston	34–94
WA	WA7KGV	Bawfaw 1.95 kHz tone burst	34–94
WI	W9AYR	Green Bay	28–88

Thanks to WA9SXN, WB9HWS, K9DZE, WA9AFM/Ø, K8ZOA, K7ZMA, K5BNK, W3WJC, K3BEQ, K2VWZ, W1KJL, W1GBO, W1BHD, W1AGJ.

Please, when reporting repeater activity, give call letters and location. Club bulletins often omit these items but we need it to adequately inform our readers.

Tone-burst Freq's – 1.5, 1.65, 1.8, 1.75, 2.1, 2.25, and 2.4 kHz.

MASSACHUSETTS HAM WINS COMMUNITY SERVICE AWARD

73 salutes W1NN of Reading, Mass., who, according to the *Reading Chronicle*, is the recipient of the radio station WEZE Community Service Award. Theodore Barron, an active phone-patcher, earned the award for helping people in need throughout the Western Hemisphere. In recognition of this feat, we congratulate you for typifying the ham radio operator as dedicated to public service.

HOT GEAR

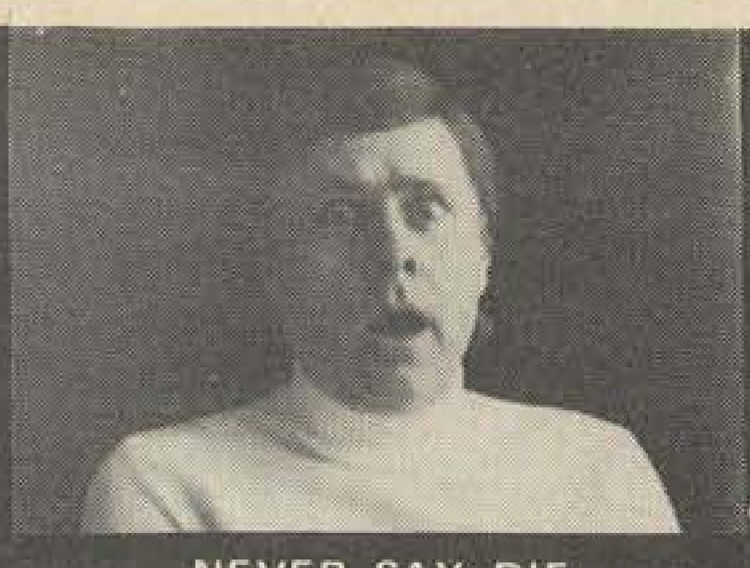
House of K2AOQ, Melvin Stoller, 373 Park Ave., Rochester, N.Y. (716-244-2839) burglarized Sept. 26. New GE Personal Portable Master Radio, model PR-36-RFS-55, S/N 1041218. Set up for 28/88, 94/94, 34/94, 34/76. Reward for info leading to recovery. Contact Mel or Rochester Police, Detective Division.

S-Line stolen from Colorado State Univ. during summer. 75S3-B S/N 15640; 32S3 S/N 12000; 516F2 S/N 1649; all have distinguishing marks. Contact W. Solfermoser, 1905 W. Lake, Ft. Collins CO 80521 (482-9668) or Dave Balsick, 515 S. Meldrum, Ft. Collins CO 80521 (493-4774).

STOLEN: Simpson Electronics Model-A FM transceiver (serial number 35457) and a Hy-Gain Diplomat-2 5/8 wavelength mobile whip with magnetic base. de W2PWG, Robert F. Scott, 9 Jackson Avenue, Brentwood NY 11717.

HOT GEAR CUMULATIVE LISTING

Mfr., Model, Ser. No.	Owner	Issue
Halli., SR46A, #446100	WA1EMU	9/71
Reg., HR-2, #04-03505	WA5BNM	11/71
Sonar, FM3601, #1003	WB2ARM	11/71
Coll., 75A4, #804	WØMGI	12/71
GE, Portable, #1041218	K2AOQ	1/72
Coll., 75SE-B, #15640	Col.St.U.	1/72
Coll., 21S3, #12000	Col.St.U.	1/72
Coll., 516F2, #1649	Col.St.U.	1/72
Swan, 350, #C567347	WA8NIB	---
Hamm., HXL-1, #33841269	KZ5MM	---
Mos., TA-33,	KZ5MM	---
Telr., 2M-814	KZ5MM	---



NEVER SAY DIE

. . . de W2NSD/1

EDITORIAL BY WAYNE GREEN

Ten Meter FM Link

A call from W7DXX got the juices boiling for a ten meter link channel between FM repeaters around the country, or even around the world. As a result I have ordered a little ten meter FM rig which we will be setting up in conjunction with WA1KGO to send and receive on 29.68 MHz with tone access from the 19–79 two meter service.

When six meters opens up I have a great time through W1ALE in Concord, N.H., which has a 52.525 MHz function connected to its 46–94 operation. Ten should be even more fun since it opens a lot more than six does.

Say, I'll bet all those swingers down on 3999 kHz would really dig a link to that channel through your repeater! How about it? It would wake 'em up for sure. When you do it please be sure to make careful notes of the ensuing bedlam and send them to *73* for the newspages.

In the meanwhile, how about getting set up on 10m so we can have some news of mobiles in Munich talking via 2m–10m repeater to Oregon?

Expanding the Tech Band

The FCC has been sitting on several proposals to expand the Tech frequency allocations on two meters. If, for some reason which is really not too apparent, the FCC is reluctant to let the Techs use all of 2m, perhaps they would buy an expansion of the band. This could be tried if an individual or group would petition the FCC to expand the Tech privileges to, say, 144.5 through 148 MHz. This would still leave 500 kHz for the higher class licensees, which is far more than adequate for the amount of activity on the band at present . . . or that has been on the band during the last 20 years . . . or that we can envison on the band in the foreseeable future unless some development comes along which is not imagined yet.

The progress of FM would be eased with such an expansion. What do *you* think?

Ideas

The Morse Memory unit in the December issue got us to thinking, when this is used for repeater ID, all that storage capacity is not really needed . . . so why not use some of the left over IC function for a timing circuit or two? Most repeaters need a timer to permit a one to three second lag for the squelch tail and another to time the repeater off the air if a continuous signal comes in for three minutes.

And how about someone coming up with a simple LED numerical readout for FM channels which is controlled by the crystal switch? You wouldn't need a counter, just a means of coding the readout when the particular crystal is installed. It would be a lot better than just channel numbers, right? Two numbers for the transmit channel and two for the receive would do it. Well?

220 Repeaters

Little has been done with 220 FM as yet and the pattern of repeater channelization is in a state of flux. I would like to offer the pages of 73 as a forum for discussion of possible channel plans. As a starter you might consult the chart on page 100 of the April issue of 73 which listed the 220 proposed channel frequencies.

One of the deficiencies of the two meter FM development, from my point of view, was the use of the commercial scheme of using just one channel for both transmit and receive, thus enforcing the usual type of radio contact where one person at a time can talk. Duplex, where both parties can talk at once, would be more fun and, unless there are serious problems of available frequencies, would seem beneficial. So naturally I suggest that we give strong consideration to setting up 220 for duplex operation.

If we set up our repeaters on 220 spaced 3 MHz, we should be able to receive while transmitting without any serious problems. Okay for one channel. So I propose that we start at 220.02/223.02 for the first pair, and then run a duplex pair for that repeater on 220.06/223.06. In use we would transmit on 220.02 and receive on 223.06 for one pair and transmit on 220.06 and receive on 223.02 for the second pair, transmitting and receiving simultaneously for full duplex operation. If 220 repeaters proliferate anything like 146 repeaters, the crystal expense could be almost prohibitive, running double that of two meter channels. I suspect that synthesizers will be with us shortly and will provide a low-cost solution to that difficulty.

If you have any experience or educated opinions on repeater channel standards for 220 please consider this a request for your expertise.

Coming Special Issues

We are hard at work on our usual spectacular March Surplus Issue of 73. If you have any last minute surplus conversions (relatively simple ones) this is the time to send them in. And what else would you like to see in a surplus issue? Let me know. I'll try to have the biggest collection of surplus ads I can muster.

April will again be special FM Month. I would appreciate getting as many FM circuits as possible for inclusion in this issue. Please make the circuits as complete as possible so only a little text is required for them. Send in tone code, decode, COR, PL, touchtone, control, timers, identifiers, logging devices, antennas, or whatever you think you might have that others would like to know about and have not seen. I'll have a complete crystal selection chart for all commercial rigs in the issue. And I'll try and bring you a complete rundown on all available FM ham transceivers, amplifiers, and such.

Beyond April we are working hard on special features in later issues on portable and mobile equipment, antennas and towers, VHF/UHF, DX, IC/solid state . . . and plenty etc.

FM Expansion Proposal

The FM channels between 146–147 MHz are pretty well occupied in the New England area and are filling up rapidly in several other population centers. The question that arises is where next?

Since there is no FCC regulation prohibiting the repeating of a Tech licensee into a higher class license segment of the bands providing the licensee of the repeater is appropriately licensed, the expansion of repeater outputs into the 147 MHz range is possible. But where do we put the input?

In practical application, most of the AM and other non-FM activity on two meters occupies the lower half MHz of the 144 and 145 MHz segments of the band. It seems to me that it would be practical for FM repeaters to start using the other half MHz bands, with their input from the 145.5 to 146.0 band and output in the 144.5–145.0 band, separated exactly 1 MHz. Remember that the 600 kHz separation used in the 146 MHz band was a compromise for operators who wanted to transmit on both input and output frequencies (146.34 and 146.94) without having to retune their rig. If you can give up the need to use the repeater output as a simplex channel you are freed from the 600 kHz restriction.

If we had it all to do over I just wonder if we might not opt for an even wider spacing between input and output so full duplex would be possible? A 2 MHz spacing would permit this and enable us to indulge in a completely different type of contact. Well, I guess it is too late to cry over spilt milk on two meters, but we certainly should keep this lesson in mind when we start populating 220.

What do *you* think?

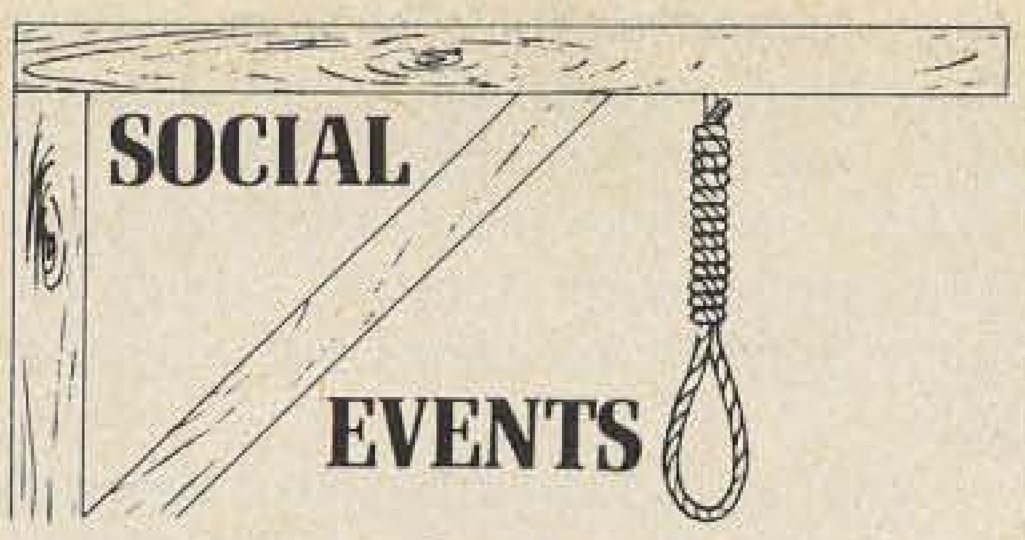
Proposed FM Repeater Channels

Input	Output
145.50	144.50
145.53	144.53
145.56	144.56
145.59	144.59
145.62	144.62
145.65	144.65
145.68	144.68
145.71	144.71
145.74	144.74
145.77	144.77
145.80	144.80
145.83	144.83
145.86	144.86
145.89	144.89
145.92	144.92
145.95	144.95
145.98	144.98

FM News

C. T. Power, who makes the Tempo amplifiers being marketed by Henry, will be out shortly with a little FM two meter amplifier for under $100 (namely $99.50) which will take the average 10 watt transmitter and boost it to 40 watts out. This should be a popular item since an extra 6 dB from most mobile rigs could extend the range substantially. Their 220 transceiver, announced recently, is seriously back ordered, proving that a U.S. made 220 transceiver at $180 was definitely needed. Their repeater version of the rig should be along soon and we're going to do everything we can to encourage every repeater group in the country to add a 220 MHz repeater to their present setup in the hope that a quick population explosion in that band might tilt the table in our favor when it comes to consideration of the dreaded EIA proposal to carve up that band for the CBers.

As if all that weren't enough, C. T. Power is also hard at work on a 450 MHz transceiver. They already have a beauty of a solid state 450 amplifier which turns 4 watts into 30 watts and sells for $210. If they can keep up with the commercial demand for that one perhaps we will be seeing some on our 450 repeaters. They also have a two meter transceiver and a repeater package well along. The transceiver will have 11 channels plus a vfo and is planned to sell for about $255! 15 watts. The repeater will have its own 12 volt supply and use a car battery in case commercial power is interrupted, with its power supply keeping the battery in full charge.



GATHERINGS

Wheaton Community Radio Amateurs (WCRA) will hold its tenth annual Mid-Winter Swap and Shop on Sunday, Feb. 20 at DuPage County Fair Grounds, Wheaton, Ill.; 8:00 a.m.–5:00 p.m. $1 advance, $1.50 at door. Refreshments and parking. SASE to WCRA, P.O. Box QSL, Wheaton IL 60187 for info.

California

Southern California DX Club plays host to the 23rd annual California DX Conference on January 22 and 23 at the Del Webb Towne House in Fresno. Beginning and experienced DXers are invited to attend. Speakers include 3CØAN, ZA5C, VK9NP, and 3B9DK. Talk, cocktail party, steak dinner, DX breakfast on Sunday are some of the events of the conference. Signal/One CX7A pre-registration prize. Send check for $14.50 to SCDXC Treas. Jack Hollander WB6UDC, 13531 Malena Dr., Tustin CA 92680. Include SASE. Pre-registration ends Jan. 7.

Indiana

The Lake County ARC's nineteenth annual banquet on February 12 will be held at a different location this year. It will be at the Scherwood Club in Schereville, Indiana. Map is on back of the five dollar tickets which can be obtained from Herb Brier W9EGQ, Ticket Chairman, 385 Johnson St., Gary IN 46402, or from other members. No tickets at door.

Arkansas QSO Party

From 2200z Sat. Jan 22 to 0400z Mon. Jan 24. Ark stations score 1 pt per contact times number of States, Provinces and countries worked. Non-Ark stations 5 pts per Ark contact. Stations may be worked once on each band and with each mode. Certificates for highest scorer in each State, Province and foreign country with 100 pts or more. Exchange QSO number and signal report plus State or country. Suggested freqs are 3560, 7060, 14060, 21060, 28060, 3960, 7260, 14300, 21360, 28560; 3735, 7175, 21110. Logs before Feb 21 to North Arkansas Amateur Radio Society, Rt. 1, Green Forest, AR 72638.

Contests

Second World SSTV Contest, sponsored by *cq elettronica magazine*. This contest is to promote increased interest in SSTV as used by radio amateurs. Contest period is Feb. 5, 1972, 1500–2200Z, and Feb. 13, 0700–1400Z. All bands may be used, and the exchange is picture and number of the message.

Two-way contacts score one point (total points is number of individual stations contacted), no extra points for contacting same station on different bands. There is a multiplier of 10 points per continent and 5 points per country (ARRL list). Score is computed by multiplying exchange points times multipliers. All logs to be submitted must contain date, time (GMT), band, call, message numbers sent and received, and points.

Send logs to Prof. Franco Fanti, via A. Dallolio 19, 40139, Bologna, Italy. First prize is a year's subscription to *cq ellettronica*; second and third prizes are 6 month subscriptions. There is a special SWL prize.

The Milliwatt: National Journal of QRPP once again will sponsor a QRPP NET for 1971-72, commencing operation on November 15, 1971. The QRPP NET will utilize the QRP ARC I calling frequencies of 7040 kHz and 14065 kHz. Regular NET times are: 7040 kHz – 0830 EST Wednesday; 14065 kHz – 1100 EST Saturday and 1800 EST Sunday. Procedure: check-ins will call CQ QRPP NET and make contacts individually; there will be no regular NCS, as we will allow conditions and activity to determine operation of the NET. In addition to the regular NET times, stations are requested to monitor the NET frequencies for possible calls at the following times: 7040 kHz – Sunday, Monday and Wednesday at 2100, 2200, and 2300 EST; 14065 – Sunday, Tuesday, and Thursday at 0900 and 1845 EST. Monitoring stations are requested to tune ±2 kHz, and should be reminded that calling stations, running at the milliwatt power level, will probably be weak, and hence rf gains should be turned up. We request stations making contact on the NET to report them to *The Milliwatt* c/o Adrian Weiss, 117 Central St. #F-10, Acton MA 01720.

Also, *The Milliwatt* sponsors two awards for QRP DX operation. One is for low power contact with twenty-five or more countries, and the other is for very low power (under 1W) contacts. For full details, contact Adrian Weiss at the above address and include a SASE, or check a copy of *The Milliwatt*.

Guest Editorial

Wells Chapin W8GI

The introduction to the fiftieth anniversary publication of the Institute of Radio Engineers proceedings started thusly: "The life of a man or organization has been aptly compared to the sequence of lights and shades during one day on earth. In the early morning, long shadows lie to the West as the sun rises. Then these shadows shorten as the day advances until no shadows are visible in the noonday blaze of light. And later, the shadows lengthen as the sunlight wanes, and twilight and night approach."

These words were written during a critical period of the life of two very fine professional organizations, the Institute of Radio Engineers (IRE) and the American Institute of Electrical Engineers (AIEE). Both organizations were facing real problems and both competed in many instances for the same men. The managers of these groups – being professional men – recognized the dynamic changes swarming around them and planned ahead. They could see that both groups were headed for trouble unless something was done. They acted, merged, and formed the present Institute of Electrical Electronics Engineers (IEEE), which is now a very fine, respected and prosperous organization.

Herein lies a parallel – the ARRL is in the shadows of the afternoon and faces the darkness of the night, and the same type of problems that the IRE AIEE faced. It is amazing to look at the parallels. In amateur radio we have CW vs phone, DX vs ragchewers, traffic men vs non-traffic men, one band vs the other, one modulation vs the other, miscellaneous organizations and their separate goals, ad infinitum. Yet all these men are amateurs and should be brothers. Just as the IRE and AIEE did, the ARRL faces many of the same type of problems, including financial difficulties. So what do we do about it?

It is interesting to compare the problems of IRE and AIEE to those of the League and at the same time look at the different approach to their solution. First of all, the IRE put their problems on the table. They were freely admitted and written up in the Proceedings, both pro and con. The Proceedings did a magnificent job of defining the problem, presenting both sides. They did a real management job and followed this up with action and a factual reporting job. When a merger was suggested, they presented the pros and cons and sold the idea. That is why the IEEE is a solid, respected organization. They knew how to keep their members happy; they calmed dissention through the printed word. Why not take a serious look at the IEEE and take advantage of their experience in successfully solving the same sort of problems we amateurs face.

The IEEE now has two magazines for its members. One is very technical, the other is more broad brush and appeals to those who do not care for the highly technical. They have 34 technical groups, each with a different interest, and each have local chapter meetings. Each group has a small paper-type of publication for its members which covers their particular interests. The IEEE has regional and local chapters. According to a 1970 article in their *Spectrum* magazine, the IEEE has 169,059 members, not unlike that of the League numbers or at least what the League numbers should be. They have different classes of memberships, including Fellow Senior Members, Members, and Student Members.

The roster of the IEEE has thousands of amateurs. One famous, highly respected name that appears in the roster is that of our former ARRL president, Mr. George Bailey. In the past the ARRL has had some wonderful, highly respected, very competent men as president – for instance, Herbert Hoover, Jr. Now let's ask why these men resigned the presidency of the ARRL? All you have to do is read the Constitution and by-laws to find the answer. As you read, you find that the president is for all intents and purposes, powerless to act. Therein lies a basic problem. Therefore let's take a look at our antiquated Constitution and by-laws and bring them in tune with the times and give our president some real authority and responsibility. Let's have a paid president who works at the job. Other sections of the Constitution eliminate some real talent, because they prohibit a person to be a director who has an interest in manufacturing of electronic equipment, or a person associated with a radio magazine. There are other sections just as unwieldy and outmoded as these. How about a committee to report on bringing our Constitution and by-laws in tune with the times?

Let's look at a name change to better reflect the purpose we have of selling amateur radio. Then pattern local chapters of amateur radio groups just like the IEEE. For instance, why not call our League the Institute of Amateur Radio, and then instead of a flock of clubs with various names and aims we could have, for instance, the Detroit Chapter of the Institute of Amateur Radio, and under that subhead have the Detroit DX group of the IOAR, the Two Meter group and FM, the CW group, and so forth, and then have Michigan Regional State groups. Here in Detroit we have a social occasion each year for the regional IEEE members. Why not envision all amateur radio groups under one name? A name projects one's aim or purpose. Who knows what the ARRL means but an ARRL member? Let's get public relations conscious and organization conscious. Look at the power of the auto workers and the various other unions. In union there is strength!

Now let's take at look at the League. Only one side of the story appears in QST and that is highly biased. You never read what a director stands for. Even our directors cannot get the other side of the picture printed. Why can't the ARRL lay the problems on the table and then solve them and sell the solution to all – repeat, all – amateurs and not just League members, and at the same time show the importance of all amateurs belonging to the League. It just is not healthy to have dissension in the ranks of the ARRL dividing the approximately 80,000 members. At the same time, we tell 200,000 other non-member amateurs what is good for them, and we supposedly represent their views in the League presentations to the FCC, when in fact they haven't been represented at all and what's worse – they don't know what is going on because they don't get QST and don't even have the chance to read the biased views presented.

Why do we resist change? Those who resist change generally suffer the consequences. While we are sitting around operating as we did fifty years ago, a communications revolution, population explosion, and dramatic world changes are swarming around us. The ARRL seems to doggedly resist change, and in addition sweeps the problems under the carpet when they should be laid out to view. We should ask the help of some of our very competent amateurs who are not League members in solving our problems. Read the *Who's Who of Amateur Radio* and you will find thousands of names that would add prestige to our organization in addition to bringing real talent to revitalize the League.

What ideas do you have? Write your director, demand action, and send a copy to *73*. Let's revitalize amateur radio and make it the healthy, respected entity it used to be.

. . .W8GI

Mr. Chapin has some interesting constructive ideas regarding the League which need airing. 73 welcomes such comments from any reader, pro or con the League and any other matter of vital interest to all amateurs.

NEW PRODUCTS

CW KEYER and MORSE MEMORY UNITS

Data Engineering Inc. has come out with a pair of keyers that may just revolutionize the whole keyer field.

The Space-Matic 21 keyer is designed to work with any key or paddle, but in particular with the Data Engineering solid state electronic key. When both dot and dash paddles are touched the keyer alternates dots and dashes. The spacing between dots, dashes, characters and words are automatic and fixed in length, assuring the most beautiful CW you've ever sent.

The keyer has sidetone built in and a reed relay to key the transmitter.

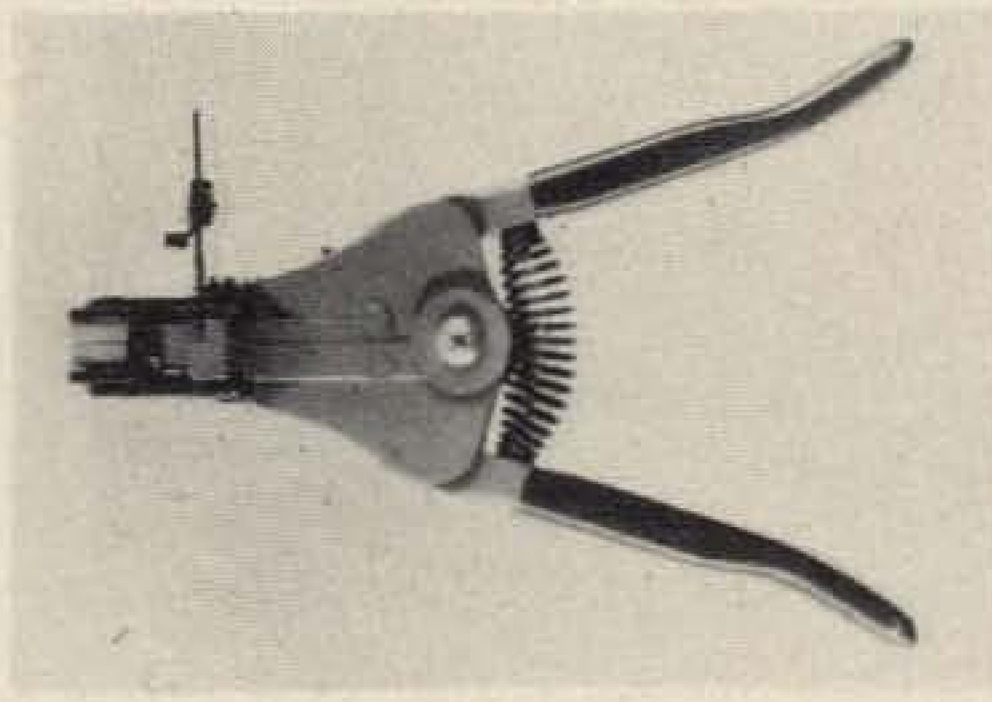
The Memory-Matic 500 has all of the same features of the above plus a 500 bit memory which will handle about 50 characters. Imagine what a difference this can make in a contest! You can put in the signal report, section and date to be sent to each contact automatically, so all you have to add is the call and time by hand and you are on to the next contact.

Two meter repeater owners may like using this for identification, as may remote base users on the VHF and UHF bands.

When you are loading the memory with a CQ call or a contest exchange, a side tone lets you know when the memory is near full by rising in pitch. A steady tone indicates it is full. The message in the memory can be sent back at any time at any speed from 3.5 to 85 wpm. Will we be hearing even sideband stations being identified every ten minutes with a short burst of weak tone from these memories? Will RTTY operators flip one of these in to give the CW identification required?

Prices are very reasonable for these two devices. The Space-Matic 21 keyer is \$89.50 and the Memory-Matic 500 is \$198.50. Write to *Data Engineering Inc.,Box 1245, Springfield VA 22151* for specification sheets.

Automatic Wire Stripper and Cutter



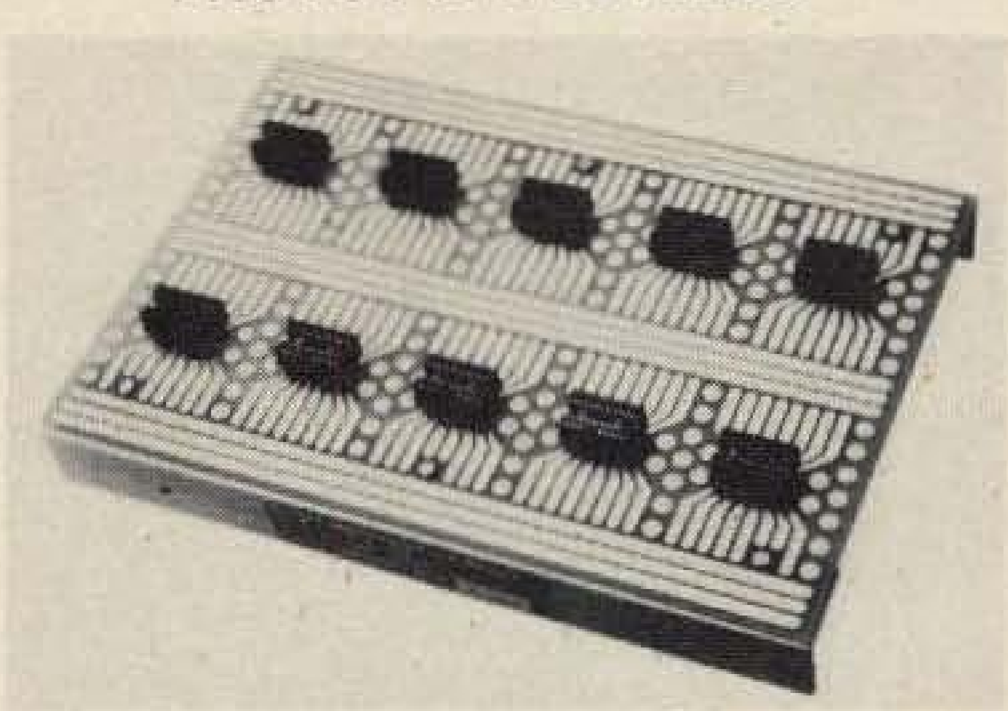
Radio Shack is offering a new Automatic Wire Stripper and Cutter in their line of Archer tools which they say strips #24 to #12 gauge wire perfectly in a second.

To operate the wire stripper you simply insert the wire, squeeze the insulated handles and release. Insulation is removed cleanly and completely without nicking or breaking wire. A strip gauge guides the wire to the correct portion of the blade and assures a uniform stripped length every time.

The Archer Automatic Wire Stripper and Cutter is priced at \$4.95.

Archer tools and accessories are available exclusively through Radio Shack's more than 1100 stores in 49 states and Canada, or by mail.

PROTOTYPE BOARDS



Experimenters, rejoice! Maratron *(Box 777, Dallas TX 75221)* has come up with just what you are looking for. Prototyping boards designed for transistor and IC circuits. They have patterns for 4 lead transistors, DIP IC's, and TO-5 IC's of 8 and 10 leads. Dot patterns available for using discrete components, too. And all boards are reusable. Write and say 73 sent you.

Security Catalog

Amateurs interested in working up a nice little second income could do a lot worse than getting into the security business. There are few offices or stores, or even homes for that matter, where some security system might not be needed. Wouldn't your wife sleep better if your home were protected against intrusion and fire? One of the big problems for anyone wishing to get into this fast-growing field has been one of getting information as to available equipment. *The Mountain West Alarm Supply Co., 4215 North 16th Street, Phoenix AZ 85016* has a free catalog (64 pages) of the latest security gadgets and, armed with this book, you can go into business for yourself. Please mention 73 when you send for that catalog, okay? And please remember where you got the idea to do this when you are rich. Don't be a fair weather friend.

FREQUENCY MARKER DELUXE

100 kHz markers have been around for a long time, but they are inadequate to meet the demands for band edge marking and calibration with today's split up ham bands. How many operators know for sure exactly where the 3825 band edge really is? Or 14275?

Large scale integrated circuits make a low cost (relatively) frequency marker possible today which starts at 400 kHz, splits that to 200 kHz, 100 kHz, 50 . . . 25 . . . 10 . . . and even 5 kHz! Data Engineering Inc. has announced just such a unit and is marketing it for \$32.95 complete with built-in battery holder and a five year guarantee. The marker, less cabinet and stuff is available wired, tested and calibrated for \$22.95 . . . or even in kit form for a lowly \$19.95. It runs from four penlight cells. The uncabineted one should be fine to build into your receiver if you can figure where to borrow a few mils of 6 volts. The square wave output of the marker rings out clearly even above 150 MHz, so it can be used for zeroing in those FM crystals. The calibrate screw driver control on the front panel is for touching it up against WWV.

Spec sheets are available from *Data Engineering, Box 1245, Springfield VA 22151.*

More New Products

NEW TONE BURST ENCODERS ARE DIRECT POWERED

The Ross and White Company has announced two new Tone Burst Encoders that are powered directly from FM, 2 meter transceiver power sources in transmitting repeater access signals.

Keyed by closing the transmitter microphone switch from the 12 volt dc keyed source, the Encoder generates a half second tone burst which modulates the transceiver and automatically activates the tone allowing activation of tone access.

Two models are available. The two tone model TE-2 sells for $39.95 and the five tone model sells for $49.95 postage paid. Both are sold on a 10 day trial, money back guarantee basis.

Installation of the TE-2 and TE-5 is relatively simple using the complete instructions provided for your make and model of transceiver. The battery powered models will continue to be available for hams preferring that arrangement.

For full data including specifications, write direct to the *Ross and White Company, 50 West Dundee Road, Wheeling IL 60090.*

Motorola's HEP Introduces LEDs

Light emitting diodes are now available to the hobbyist-experimenter through Motorola's HEP semiconductor line, with the introduction of four new light-emitting diodes, three visible red and one infrared device (P2000, P2001, P2003 and P2002). These devices are ideal for digital clocks, frequency counters burglar alrms, panel lights and on/off indicators. The devices are available now at authorized HEP suppliers nationwide.

NEW 2M FM TRANSCEIVER

A built-in tone burst encoder is featured in the new Ross and White 2 meter FM transceiver Model RW-Bnd now available from the Ross & White Co., Electronics, 50 West Dundee Rd., Wheeling IL 60090. The built-in tone burst encoder provides quick and easy access into tone activated repeaters now becoming common across the country. Three tone selections are provided. All tones are factory preset to commonly used frequencies but can be easily reset.

A front panel power selector switch lets you choose power output for 0.1, 1.0, and 10W. Another switch allows 12 channel capability. For those who do not wish the tone burst function, the rig is available without it, and the encoder may be added later as an accessory. The RW-Bnd comes with mike, mounting bracket, and four channel combinations installed.

MEMORY IC'S

Repeater control and CW keyers with pre-recorded message circuits are advised to investigate Intel Corp.'s sixty-four bit memory and binary decoder IC's. These are random access or addressable memories. Series 3101-3104 memory and 3205/3404 decoders; info via *Intel, 3065 Bowers Ave., Santa Clara CA 95051.*

NEW SWL RECEIVER

Heath of Benton Harbor has come up with a new SWL receiver, the SW-717. It covers BC through 30 MHz, has a built-in speaker, and tunable bfo to copy CW or SSB. It looks good for the Novice or as a second receiver for the occasional SWL in all of us. Write to *Heath* in *Benton Harbor MI 49022.*

DIGITAL MULTIMETER

Triplett, after all these years of being first in the meter biz, has come out with a digital v-o-m! Billed as a 2¾ digit meter, the last figure tells you whether the number is above or below five. The price is 2¾ centibucks, which makes it a little high for the average ham shack and probably of more interest for lab or service shop use where the time saved by using this meter could eventually pay for it. *Triplett, Bluffton OH 45817* will be delighted to tell you all about it and ecstatic if you buy a few dozen.

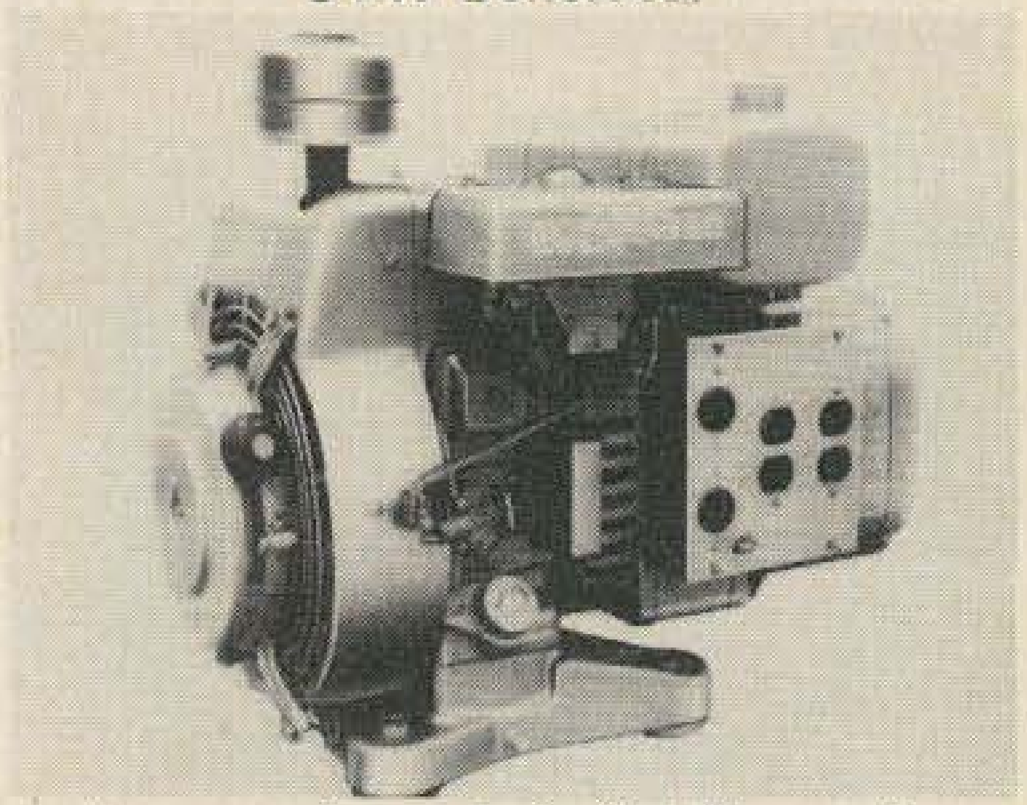
1W FM TRANSMITTER

Avcom has come out with just the thing for those who want to go FM but cannot afford to. The FM-201 is a miniature 1W transmitter that can be mounted inside any of the high-band monitor receivers to make an instant transceiver for under $200. Or if walkie-talkie is your bag, any of the portable high-band receivers and this rig will make a hand-held unit for under $100. Multi-channel operation is possible; and with the 10W power amplifier, a handy walkie and mobile combination is easily within the reach of most hams' finances. Contact *Avcom at P.O. Box 29153, Columbus OH 43229.*

RECTIFIER INFORMATION

Hams working in RTTY, FM, and those experimenting with logic may find a new Motorola silicon controlled rectifier useful in low power switching, detection and sensing, and control functions. These units draw very little current from the circuit and are less than one tenth inch in diameter. Write to the *Technical Information Center, Motorola, Inc., Semiconductor Products Div., Box 20924, Phoenix AZ 85036* and ask for info on their Micro-T MCR051 through 054 series.

3 kW Generator



A new air-cooled, 3 kW gasoline–driven electric generating set was announced by the Onan Corporation.

Available in both manual start and remote start models, the new model 3.0NB provides 3 kW of 120/240V, 60 Hz, single-phase, 4-wire electric power at 1800 rpm. All models are reconnectible to deliver rated output at three different voltages 120V, 2-wire; 240V, 2-wire, or 120/240V, 3-wire – permitting the user to employ equipment of different voltage requirements through a simple wiring change.

An important feature of Onan's new Model 3.0NB is the single-manufacturer construction throughout. The air-cooled engine, revolving armature generator and (when used as a standby unit) the matching automatic load transfer control are all designed, built and tested by Onan to operate together as a single-integrated system. *Onan Division of Onan Corporation, 1400 73rd Avenue, N.E., Minneapolis MN 55432.*

NOVICE

What with the emphasis on upgrading one's license due to incentive licensing structure, it behooves the amateur to learn, not memorize, his electrical theory. When test time comes and the Man is staring at you and the temperature in the room creeps to 120°, your memory can fail,but not if you really know what you are talking about. You can read books or attend classes, but there is a lot to be said for practical experience, too.

One way to get this experience is to operate your station, but twisting knobs and watching meters bob around only goes so far. If you want to know how to operate your rig, read the instruction manual which should have come with it. If you want to know how your rig operates, read the instruction manual section entitled "Theory of Operation." It's easy to quickly read a few paragraphs, but try this way instead. It will take longer, but it is better for anyone who wants to learn.

Disconnect the rig and open it up, but leave the ground wire connected. Use all safety precautions. Now with the manual in front of you, read the section slowly and where it says plate tank coil, find it in the rig and touch it. Examine how it is placed. Is it parallel to any other coils, or perpendicular? Is it shielded or in the open? Notice parts placement in the rig and also how they are placed on the schematic. To become familiar with these pictures will make the FCC tests easier and also you will be able to read any of the amateur magazines with greater enjoyment. Also look for the different components mentioned in the theory section of the manual. If C6 is a bypass capacitor, what is it bypassing? What is bypassing? Why bypass at all? Any terms that are unfamiliar or vague should be looked up in a handbook or other references. Even after looking at your own rig a few times and perhaps a few others, and then reading the pages of this or other magazines, you might recognize a section of the schematic. It may be an oscillator stage, or an i-f. In time, the different sections become connected in your mind and you will know what the author has in mind. Of course, you should read his comments about the theory of operation of his unit, also.

For many – Novices and Generals alike – this can open a whole new dimension in our hobby. An awareness of what takes place behind the brushed aluminum panel is valuable not only for assistance in passing the next higher ticket, but it adds enjoyment and comprehension of the journals. Never overlook construction articles or articles of electrical theory. These are what the hobby is made of. As you become more familiar with the theory, you might want to try a small construction project. Nothing fancy, perhaps a field strength meter (meter, diode, and a choke). When it turns out right, the next project might be a little more complicated, like a one transistor code practice oscillator. Maybe you can even design one yourself. Then maybe a small QRP transmitter. Speaking for myself, I was a ham for over ten years and never built more than two kits. Then, about a year ago, I built an antenna. Then a CPO and monitor. Then a field strength meter. Then a QRP transmitter. There really is nothing that can compare with the feeling of satisfaction that comes from communicating with someone on a rig that you built yourself. It is a warm glow that spreads up from the gut to a dizzy sensation in the head. It happened to me on my first QSO with a 100 mW transmitter. I'm getting the bug to build and I know what I'm building, and why it works.

When you face the examiner the next time, you'll walk in with confidence, knowing you have the knowledge at your fingertips. After all, you've been working with this material for some time and you have made electronics a part of your life, not just another pastime.

...K1NUN

LETTERS

ou goons don't ever proofr

I insist that you print ev

I have finally given in to my carnal desires and am begging for a chance to read 30 untouched issues of 73. I had to decide whether I wanted the Gunsmoke or the Extra Class Study Guide. I guess I like fun more than work. Seriously, I used the Advanced Class Study Guide and passed with only a week of study. This fact did not change my views on the horrible nightmare of incentive licensing, however.

As I now have a new call, W7INH, I feel like an old timer and can now give out my opinions with the rest of them. WB9FIN in the Oct. issue mentioned only a few of the rotten acts which take place on 20 meters. I used to think 40 AM in the early sixties was mayhem. I cannot even speculate why hams' manners have deteriorated so much lately. I could not afford SSB equipment and was inactive until recently and the change in operating habits is startling, to say the least.

Everyone seems to promote their own interests these days, so I have a few proposals':

1. I cannot afford a tower or a beam as I am now paying back all my law school debts so all beams and quads should be outlawed.
2. My transceiver only runs 200 watts PEP so that should be the power limit.
3. I did not notice the code "hump" of ten words per minute but I am rusty now so the 20 wpm requirement for the Extra must go.
4. I am too dumb and too busy to homebrew my equipment so all questions on the exams concerning theory except those on antennas and feed lines should be removed. (For some reason I understand SWR.)
5. As I just finished three years of law school, most questions on the exam should be from pertinent FCC and international regulations. I think I could pass the Extra exam and be on someone's honor roll if this were done.

Steve Guelde W7INH ex K8RSX
Cheyenne WY

As a professional language educator, I want to congratulate Gilbert Ford on his excellent article, "Say Coo, Say Coo, Day Eckees." (September, Page 107). It is well written, good content-wise, and – hopefully – useful. May I, too, encourage amateurs to try even a few words of another language. It pays handsomely in friendship if you'll just try.

Philip D. Smith W3DZR
West Chester State College PA

This is a comment and suggestion about your proposed "handbook" format. It is basically an exellent idea. It seems to me that many advertisements are almost useless. They say someone is selling such and such, give a price and address and perhaps a sales pitch. On the other hand I suspect most hams and experimenters have some difficulty obtaining technical data on components. Do you suppose that the component manufacturers or suppliers could be persuaded to devote some of their advertising space to data sheet type stuff. For example, the ad in the October issue listing a bunch of semiconductors is useful to someone shopping around for the cheapest price on,

Continued on page 10

LETTERS CONT.

say, a FET for a VHF front end, but I would rather see, and might sooner be tempted to buy, an ad with data on a single device or family, with prices and an address at the end.

Bill Rutiser
Brandywine MD

Good idea!

DEPARTMENT OF AMPLIFICATION

I want to thank you for the nice write-up you did on our alarm. One thing you didn't mention in the article which is important, is that our system (when used with your car's horn) causes the horn to pulsate in a "beep-beep-beep" fashion so that it cannot be mistaken for a stuck horn. It may seem like a small detail, but we feel it's a very important one.

Walter Scudder Jr.
Technical Product Development. Co.
Nutley NJ.

I just finished reading Gilbert Ford's article in the November issue, "Let's Revise the Morse Code." He makes a very good case, but we all know it will never happen. However, some rather interesting conclusions can be drawn from Figures 2 and 3 (bit length of letters and frequency of occurrence). Just nine letters (E-T-I-A-N-S-R-D-H) constitute 65% of all letters used according to the "frequency of occurrence" (Fig.3). These same letters have a bit length of 10 or less. Mr. Ford makes the valid point that the "momentary speed burst effect' is the ultimate limiting factor in anyone's ability to copy code. Any ham who can copy 13 wpm already has the ability to copy these nine letters at better than 20 wpm. It seems reasonable that every ham could copy over 20 wpm by concentrating practice on these nine letters until he could copy these at an average speed of 35 to 40 wpm.

Now, if we could get our friends at Newington to include 15 minutes of E-T-I-A-N-S-R-D-H at 40 wpm as a standard part of daily code practice we would soon all have "Extra" class licenses and the need for confusing "sub bands" would vanish!

Robert B. Baker WA7NCT
Billings MT

That Heathkit 15 MHz counter took me 5 hours at the most, and worked first time. Now my pupils won't believe any other kind of frequency meter. I'm not an experienced assembler – I'm a Physics teacher; I pick up the iron when I feel in need of therapy.

Bill Jarvis GM8APX, GM6AGF/T
Dall School
Perthshire, Scotland

Re the Washington tower case, page 5 October issue, I have sent along a modest amount to help in the case. It is important to all of us to cooperate in these tower cases as they arise, in order to establish as many favorable legal precedents as possible. They will be needed in the future, as public opinion against towers and poles increases. The power and telephone companies are already under increasing pressure to put their distribution lines underground. It is anticipated that cable TV will, in the near future, expand very rapidly, mostly because of the extended service it offers – 20 channels are quite likely. In time, as sets and antennas wear out, people will switch to cable TV. Eventually, the forests of TV antennas will disappear, and the pressure against the ham antenna will mount even more. (On the plus side, hopefully, the TVI problem will be eased.) Looking into the distant future, and barring catastrophe such as nuclear war, the TV frequencies will be commandeered for mobile use. Probably all non-mobile radio uses will be banned. But by that time, the hams' spectrum space will long since have been eroded.

John P. Kinzer KV4FY
Christiansted, St. Croix, USVI 00820

Thought you might be interested to know that my article, "Amateur Radio and the Handicapped," in the November issue was very well received.

I received personal letters from other disabled and non-disabled hams in California, Minnesota, and Arkansas and many comments from local amateurs.

It is not too often that articles like this or information for disabled operators appears in magazines like 73. I wonder how many amateurs know of the Handi-Ham System in Minnesota where amateur equipment is loaned free to those who need it, or the Handicap Net? How much of the transistorized and IC logic can be used for the blind, deaf, and physically disabled? There could be many interesting and quite worthwhile articles written in this area.

Ron Perry WA2CGA
Trustee W3CVT

Having just read the plight of WN30SI in November Letters section, I decided I'd better not take *any* chances. Renew my subscription, take my money, and leave me in peace. (Could you get word to the Subscription Department about returning the rest of my family and my receiver, please?)

All kidding aside, I really enjoy 73. I just hate to see you dump it on some unsuspecting person. From where I sit, the reason 73 is successful (and it is) is that none of the people connected with 73 have lost the "common touch." Congratulations on that and the best of luck in your new endeavors.

James Morrison WN9FRP
Geneva IL.

Rather than to fight non-business CB over 220 MHz, a much more practical solution is to establish a "Communicator" class ham – no test, or modest test, crystal control on assigned frequency, modest power, transmitter adjustment by other class ham or 2nd Phone. Rather than to open a Pandora's Box – to my mind it will stimulate other class ham growth, provide commercial incentives now lacking on 220, stimulate observance of radio regulation rather than to make the citizen a criminal as is now the case by multitudinous regulations, low power, and skip band temptation – certainly a hot potato for the FCC – with neither enough manpower or money to enforce the regulations.

We as hams need more of us when it comes to international frequency conventions, e.g. 1 or 2 million rather than ¼ million to provide public service in time of trouble or disaster.

John K. Lassig W5IOV
Houston TX.

I just received my long awaited November issue of 73, but, alas!! What happened to the mobile theft alarm mentioned under "FM" on the cover? Did I not read the fine print?

John H. Bauer W4AWM
Arlington VA.

Someone stole it.

Sorry to have neglected to renew my subscription. Certainly would not want to be without 73, it's tops. At my age (75) discretion may be the better part of valor, so a 1 year renewal will suffice. Have been hamming since 1911 and still enjoying it immensely with the help of 73. Long may it wave.

Edward J. Gallagher W1DD
Quincy MA.

FM PRO AND CON

I have received your information that my 73 magazine subscription ran out. Thanks. I received all issues and thanks on that. You run too much on your pet FM, FM Repeaters, and that cuss hog talk junk. You call it sideband. I would not have any of such junk in my shack. Only two issues of 73 had any ham dope on AM.

When you publish a lot of AM Trans. construction then I will sure subscribe.

Geo. Ball 9BFU
Omaha NB

I know you want to retire, but I must say it is a great relief to have you back at the helm of 73 once again. Now perhaps we can get out of the FM rut. Not that I'm not interested in FM, but too much of one thing bores me to death. I'm confident that 73 will continue to receive periodic renewal checks from this QTH. Although one of your subscribers from issue #1, I must say I nearly jumped ship this year.

Hopefully your annual surplus issue will once again have articles about surplus in it! Hopefully they will be written by those superstars of 73 such as Roy Pafenberg and LeRoy May. Ah, those were the good old days . . articles about RTTY, SSB, CW, antennas, new fangled domaflotchies and old circuits . . . and an occasional article about FM. Bring 'em back, Wayne.

Kenneth D. Grimm K5KBH/4
Sweet Briar VA

FM? What is that?

In regard to WA1LOT letter in Nov. 1971 issue let me say I agree with him fully. I would like to see a little less FM – more Bob Manning – and more YL candid shots.

Greg Bodker WN8IZM

While we have had hundreds upon hundreds of letters from readers who are having the time of their life as a result of reading about it in 73, we have yet to get a letter from anyone who has said we mislead them about the fun to be had on FM. We're with you on more Manning and more girls . . . heh, heh.

I wrote the article appearing on page 63 of the November issue of 73. Several persons have asked me, on the air, about a deletion on page 65 of the article. You might want to add an addenda in a future issue to the effect that on page 65 of Nov. issue, on the 7th line down from the top of the right colum, the addition of: *5 percent* to the right of the plus/minus sign.

The line should read, *"May 1968 QST but I found that a ±5%"*

Jim Talens K3MNJ
Philadelphia PA

Some time ago I promised a group of people that I would put together some information on a series of very economical decade counting/display modules. I didn't get the job done until quite recently, and by now the IC price war has made most of the information obsolete. I went ahead and printed the stuff anyway, partly just to make good on an old promise and partly because there may be some residual value for general education even if the circuits are now uneconomical to build.

As you are in that business, you will know it was no more expensive, once the printer was tooled up, to produce 1000 copies rather than the few I needed, and the net result is that I am swamped with excess copies of this publication, grandiosely entitled *Application Note #1*

If any of your readers would like a copy – for whatever use they can make of it – I'm ready to send out copies upon receipt of a (preferably large) SASE. It seems necessary to ask that any respondents refer to this letter so I'll be sure to know what they want . . . every now and then I get a SASE with no indication of just what it is that the sender would like stuffed in.

T. R. Jackson W1DMU
Box 1, Corinth VT 05039

Looks good, TR, better print another thousand.

It is amazing to see that a manufacturer has come out with a rig for 220 to 225 MHz. Some 15 years ago I wrote to various companies who made VHF gear if they might build a rig for this band. They all said there was no demand for them. I say there's no more demand now either. Who the hell do they think they're kidding.

This only to make it easy for citizen banders if and when FCC approves or disapproves.

I know that you along with your enemy CQ are strictly for CB and a traitor to amateur radio. The subscription I get of 73 magazine, I received as a gift. I damned sure would not pay for it, or CQ magazine. QST is for amateurs and ARRL represents us. We would never have lost 11 meters except for you traitors.

M. Schreck Jr.
Kearny NJ

The unparalleled success of 2m FM has increased amateur interest in 220 tremendously and the use of that band is being held back only by the scarcity of equipment available. The recently announced C.T. Power transceiver for 220 at only $180 has started thousands of amateurs to thinking seriously about this band. Their upcoming repeater for that band could well be installed by many or even most of the 2m repeater groups, thereby providing countrywide 220 communication.

Your faith in ARRL is touching. But who, exactly, did put up a battle to save 11m? Was it ARRL? Or was it Wayne Green, then editor of CQ? Please do go to the trouble to ask any old timer who was there . . . anyone. Now, about CB, I can understand why CQ might be pushing for CB since their S-9 CB magazine is the keystone of their publishing empire, but what explains any interest in CB on my part?

The EIA 220 proposal (see March 73 for complete details) is extremely well financed and could easily go through, thus permanently taking away a good part of our band. My proposal seems like a good compromise and gives us an alternative. Remember that EIA has a strong Washington LOBBY and amateur radio has NO Washington lobby at all.

I note in your last issue that you have been getting a bit of backlash on the amount of FM info you have been running. I am not particularly interested in FM as yet but I rather enjoy reading up on what the gang is doing on a new facet of ham radio. At least it makes more interesting reading than "Station Activities" in QST!

Speaking of new facets of ham radio, I saw some *color pictures* that Bill DeWitt W2DD had sent and received by slow scan TV on 14mc. He used a field sequential system much like the old CBS system with six frames of each color. A story like that ought to jar some of the boys who figure that the state of the art has gotten away past the average ham.

Edson B. Snow W2UN
Rochester NY

Thank you, *thank you* for returning the 73 newspages to the horizontal where they can be read without tearing the magazine apart and incurring serious migraine. Usually interesting material was becoming quite a chore to read. As an inveterate article filer, I also appreciate your new system of beginning articles on a right-hand page – please continue.

Louise Frankenberg WA3LEQ
Pasadena MD.

I will probably be going to the University of North Carolina at Chapel Hill. Please print a request for me in the letters column for a ham to room with on campus. Thanks very much and keep up the good work.

Donald Lee Curtis WN4TMU
22 Craven St.
Asheville NC 28006

Thanks for the reader service and the large, easy-to-read print. Incidentally you discontinued the "sideways" printing just in time to restore my sanity and lower my blood pressure. I don't like C.Q. and QST print is too small, so I'm depending on 73.

Arthur Ideker W5CAM
Pine Bluff AR.

How about a complete Novice station – maybe in several 73 articles or perhaps a small booklet to follow the Study Guide? Have been building QST's QRP Rig myself, but wouldn't it be fun to build something in a complete package aimed directly at the young Novice? Maybe something that could be used as a club project. I'd be the first.

D. K. Howard
155 Crescent St.
East Bridgewater MA 02333

Let's hear from some builders about this. A club project is a great way to involve Novices.

How come you had nothing on the story behind the cover of Nov. '71 issue? Most hams (all single like me and most married) appreciate the finer things in life and wish to enjoy these pleasures to the fullest! FB on the mag. too.

Russ Kinner WA8ZID
Toledo OH

Many thanks for a good year's reading. Best regards to all at 73 and keep up the good work.

Doug ZL2AWF
Petone NZ

Caveat Emptor?

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

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

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

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

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor. . .

SB200 HEATHKIT kilowatt linear amplifier $150. 415-593-7369. W6KJG, M. Harp, 1120 Furlong St., Belmont CA 94002.

SELL: Heath Transmitter HX-10, Heath Linear Amplifer HA-10, manuals, extra crystals, Dowkey relay, package $300.00, firm. Mint condition, pre-wired, no mods. Bill Robinson, 1640 Wandering Drive, Monterey Park CA 91754.

VHF-FM FREQUENCY DECALS most used frequencies. Peel off & stick on. $1.00 postpaid. Check or money order. Electronic Systems, Inc., P.O. Box 11208, 1518 Gregg St., Columbia SC 29211.

RADIO-TV SHOP SELL. Retirement. All instruments, parts, hand tools, Sams Fotofacts, books, Caddy I-Com & 2-way. Have names – Simpson, Precision, Sprague, Seco, Sencore, Jackson, Paco. Check VA for funding. BARGAIN. Must sell before MAY 72. FONE: 814-652-5126 day only. Dick Myers, 122 W. Main St., Everett PA 15537.

CHANGE THE CODE? Sell your old (very old) wireless code gear to David Serette, 226 Walton St., Portland ME 04103.

SACRIFICE SALE – Simpson FM xceiver, like new, $210 includes shipping. College expenses force sale. T. McLaughlin WB4NEX, College Box 622, North Manchester IN 46962.

WANTED – Collins 30S1 Amplifier. State condition. Sell or trade BC-348, RAL-7 complete. Call or write WB5EVN, Herschel P. McCullough, 4300 Bryn Mawr, Dallas TX 75225. 214-691-3338.

COLOR ORGAN KITS $7.50. IC Power Supply Kit $2. IC's $.25. Computer Grade Electrolytic Capacitors $.35. XMTR Transistor TRW PF3690 $1. Used Variacs. Nuvistors. Catalog. Murphy, 204 Roslyn Ave., Carle Place NY 11514.

SELL: HX-10, $180.00; HQ-170C, $150.00; Speaker, $20.00; Package $330.00. Kilowatt linear, $100.00; Supply, $85.00; Package $145.00. M. C. Mayerl, 312 S. LaFayette, Shawano WI 54166.

FOR SALE – Back issues of 73, QST, and CW. Limited Supply. Jan. 61, Dec. 63, June 66, July 66 issues of 73, 50 dollars each or all 4 for $175. Only 4 left. For others send SASE for details. WB9HUC Gary Sima, Rt. 3, Box 85, Lake Geneva WI 53147.

URGENTLY NEEDED: Equipment for independent missionary support net to handle messages for 30 Bible Translators in Liberia, West Africa. Need: Tower, 70 ft. or more, linear-SSB-220 or similar, 15/20 meter quad or beam. Donated equipment most welcome or send absolute lowest price. Also need Novice and other used equipment to prepare translators before they go to the tribes. We are interested in any extra equipment you have – even on loan basis – will pay shipping. Please help. Ambassadors For Christ Net, Box 366, Concordia Seminary, Springfield IL 62702.

ELIGIBLE VETERANS build and keep a 25-inch Heath solid state color TV as part of a Bell & Howell (DeVRY) home study course. GI-bill pays 100% of the course and kits costs. Contact Bill Welsh (W6DDB), 234 S. Orchard, Burbank CA 91506.

ALMOST FREE. Taped code lessons. Beginners to 5 wpm. Refundable deposit on tapes, $1.00 for postage. Tomlinson College Radio Club, 3637 West Grandview, Tacoma WA 98466.

2-METER FM IC-20. Brand new, solid state, 12 channel, Xtaled for four, 1 & 10 watts, module construction. With mike, m-mount, & cables. $225; K7NHE, 15112 SE 44th Bellevue WA 98006.

ROCHESTER, N.Y. is again Hamfest, VHF meet and flea market headquarters for the largest event in the northeast, May 13th. Write WNY Hamfest, Box 1388, Rochester, N.Y. 14603.

FCC "TESTS-ANSWERS" . . . Original exam manual for First and Second Class License – plus – "Self-Study Ability Test." Proven! Satisfaction Guaranteed. Command, Box 26348-S, San Francisco CA 94126.

21ST ANNUAL DAYTON HAMVENTION will be held on April 22, 1972 at Wampler's Dayton Hara Arena. Technical sessions, Exhibits, Hidden transmitter hunt, Flea market and special program for the XYL. For information write Dayton Hamvention, Dept. 7, Box 44, Dayton OH 45401.

TR-108, immaculate with ac dc power cords; also 2 crystals included. Offer. WA9BYR, 627 Dundee Ave., Barrington IL 60010.

DX FOOTNOTES

AWARDS

The Rhein Ruhr DX Association (RRDXA) will issue an award to all hams and swl's who can confirm contact with one of their 100-plus members after Jan. 1, 1967 according to the following rules: First QSO with a member counts one point, another point for working him in a different mode (CW or SSB). A member can be worked as often as possible during a contest, and contest QSO's count two points. Three classes of awards are provided: Class I, 100 points, SSB and CW mixed; Class II, 75 points, CW; Class III, 50 points, SSB. Send your application (no QSL's) with 10 IRC's or equivalent of DM5,– to RRDXA-Award-Manager, DJ9NW, Bernd Jurgens, D-5604Neviges, Schutzenstr. 11, West Germany.

The city of St. Louis, MO claims the distinction of being number one for hams on DXCC Honor Roll. They are: WØDU-340, WØSYK-341, WØCJZ-338, WØPGI-338, WØKF-332, WØLWG-332, WØBMQ-332, WØBN-325, WØNVZ-331, WØAUB-324, and WØBK-325. This is a total of 3,652 countries. Any challengers?

QSL's for FØUG, HB9XID, HBØXID, 3AØFN, WA4WME/LX, DL4VA; all handled by DI4VA, Vandergrift, MATCOM-DSO, APO NY 09052.

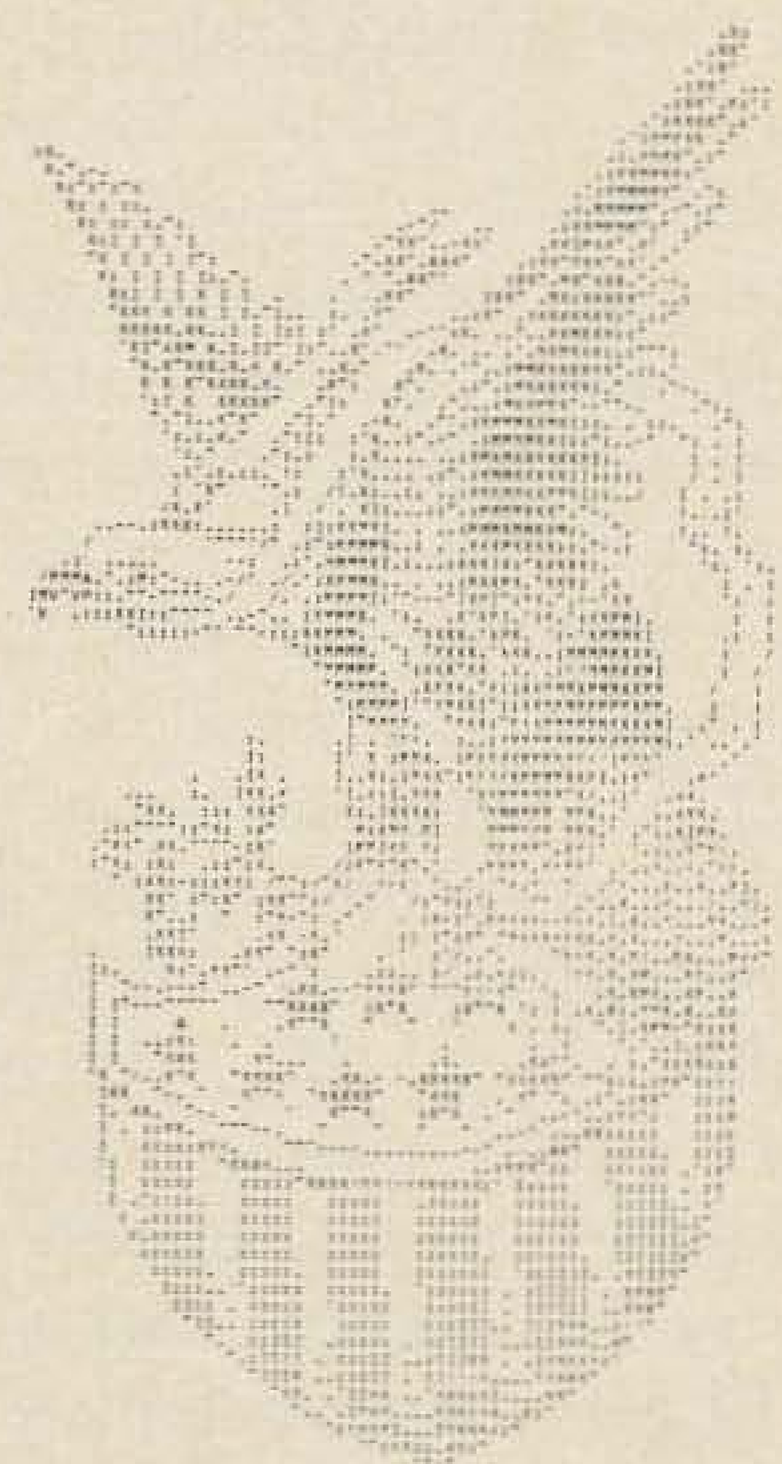
ELEPHANT hide Leather. Keycase $2; Billfold $7; Pocket Notecase $10. All three – only $15. Beautiful gifts. Money back if not satisfied. Write ZE7JV, P.O. Box 23, Cranborne, Rhodesia.

CANADIANS, Japanese gear. LOW, LOW prices. Free catalogue and information. Glenwood Trading Co., Dept. A, 4819 Skyline Dr., North Vancouver, B.C.

2 CRYSTAL FILTERS – F.M. Filter, 10.7 MHz, 6 dB BW = 13 kHz, SSB Filter 1650 kHz LSB 6 dB BW = 2.6 kHz. $25.00 ea. Paul Ramsden W1MUL, 3 Daniel Webster Dr., Hudson NH 03060.

CASH FOR PC BOARD. All types of copper laminate wanted, 20 pounds or more. Bob Miller, WA8KGE, 2264 Welch Drive, Stevensonville MI 49127.

Don Royer WA6PIR
16387 Mandalay Drive
Encino CA 91316



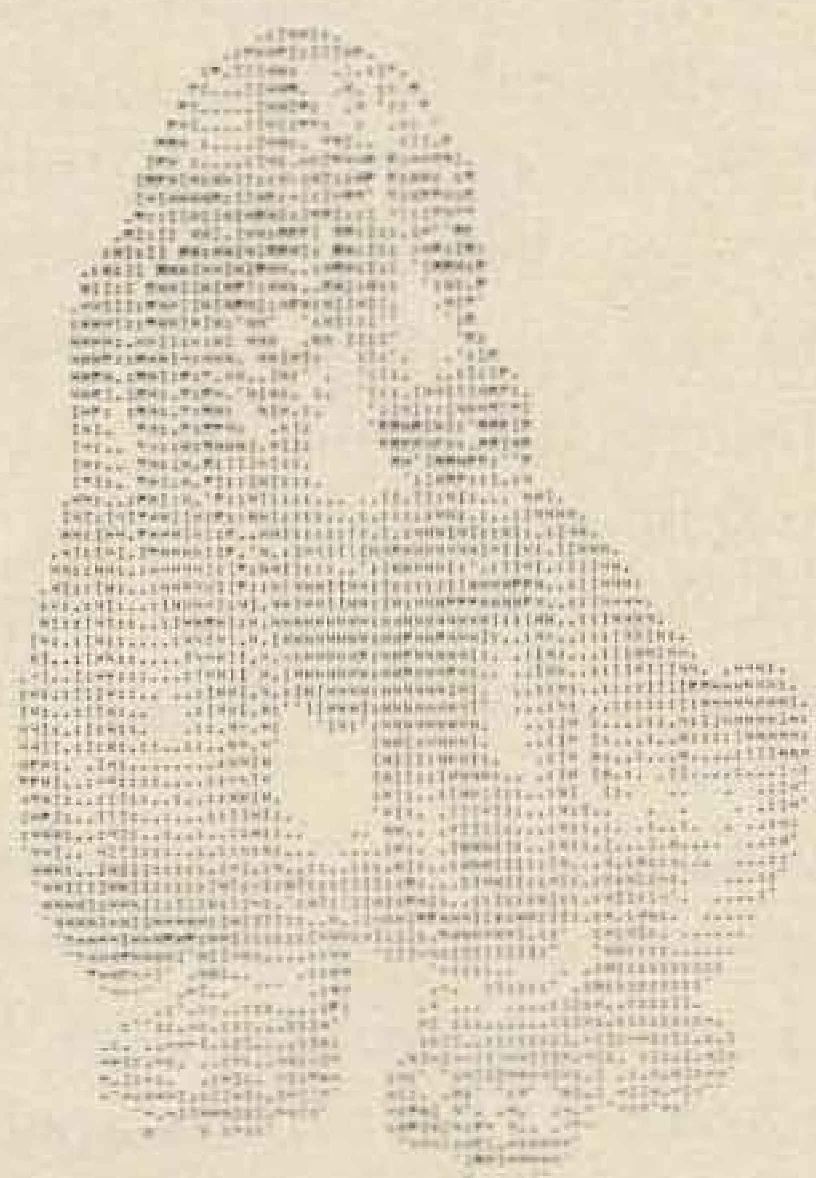
"Peace Through Victory," originated for RTTY by Don WA6PIR, art by XYL Maxine.

RTTY ART MADE EASY

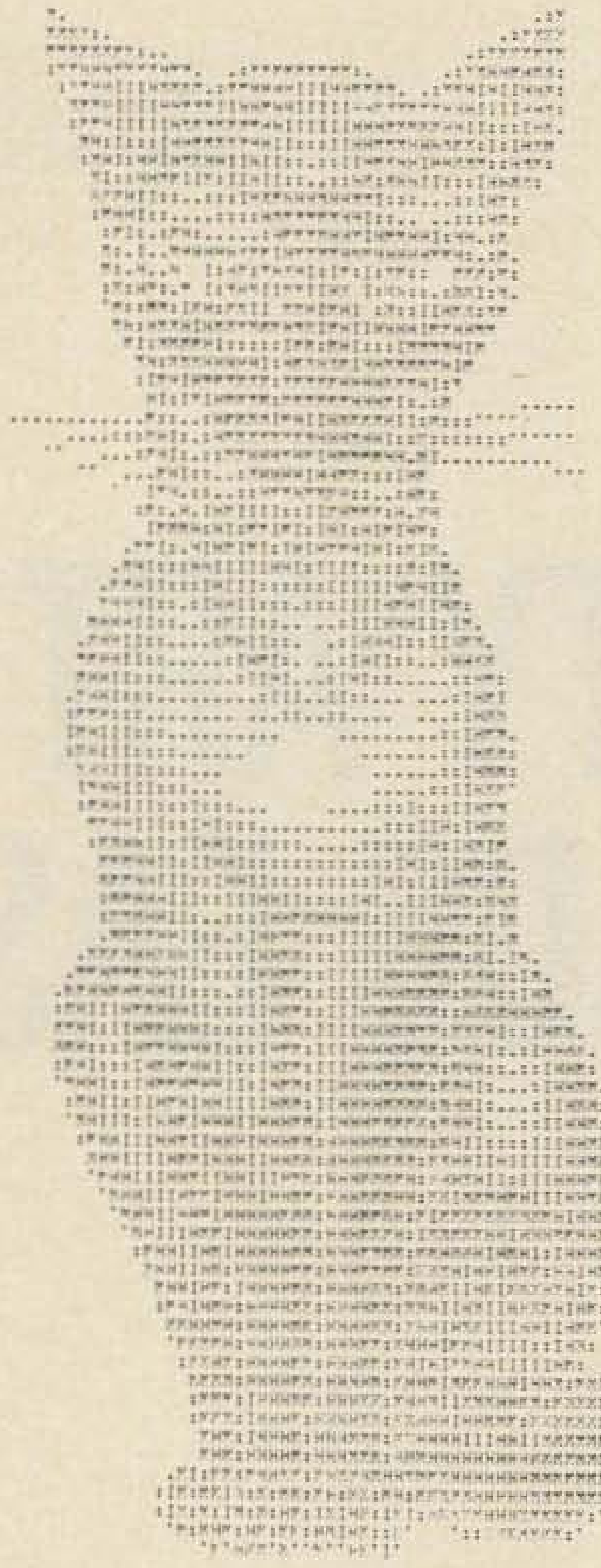
Have you ever wished that you could make some of that RTTY art that you may have printed? Well, so did I at one time. It is a great deal easier than you might think.

We (the XYL Maxine and I) have found that there is much basic art work available from which RTTY pictures may be made. Cartoons, the comic strips, post cards, magazines, newspapers, centerfolds and photographs may all serve as bases for pictures. While these may not be the right size, an inexpensive child's pantagraph may be used to enlarge or reduce them. A portrait of Washington was made from the etching on the dollar bill. While it is not that important, if you have a little sketching talent, that will also help (or enlist your wife and friends as I did).

Having decided on the subject and having the basic art work the right size, run about four feet of paper out of your printer. Use the center portion of the paper for your sketch or carefully tape or glue (white glue works well) the drawing or photo to the paper. Trim the edges so that all is still the same width as originally. Now take out the paper from your printer and insert the four-foot sheet with the sketch on it so that it will be presented to you as it rolls through the machine. Carefully align the edges of the paper on the platen. Use your line feed to bring the top of the sketch into view. With a little practice, you will be able to tell just where any character will strike the paper.



"Hiram, a Bassett Hound Dawg," originated by Don WA6PIR, art by XYL Maxine.



"Fang, A Siamese Pussy Cat," originated by Don WA6PIR, art by XYL Maxine.

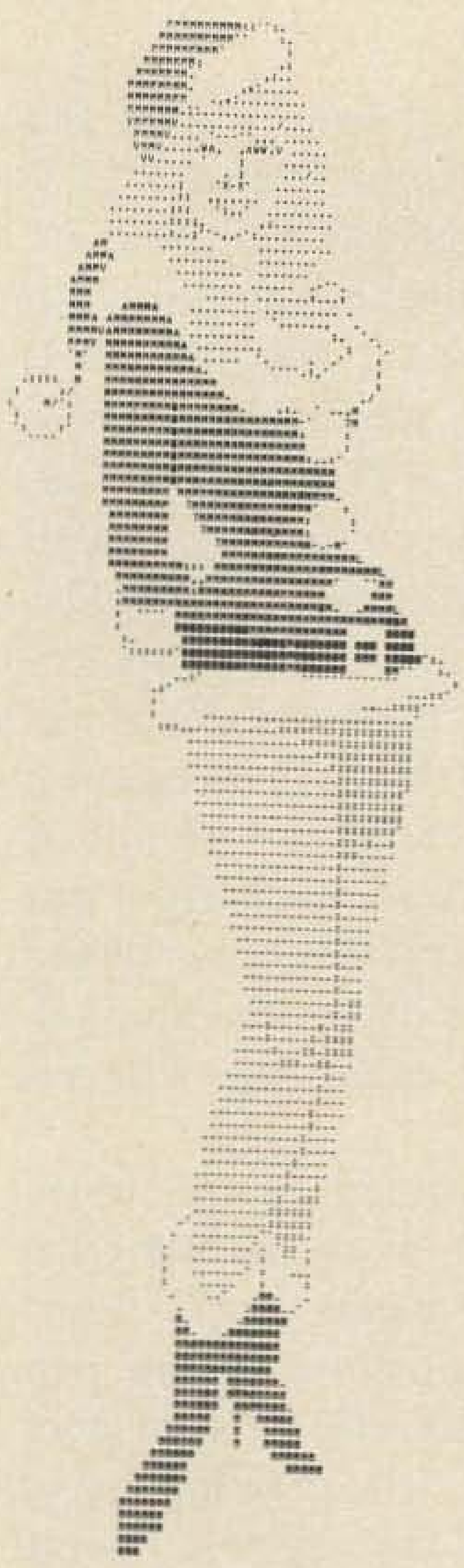
You are now ready to overtype the sketch, punching a tape as you go.

We have found that a small selection of characters is all that is really needed to produce either outlined or shaded pictures. While you may not agree with our selection, study the letters and other characters to learn their individual densities. For example, the M and W are the darkest, followed by the H or X and then by the I. Thereafter, you can use the upshifted characters such as the : or ; followed by the " or - or . and the like, depending upon where you want the print to fall. In this way, you may add the shading that you desire or leave certain areas blank like this:

MMHMHHIHII:I::.:...   ...:.::I:IHIHHMHMM

going from dark to light and back to dark again. Keep up this process over the entire sketch. Remove the four-foot paper with the sketch from your printer and reinsert your paper stock. Now play out the tape that you have made and see what you have. You will probably be pleasantly surprised. From this point on, we generally take a red pen and indicate on the print where additions, corrections and any changes are to be made and rerun the tape (having folded the marked-up print and following it line by line, using the paper holder and line guide on the printer) to make the corrections, making a new tape at the same time. In most instances, we can now come up with a pretty good picture with a series of five or six corrected tapes.

When overtyping the sketch, it helps to have a strong light directed on the sketch in your machine. This is particularly true if the contrast of the sketch is poor, as it may be in color photos. Also, as you will not be able to see the part of the sketch below the ribbon, we usually take a pencil and outline the areas where the shading will change from one density to another. This way you may be able to get a more complete picture the first time through. While we do not do this, some of the guys have found it helps to make Xerox prints of the original sketches



"Miss Santa," believed to be by WA9CCP, obtained from W9PRO and relayed by WA6PIR.

or photos and to use those for the overtyping, as they eliminate some shading and provide a black and white sketch from which to work. Keep the detail of the original art work as large as you can and don't be afraid to experiment with different letters and techniques. Do clean up the tapes – we generally do this during the first run-through after the overtyping is finished to remove the extra characters and corrections made during the typing. To give you some idea of the time required to complete the pictures, we put in about 20 hours for one of the long playmates that run 30 minutes or so. Most of this is in making the corrections while rerunning the tape. Even after they are apparently finished, we hang them across the room to see how they will look from a distance and then make the final tape with the finishing touches.

Many of the machines in use today have non-overline features so we have quit using overlining. Stay within a 73 character line. Start and end the tape with a series of letters, a couple of carriage returns and about ten line feeds, as this will help the other guy if he is making a reperf tape at his end. Also, keep in mind those who have machines that downshift on space as well as those that do not do so. If you are upshifted and then space and wish another upshifted character, put in another figures character. Of course, the same applies when you want a letter following a space after an upshifted character. At the start of each line, we generally use two carriage returns, the line feed and two letters or figures depending upon how the line starts, to help ensure that the old and tired machines have time to get to the start of a new line. Again, make your tapes as short as possible by taking out any unneeded characters, extra letters, upshifts followed by downshifts and things like extra spaces or downshifts at the end of a line. Above all, be sure to put your credit line at the end, with the hope that others will follow your lead and keep it there.

So if RTTY pictures are your bag, how about trying your hand and making a few? We will not only be pleased to receive them but the eyes here are about to give out!!

. . .WA6PIR

CONSIDERABLY SPECIAL CONSIDERING THE SPECS

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Frequency ....143-149 MHz (2MHz spread)
Number of channels.......................5
Supplied with 146.94 simplex, 146.34/.94 (same plug in crystals as SR-C826M)
R.F. Output.............1 watt minimum
Sensitivity..................better than 0.4 uv/20 DB Q.S.
Audio output.......................500 mw
Meter ......monitors battery voltage on Tx, S Meter on Rx
Current drain ....400 maTx, 15 maRx SBY
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Weight ....24 oz., less batteries

Options: external mic, or mic-speaker, stubby flexible antenna, desk top charger, leather case.

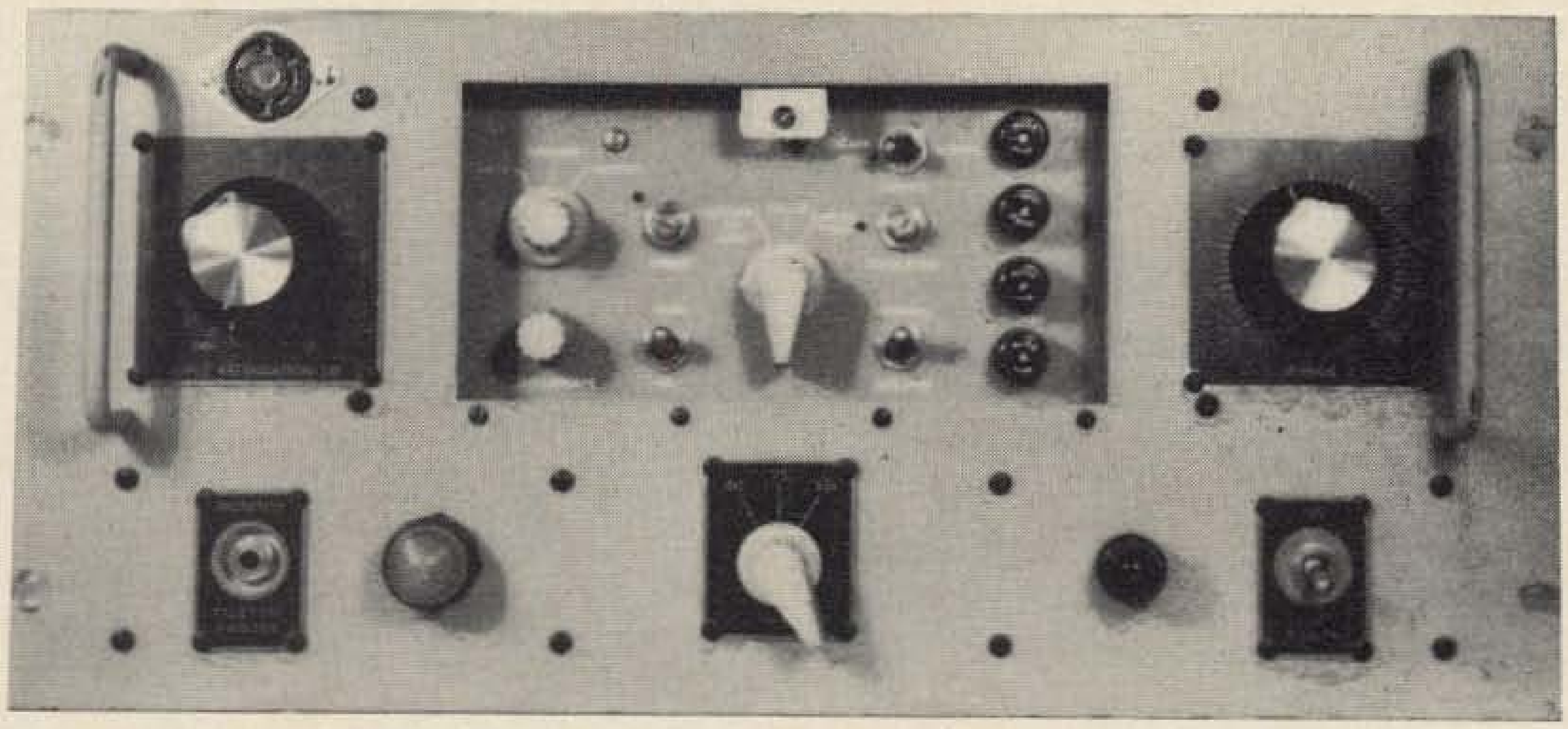
$279.00

Suggested Amateur Net Price

Consider the new VHF-FM hand held Transceiver by Standard Communications Corp., with exclusive Astropoint design. For complete specifications and the name of your nearest dealer, write:

STANDARD COMMUNICATIONS CORP.

639 North Marine Avenue, Wilmington, California 90744, (213) 775-6284



The TT-63A as a Display Generator

James J. Wenskus, Jr. K2BEH
329 Ballad Ave.
Rochester, NY 14626

Teletype Repeater TT-63A/FGC is an inexpensive and widely available piece of surplus equipment. Although many amateurs have purchased this unit, problems in getting it into operation have resulted in most TT-63As gathering dust on a shelf or filling up useless space in relay racks. (It has a neat appearance and is fine for impressing neighbors or non-RTTY'ers.)

This article describes a novel use for the TT-63A as a Teletype character-synchronized sweep generator. The TT-63A recognizes a Teletype character as part of its basic function. This characteristic is used to generate a scope presentation in which the Teletype character is always perfectly synchronized, and time marks provided, at either keyboard or machine speeds. The basic concept is applicable to any other surplus Teletype equipment having this recognition capability. The "Selcal" could probably be used in a similar manner.

These modifications will cost less than $5, depending on the state of your junkbox, and shouldn't take more than a couple evenings to build.

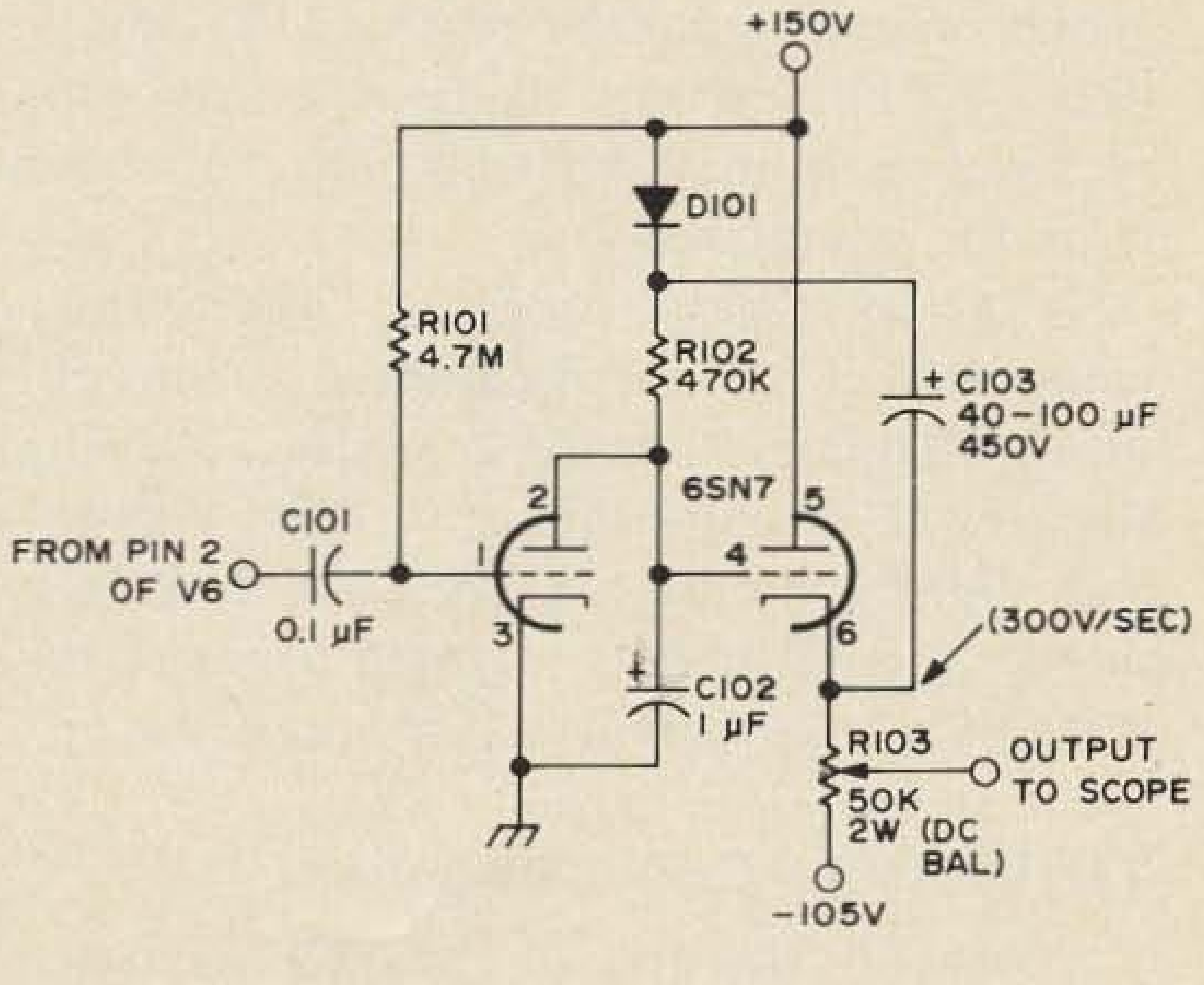


Fig. 1. The bootstrap sweep generator.

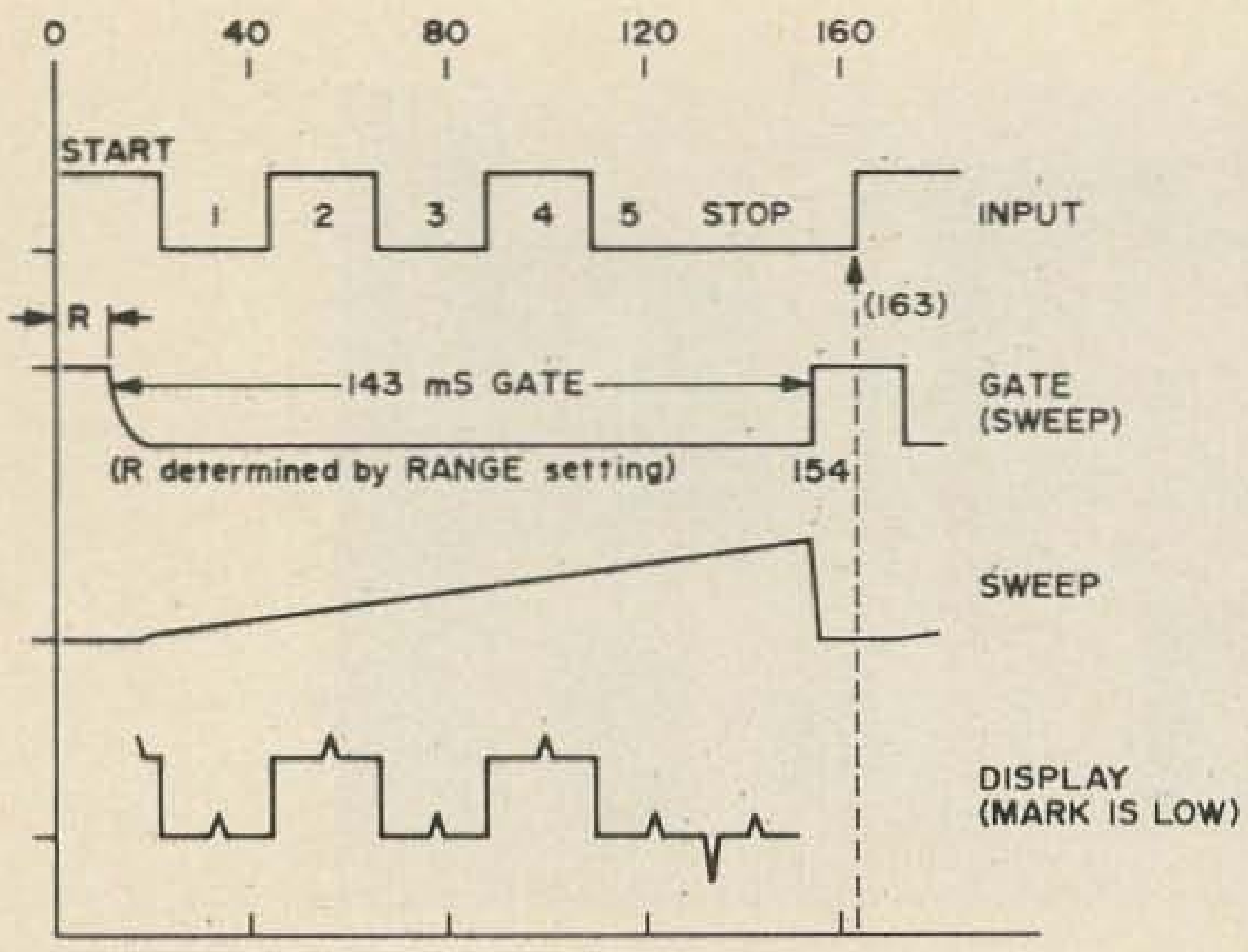


Fig. 2. Y waveforms and time relationships.

A few comments are in order. Attempting to convert this unit to a TU by adding a standard limiter-discriminator front end will not be particularly successful. This is due to two design peculiarities: The TT-63A is extremely susceptible to errors resulting from pulse splitting and the 1 ms sampling pulses coming in this hole. It needs a very good low-pass filter between the discriminator output and the trigger input. By the time you have added a truly effective low-pass filter, you will have probably duplicated half a TT/L without its benefits. Also, the chassis is too crowded for the required extra components. Another unfortunate characteristic is its performance at machine speeds when a "start" pulse is lost; the TT-63A prints several erroneous characters before timing synchronization can be regained. In adddition, if you are not using coax to your receiver, you may possibly pick up hash from the keying relay.

None of these problems will significantly affect its performance as a synchronized character display generator. Adding the simple circuits shown in Figs. 1 and 4 and slightly modifying your TU as shown in Fig. 3 is all that is required to make the TT-63A a truly useful RTTY accessory.

The Bootstrap Circuit Operation

Normally the grid of the 6SN7 is biased positive so that the tube is fully conducting. This effectively removes the charge across C102. When the negative 50V gate from V6 cuts this tube off, C102 begins charging through D101 and R102. The cathode follower portion of the 6SN7 feeds back the output ramp to the high end of R102 to maintain a constant charging rate and provide a linear sawtooth. With the components shown, the output is approximately 45V. The value of C103 is not too critical since the charging of C102 occurs mostly in its linear region even without bootstrapping. Removing C103 affects the amplitude far more than the linearity. It is necessary, however, to use a good quality capacitor for C102 – *don't use an electrolytic!* R103 allows the output signal to be balanced around ground. Some slight loss of signal results from this arrangement but it is effective and allows the scope to be switched from a cross tuning pattern to this pulse analysis mode without making centering adjustments on the scope. It should be noted that the start pulse is drastically shortened on the actual display. This is due to the poor risetime of the leading edge of the gating pulse.

Construction

The bootstrap circuitry is placed where V1, V2 and V3 were originally located. These tubes were part of the original tone portion of the repeater and are not used. The original 6SN7 (V1) is used as the bootstrap tube. One of the 6H6s may be used in place of the semiconductor diode shown in the schematic. The remaining

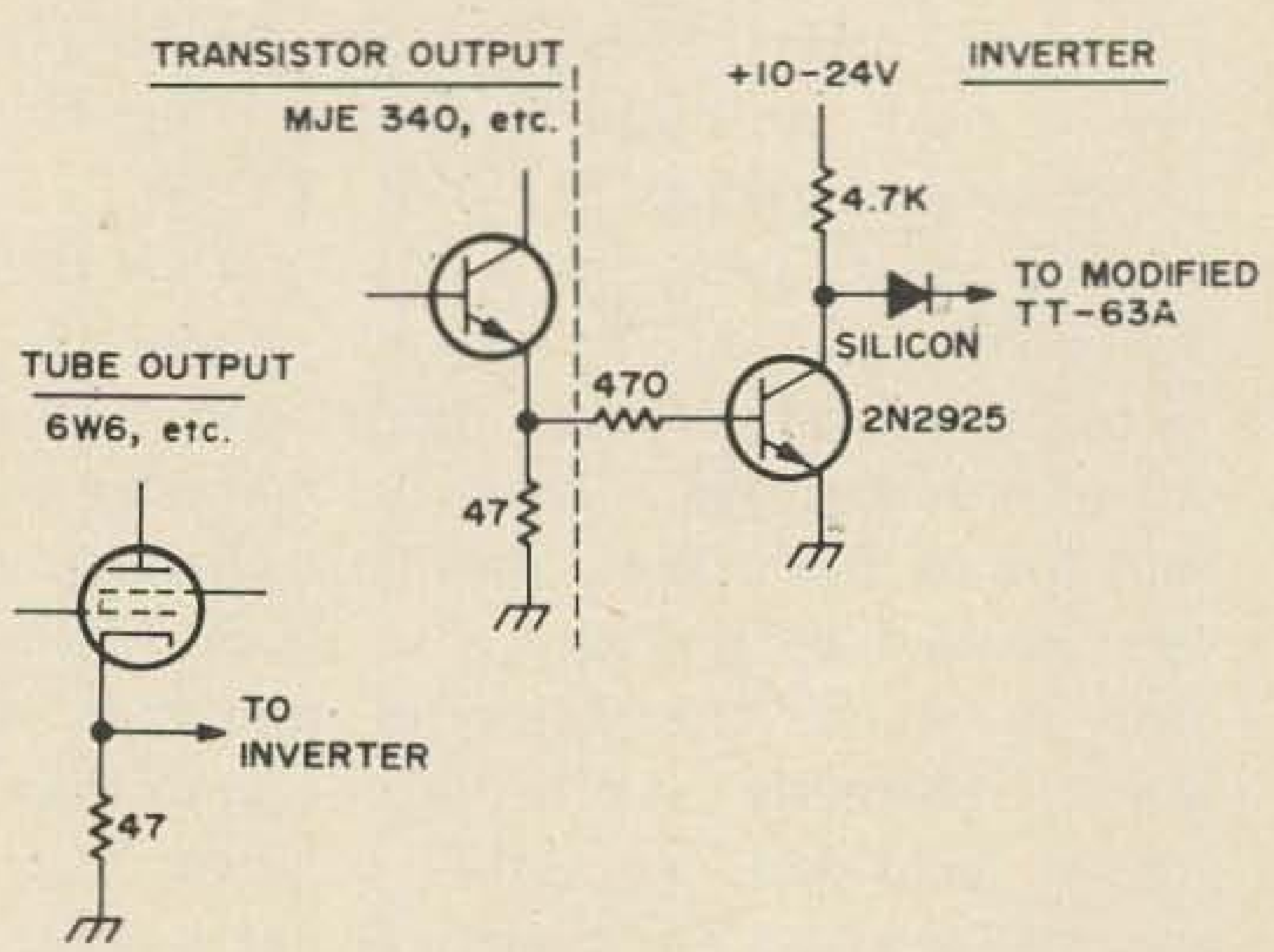


Fig. 3. Modifications of typical TU output stages to provide proper polarity pulses to the TT-63A input.

sockets are handy as tie points for the bootstrap components. Be careful when trimming wires on these sockets as several terminals are used for tie points for other stages. The sweep centering pot is a screwdriver adjustment type and can be located on the left side of the chassis after removing some unused tone parts.

The pickoff for the time-marked pulse display is shifted from its original point to the junction of resistors R55, R56 and R57. This change increases the amplitude of the time markers over the original point. A slight negative dc bias is introduced on the display by making this change but the resulting improvement in marker visibility is worth this slight inconvenience. The resulting display has vigorous negative pips where the pulse transitions should occur and lower amplitude positive sampling pulses. The range control centers the received pulses between these negative markers.

Connecting the TU

For proper operation of the repeater, the input to the Schmitt trigger must go negative on the stop mark. A few additional parts can take care of this requirement. Since most TUs can be readily modified to provide positive mark outputs; a simple inverter, shown in Fig. 3., is added to provide positive space pulses. The new repeater input circuit in Fig. 4 shifts the resulting ØV mark output from the inverter to a negative mark. My measurements show the Schmitt trigger turns on at −2.75V and off at −2V. To get the unit in operation, rotate R6 to the position which gives the best blinking of the neon. This setting is not critical.

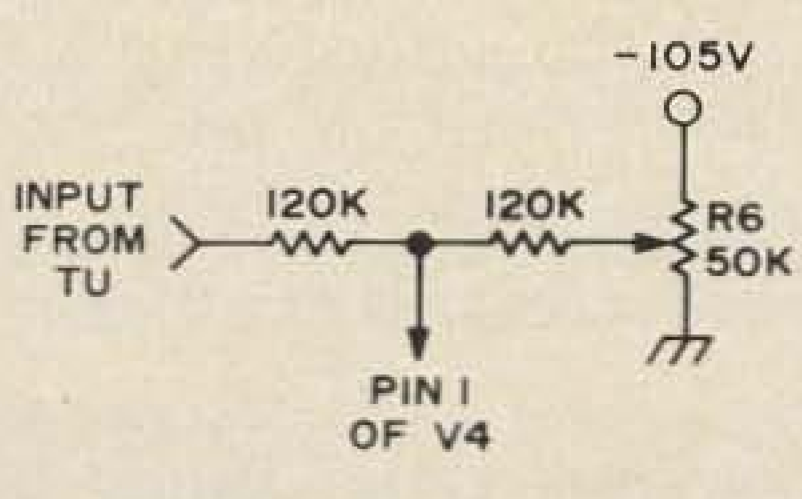


Fig. 4. TT-63A input modification to provide negative mark voltage for proper operation of V4. R6 is the input attenuator already in the unit.

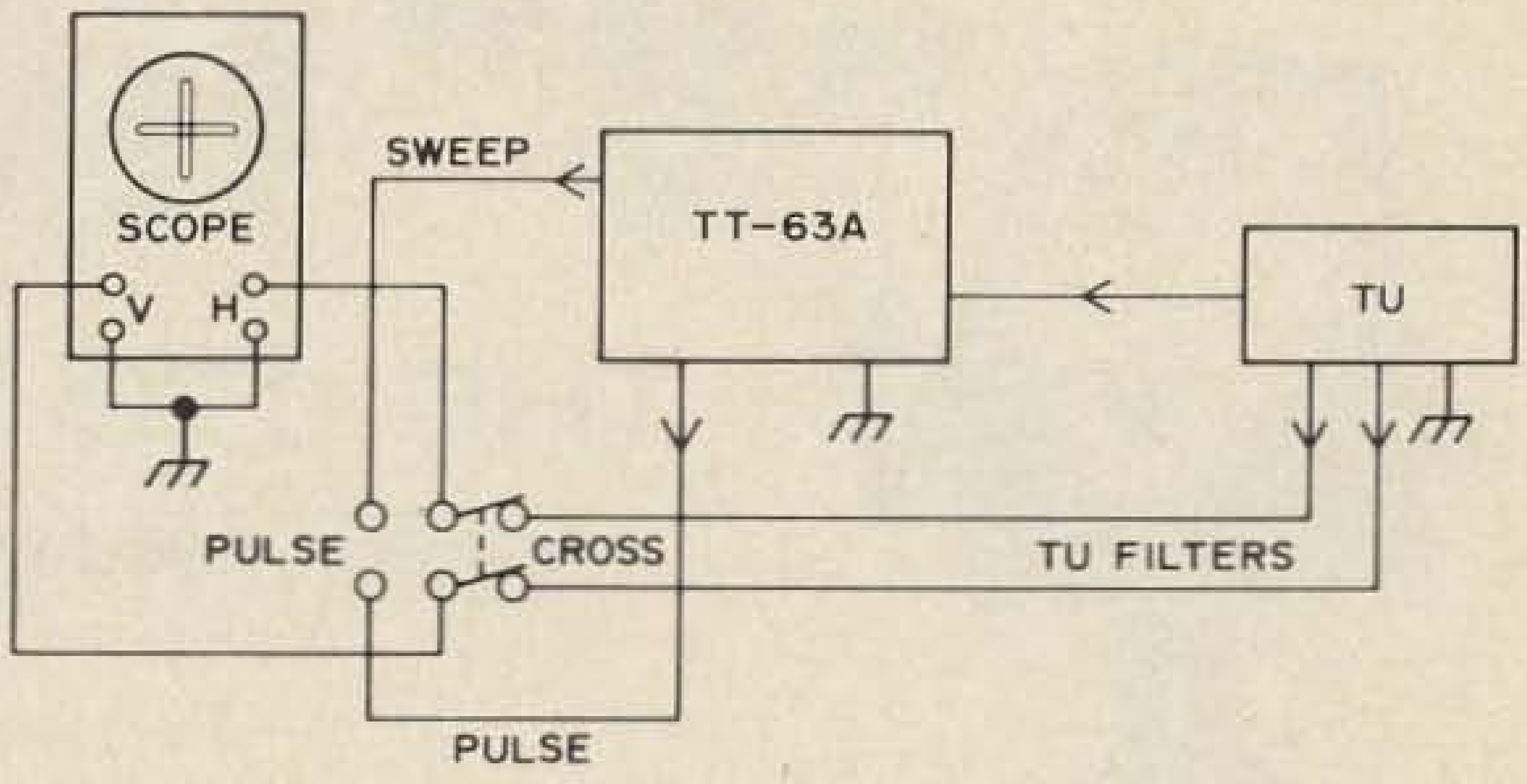


Fig. 5. Block diagram of typical component interconnections. The TT-63A subpanel can be rewired to do the required switching. Attenuators can be added to balance the voltages across the filters to that of the sweep and pulse voltages so that the scope gain does not need to be adjusted when switching displays.

Usage

When this system is set up, you can readily observe distortions on incoming signals, dirty contacts, the poor efficiency of your low-pass filters, etc. If your keyboard is in series with your selector magnets, you can readily check your own contacts. When I first tried this on my transistor TU, which had only 24V available to drive the selector magnet, the observed pulse distortion was appalling. Going to a high-voltage loop made the pulses look as they should. The vertical input to the scope can be connected to various areas of your TU and the pulses chased through always in perfect sync. This is a truly enlightening experience.

I use a 5 in. scope for my monitoring. Anything less will make observing the pulses too difficult. A dc scope must be used in order to pass these relatively slow waveforms without distortion. I find that the pulses are best viewed if the scope gain is not set too high. They are easiest to watch when they are almost square on the screen.

A very nice feature of this system is that you can tell if you have a legitimate RTTY signal tuned in and whether it is right side up, the right speed, etc., without turning on your printer. You merely see if a synchronized sweep is being generated by the TT-63A. This is possible only with a legitimate signal. This certainly saves a lot of useless clatter, bells ringing, waste paper, etc. when tuning across the bands.

...K2BEH■

John G. Oehlenschlager KØMOC
394D Ricketts Road
Monterey CA 93940

TELEVISION MONITOR

After building a Flying Spot TV camera, I acquired an old TV for a monitor. It was a typical early 1950 vintage set with a 10 in. screen and a 50 in. cabinet which a local TV repairman was happy to part with for $5. (Good thing I didn't have to pay for it by the pound!) It took only half an hour to modify the set for use with the camera. I was lucky, as it required no phase inverter or extra video amplification. But it was by no means the perfect monitor – modification required the addition of a SPDT switch, coaxial connector, a 75Ω resistor, and a short section of coaxial cable.

After using the converted monitor for several months, I began to modify the set even further. The controls were in the wrong spot . . . why leave the tuner connected, it just uses more power . . . get rid of that i-f strip. Finally, the only thing that remained was the power supply, the sync and sweep section and the video amplifier section. Even the original CRT went to the junkman. In its place I used an 8XP4 universal substitute tube. At this point no one could recognize the original TV configuration. I had even considered rack mounting the residue, but gave that idea up in favor of building a new

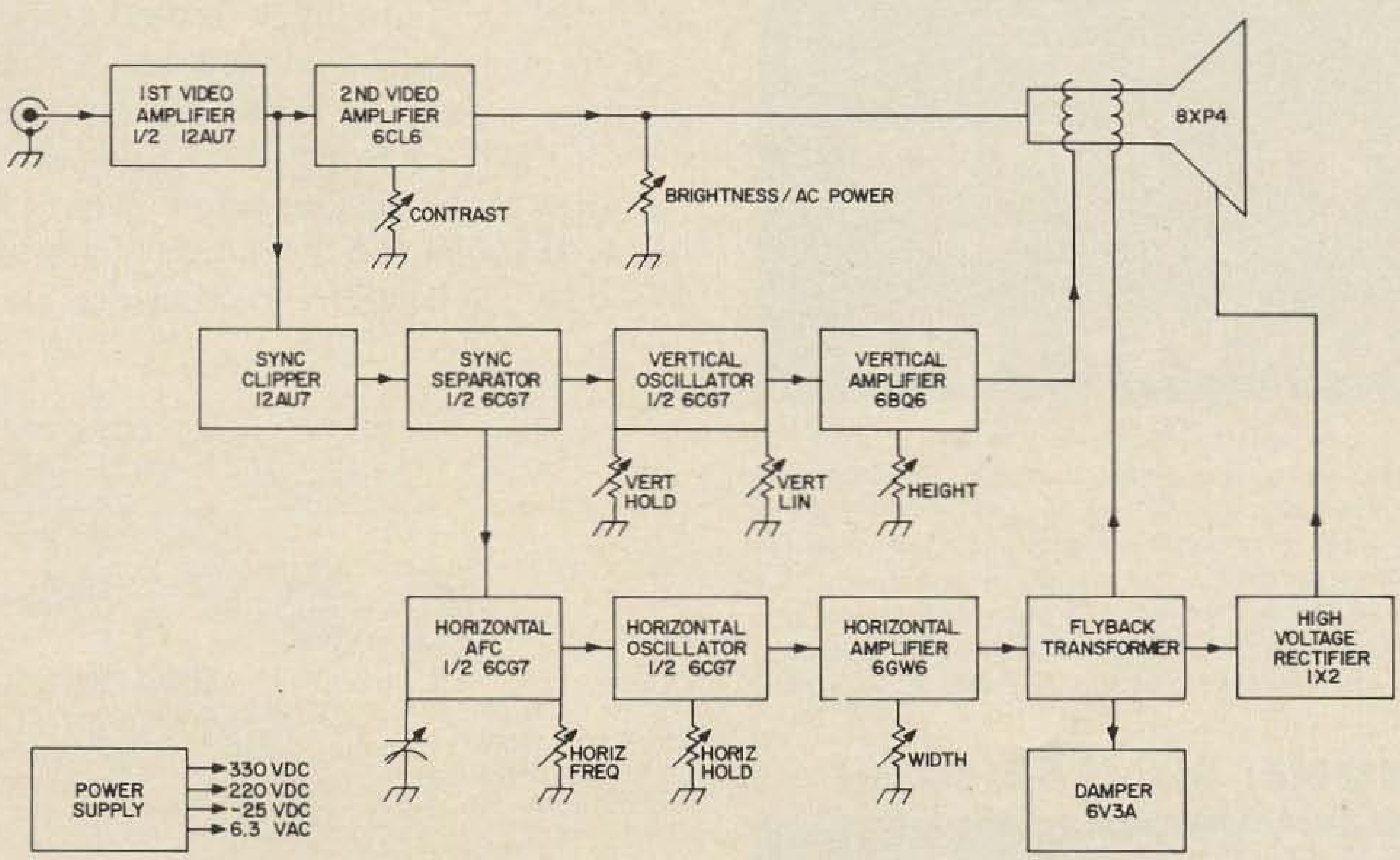


Fig. 1. Block diagram of the TV monitor.

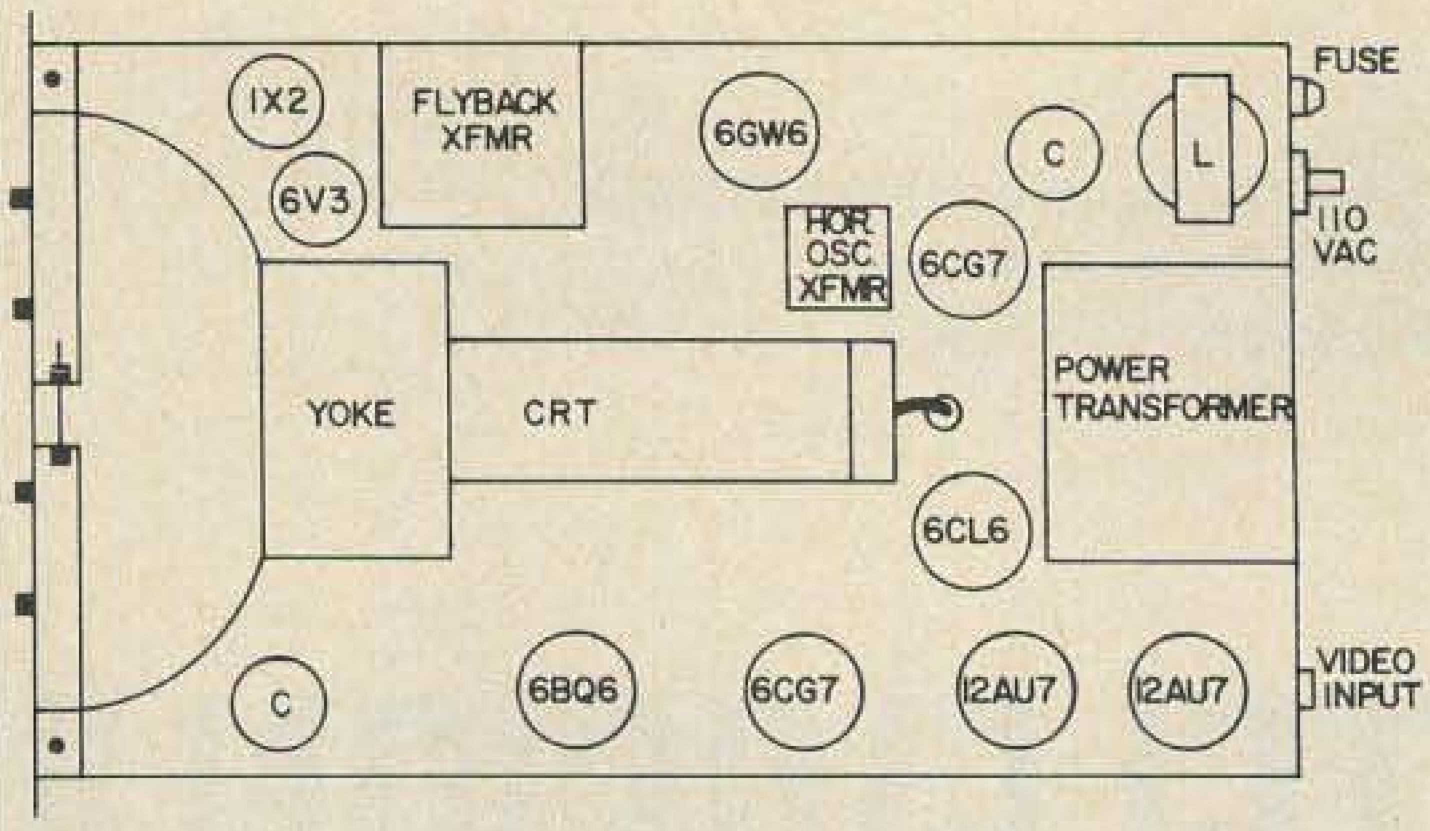


Fig. 2. The physical layout of the monitor.

monitor. Several points came to mind while designing the monitor. First of all I would limit construction cost to a maximum of \$50. It must not employ any parts unavailable to the average ham. The operational controls must be located on the front panel for convenience. The monitor must be simple to adjust, using a minimum of test equipment. Finally, it must lend itself to modification to suit the individual builder.

Using these criteria, I was able to construct a monitor for \$22 (less CRT). I was lucky enough to have a CRT left over from a previous project. A new 8XP4 will cost \$22 to \$28. The principal item I had to purchase was the cabinet. I used a Premier CC-2000 with a 3x10x27 in. aluminum chassis. The majority of parts came from several salvaged TVs obtained for the asking from a TV shop. Although I would have had no difficulty obtaining a horizontal output (flyback) transformer from a junked set, I chose to purchase a new one for \$1. If you choose to use a CRT such as a 5AXP4 or 5FP4 (requires focus magnet) you may want to use a 70° yoke and transformer, also costing \$1. 110° deflection components are also

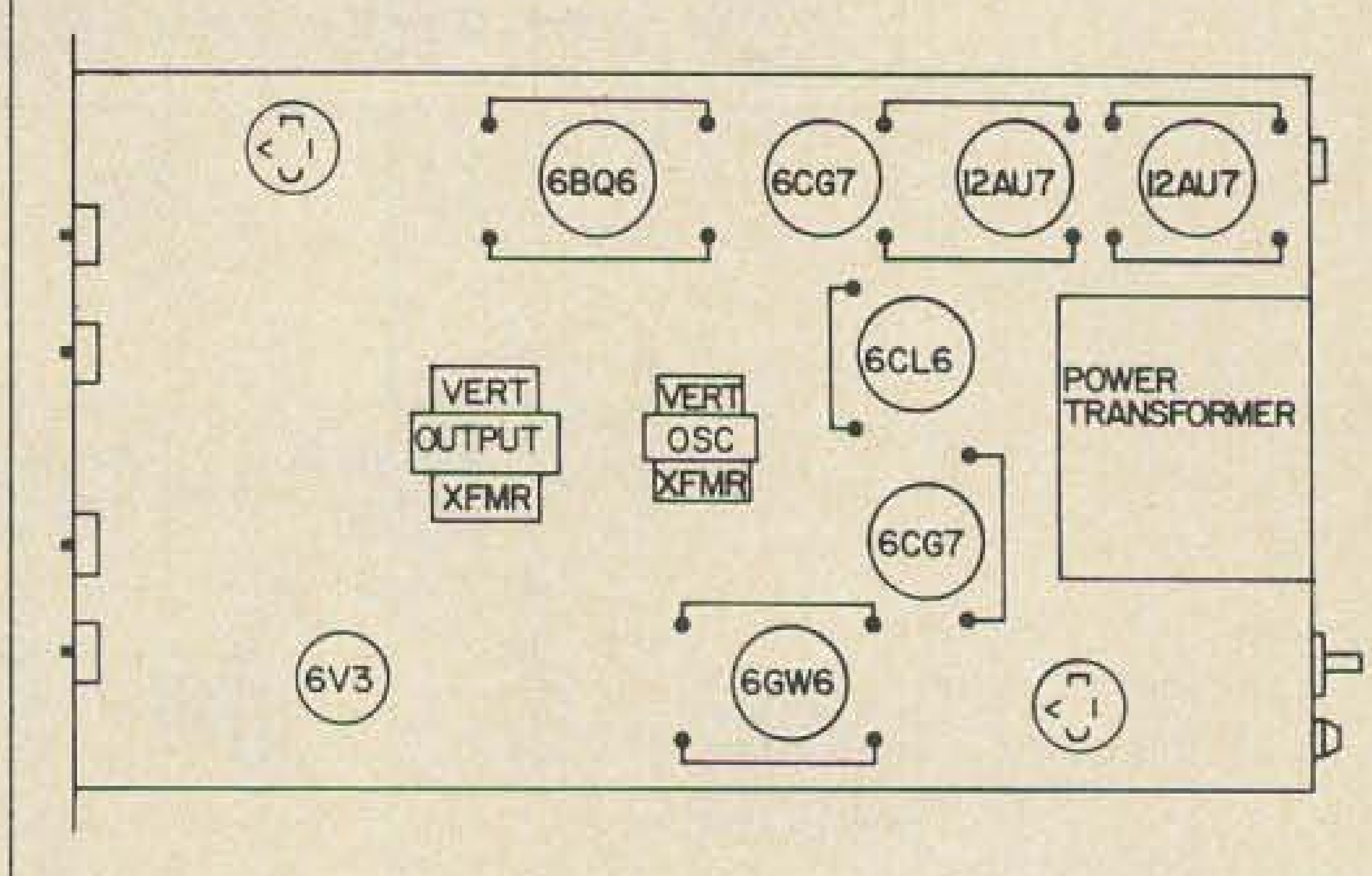
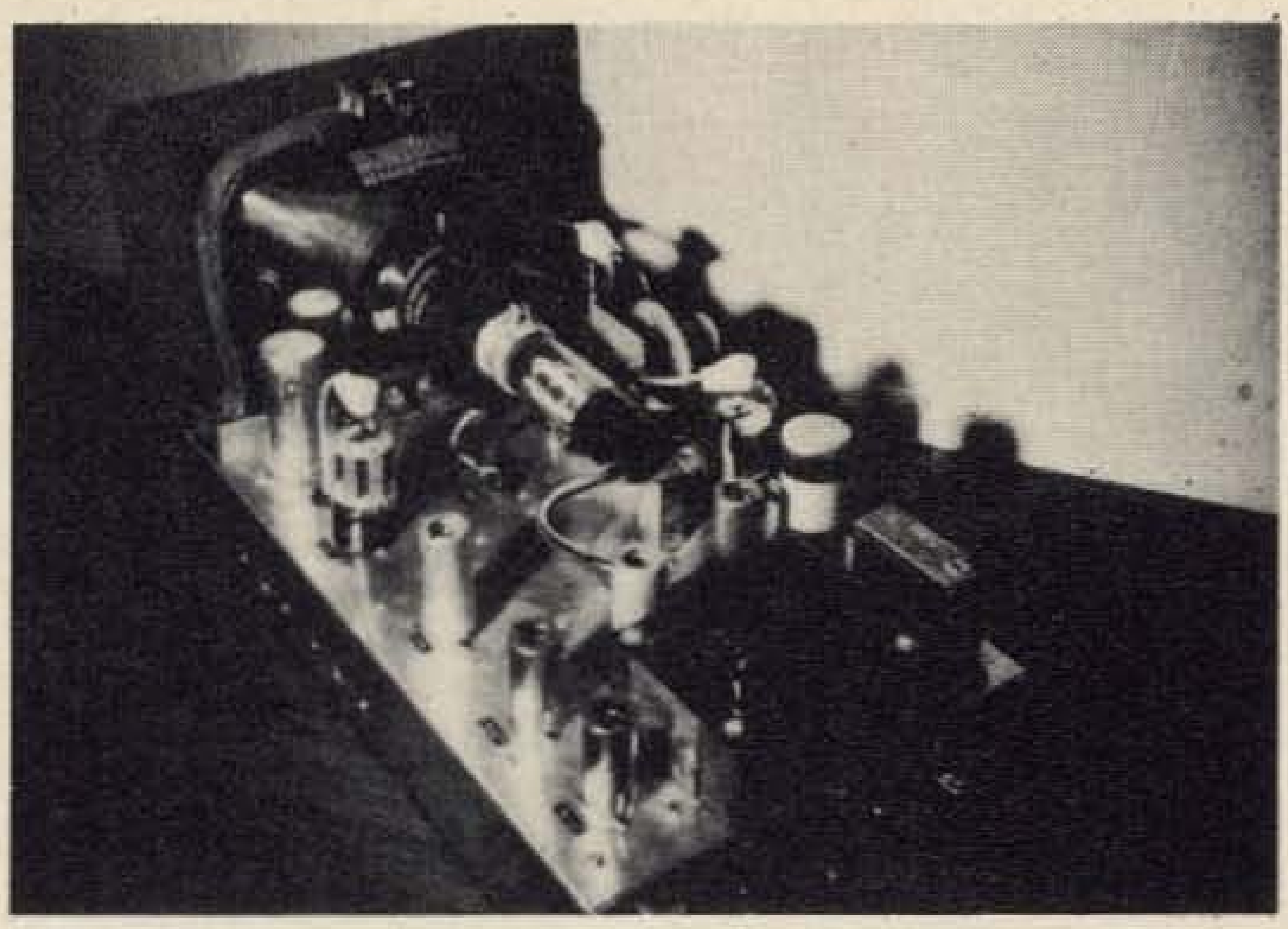


Fig. 3. To facilitate wiring, terminal strips are mounted in parallel rows.

Monitor exterior. . .



. . .and interior

available commercially. All other parts came from my junkbox.

The operation of the monitor can best be described by referring to the block diagram (Fig. 1). The input may be from ½ to 10V negative video from any 75Ω source. The output of the first video amplifier is fed to the second video amplifier and to the sync clipper. The output of the second video amplifier is applied to the control grid of the CRT.

The sync clipper consists of a normal voltage amplifier followed by a saturated amplifier. The output of the saturated amplifier contains only sync information (i.e. pulses of 60 Hz and 15.75 kHz). From the saturated amplifier the sync pulses are coupled to the sync separator. The output of the sync separator is sent to an integrator (low-pass) circuit (vertical sync) and a differentiator (high-pass) circuit (horizontal sync).

The differentiator output is coupled to the horizontal afc (control) tube. The horizontal afc keeps the horizontal oscillator (blocking oscillator) locked on frequency. The output of the horizontal oscillator is modified by the 330 pF capacitor to a sawtooth waveform at the grid of the horizontal amplifier tube. The output of the horizontal amplifier is coupled to the horizontal section of the deflection yoke by the horizontal output transformer.

High voltage pulses developed by the flyback transformer are rectified by the HV rectifier to provide 12.5 kV for the CRT. The damper suppresses oscillations in the horizontal deflection coil and provides an increased voltage (B+ boost) for the horizontal amplifier and the vertical oscillator.

The power supply provides 330V dc at 100 mA, 220V dc at 100 mA, −25V dc for fixed bias and 6.3V ac for all filaments.

The power supply was the most difficult part of the construction project. Three different circuits were tried before an acceptable supply was achieved. The supply uses silicon rectifiers throughout. Normally

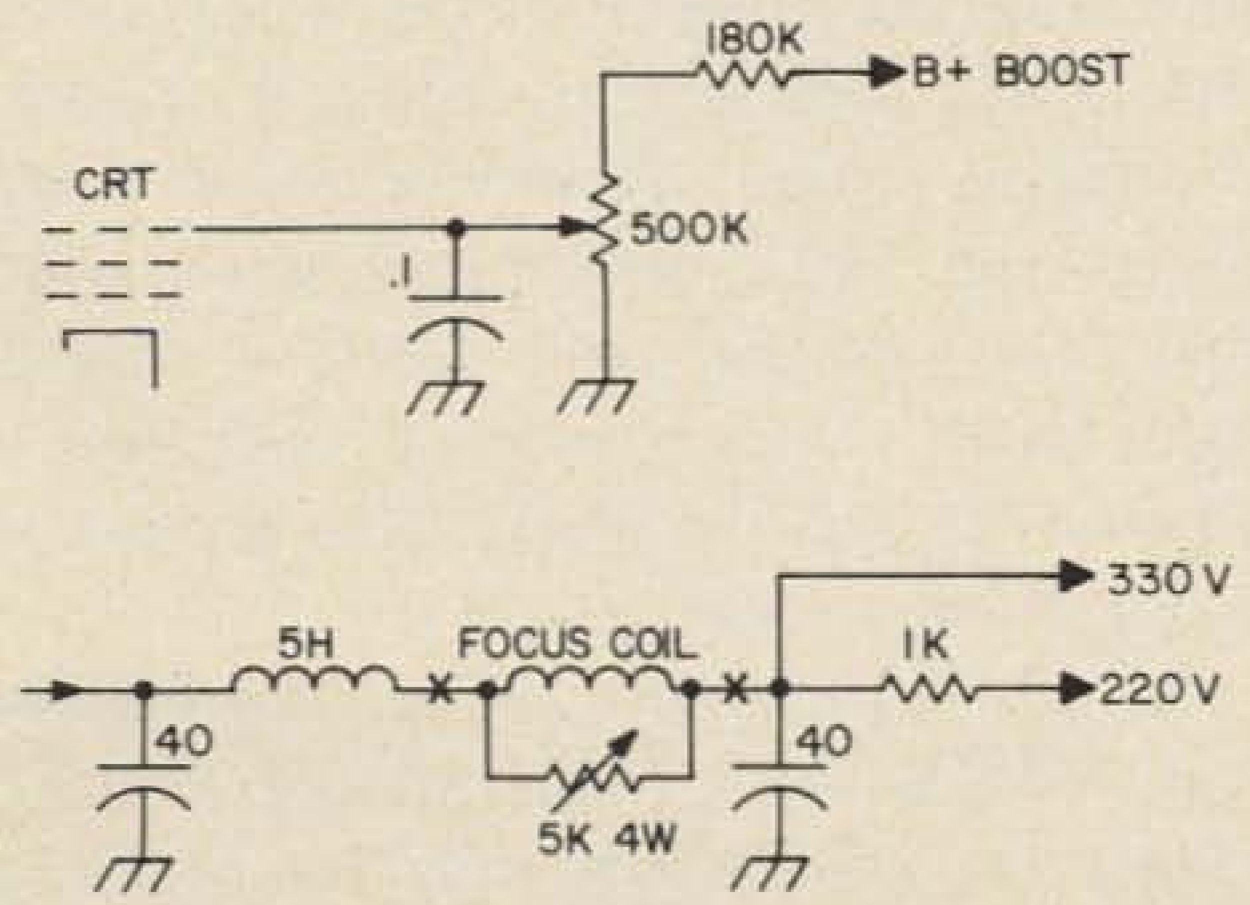


Fig. 4a and b. Two methods of supplying focus voltage/current to the CRT.

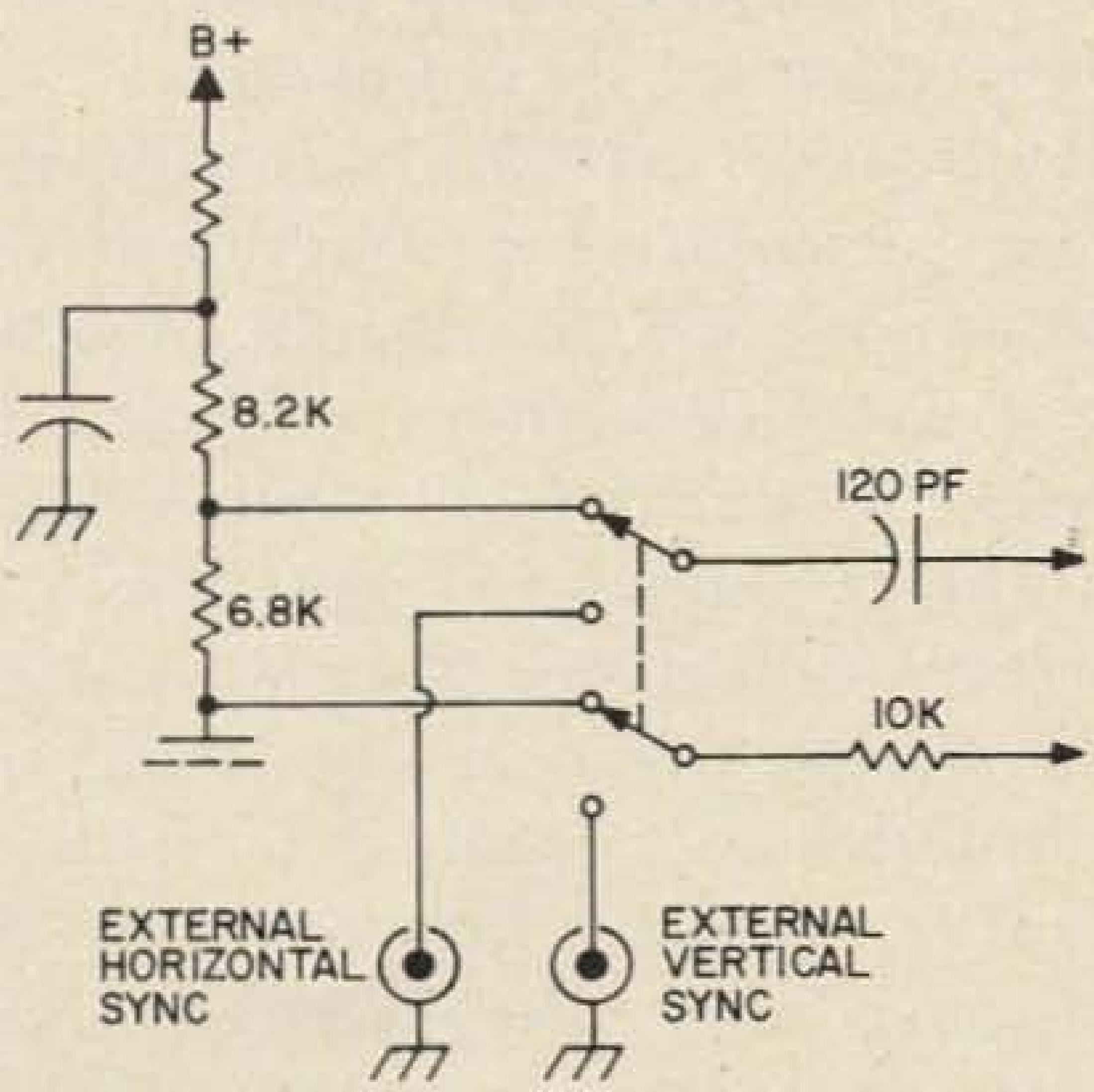


Fig. 5. A suggested modification for sync only input.

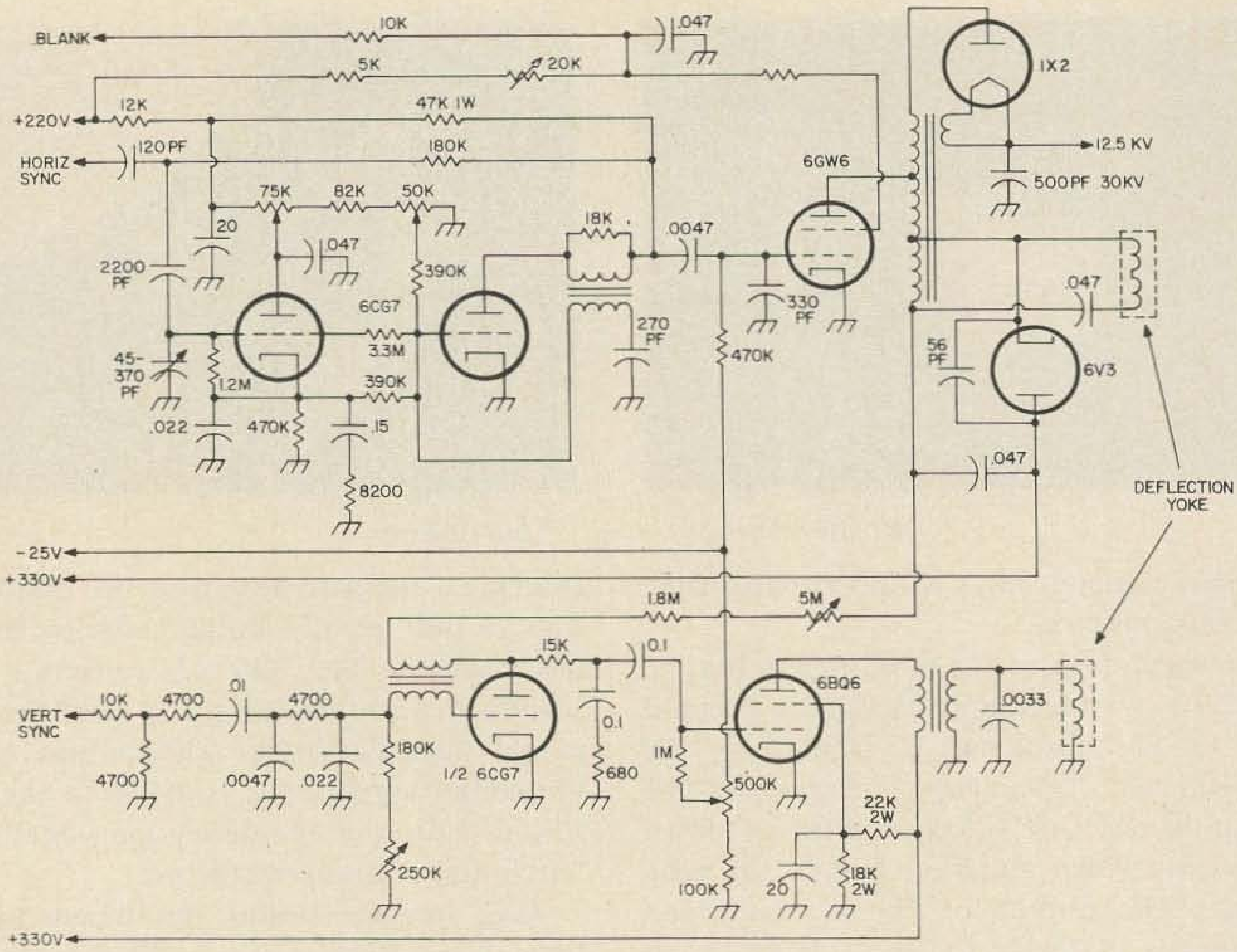


Fig. 6. Schematic of the deflection and high voltage section.

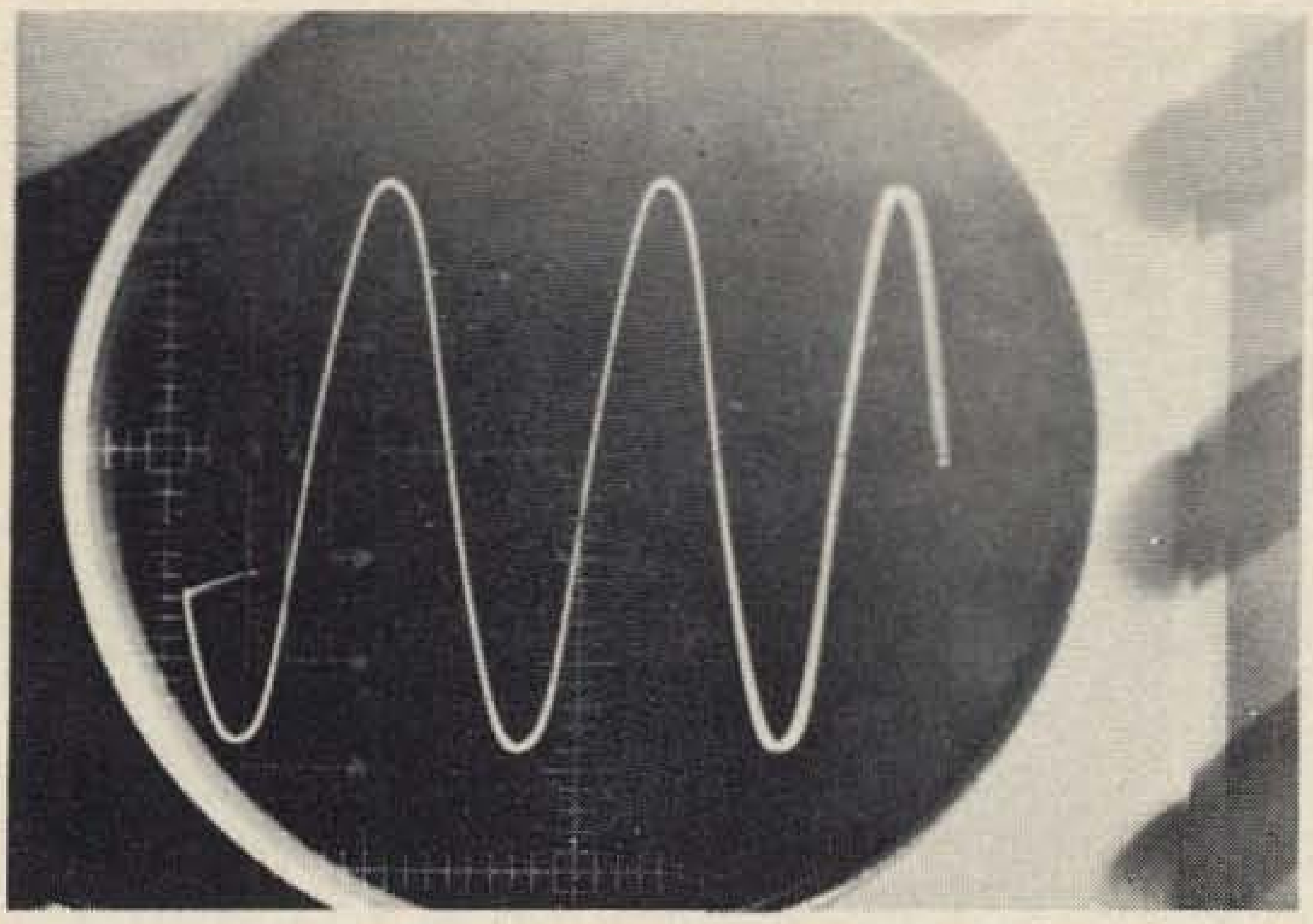
the power transformers from TV sets have three filament windings, two 6V and one 5V. They were used to obtain the negative bias voltage using a simple half-wave rectifier. If your transformer has only two 6V or one 6V and 5V windings, a voltage doubler should be used to provide the necessary −25V bias. The electrolytic capacitors used in the power supply section may have a greater capacity than those shown, depending upon what you have available; however, do not use less.

Mounting of the CRT may present some problems. I modified a mounting from a 17 in. set for my use. To simplify mechanical work, I obtained a yoke which clamped to the neck of the CRT. It required no other mechanical support, and there were centering magnets included on the assembly.

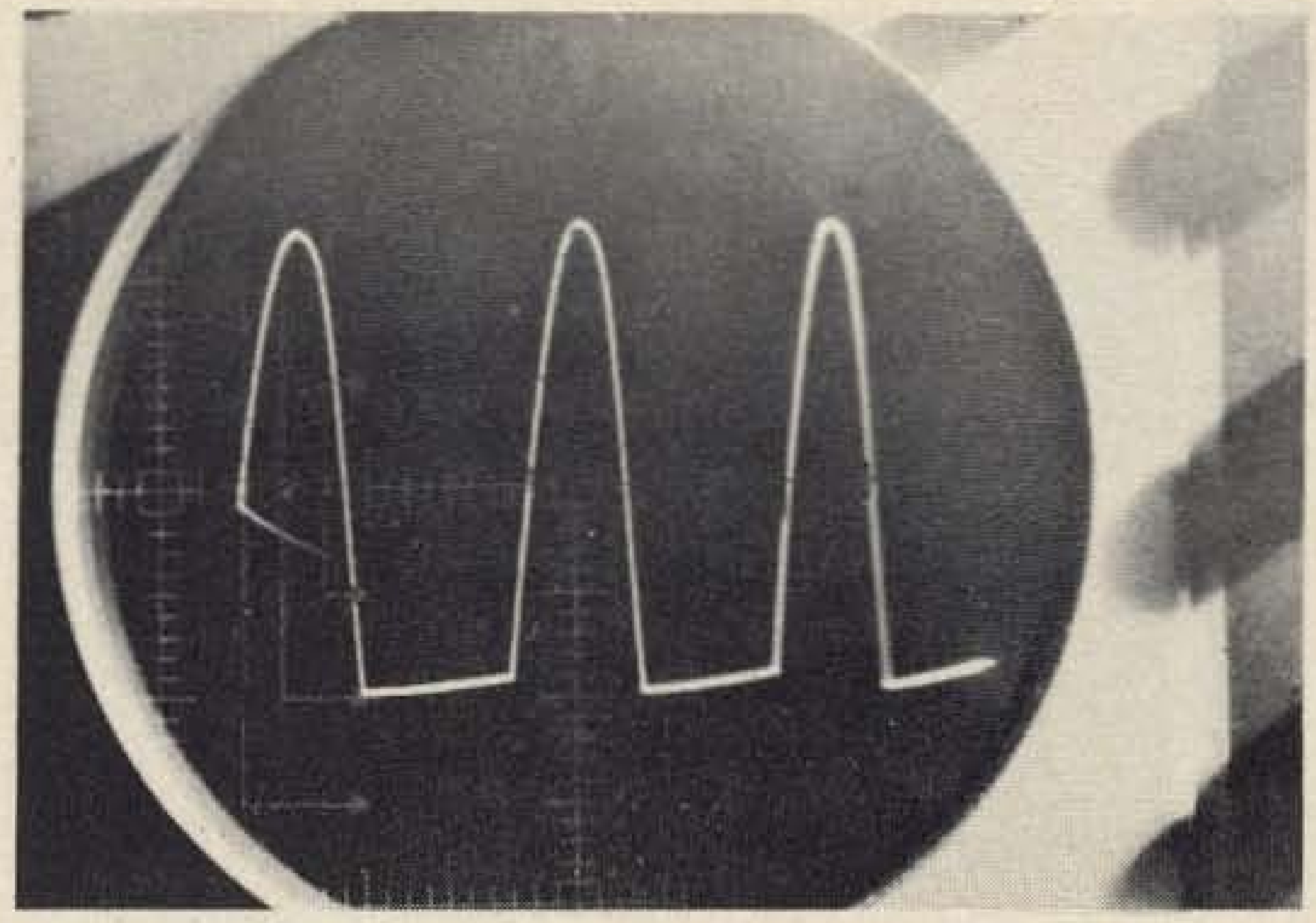
The layout shown in Fig. 2 was used. I encountered no problems with stray magnetic fields. The vertical output transformer and the vertical blocking oscillator transformers were located under the chassis. I used two four-section electrolytic capacitors, along with a couple of lead type electrolytics. There is sufficient room for another multisection twistlock electrolytic if you desire. To simplify wiring, 10 seven-terminal (2 ground) terminal strips were mounted in parallel rows as shown in Fig. 3. Other smaller terminal strips may be added as desired.

After wiring is completed, check carefully for errors before operating the monitor. For the smoke test, I recommend removing the horizontal output tube (6GW6) and the vertical output tube (6BQ6) and temporarily connecting the hot end of the height control to the 330V buss instead of the B+ boost. In my original model, I had the height control going to the 330V buss, but I was unable to adjust the height and vertical linearity satisfactorily. During normal operation the B+ boost voltage is 700V. This gives a very linear vertical sweep.

The test equipment needed for checkout are a VTVM with high voltage probe, an oscilloscope with a low capacity probe, and a source of ½ to 10V negative composite video. While a scope is not absolutely necessary, it is very helpful.



Vertical oscillator grid voltage waveform.



Vertical output plate voltage waveform.

Alignment Procedure

1. Turn on the monitor and allow it to warm up for 5 minutes. Keep a sharp eye out for overheating of resistors or tubes.
2. Set all controls at mid-rotation.
3. Connect the source of video to the monitor.
4. Check each video stage for signal. You should be able to trace it right up to the CRT control grid.
5. Check vertical oscillator for correct operation.
6. Insure that −25V is available for the vertical and horizontal amplifier grids before proceeding. Then insert the vertical output tube. Be sure that the deflection yoke is connected. If it isn't connected the tube and the transformer may be damaged. Using low capacity probe, check the waveform across the vertical deflection yoke. Rotate the vertical hold, vertical linearity, and height controls and observe their effects on the waveform. Using the VTVM, set the vertical amplifier control grid voltage to 15V using the vertical linearity control.
7. Check the horizontal oscillator using the low capacity probe for proper operation. By adjusting the horizontal frequency, horizontal hold and horizontal stability there should be a 15.75 kHz, 60–90V peak-to-peak sawtooth waveform. When you are satisfied that the oscillator is functioning correctly, turn off the monitor, insert the

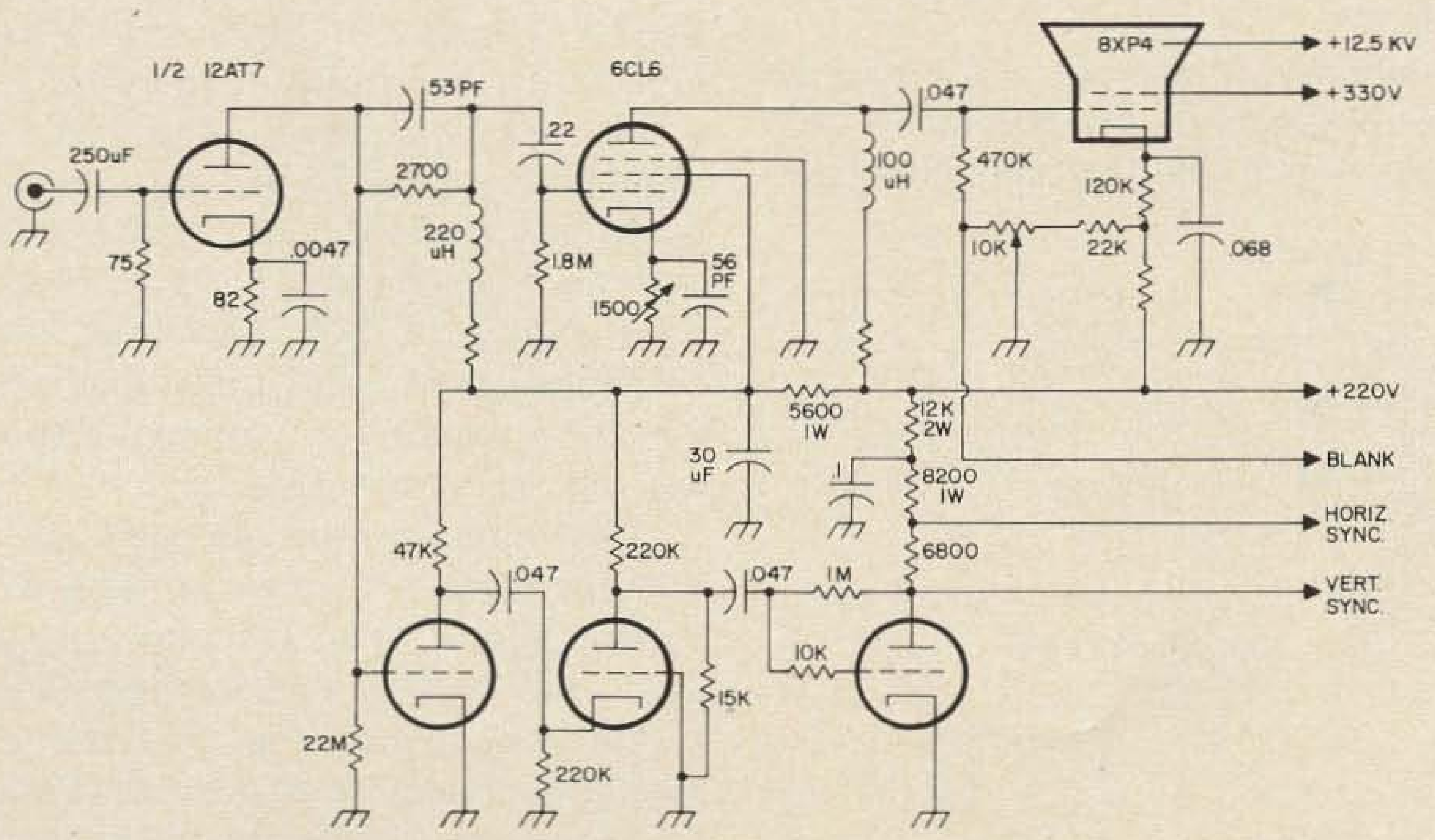
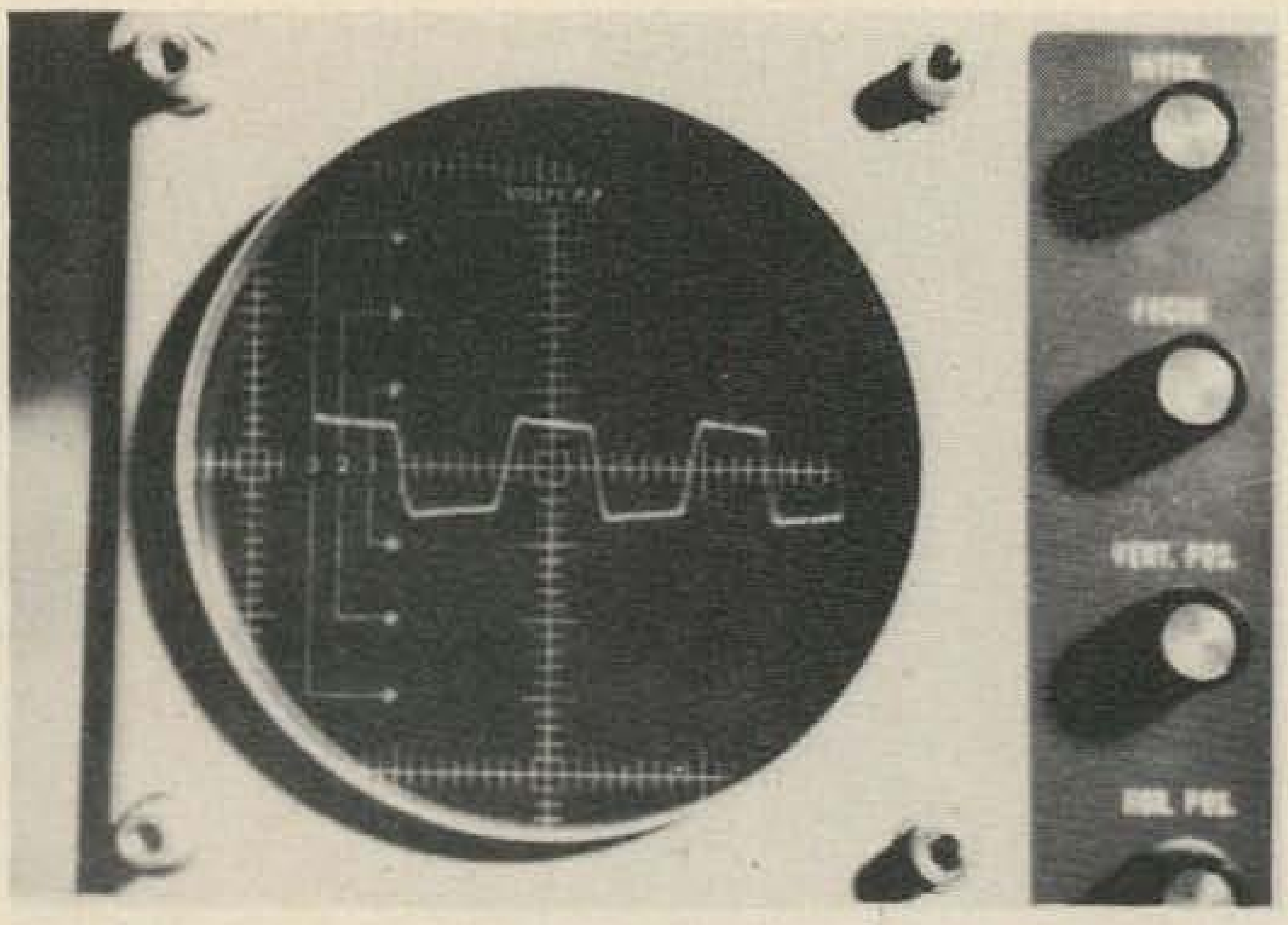
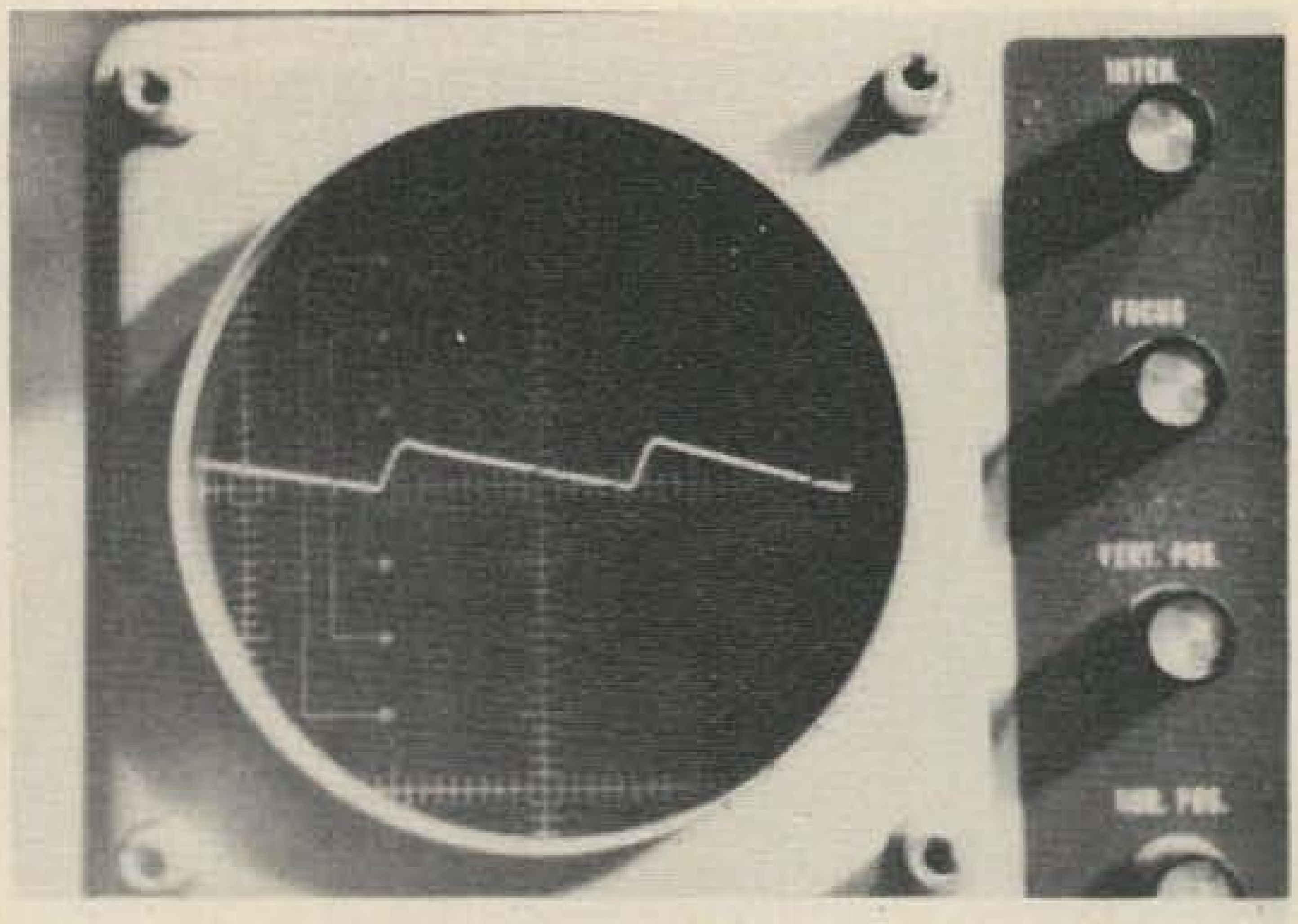


Fig. 7. The video amplifiers and sync separator/clipper.



1000 Hz video test square wave at CRT grid.



Horizontal deflection coil current waveform.

6GW6 and reconnect the height control to the B+ boost.

8. Re-energize the monitor, again looking for overheating of resistors and tubes. Adjust the brightness control to about mid-rotation. The CRT should light and a raster should appear. With the VTVM (using the HV probe) check for B+ boost (500 to 700V) and HV (10 to 15 kV). Adjust the width control for 100V on screen of 6GW6. Adjust the height control for a 100V peak-to-peak 60 Hz sawtooth on the vertical amplifier control grid.
9. By adjusting the front panel controls, you should be able to obtain a picture. Adjustment of the yoke (mine had centering magnets attached) may be necessary. If the picture is upside down or mirror image, reverse the necessary yoke leads.
10. Fine adjustment may be accomplished by using standard TV alignment procedures. Notice that the horizontal hold and horizontal frequency controls interact, as do the width and brightness.

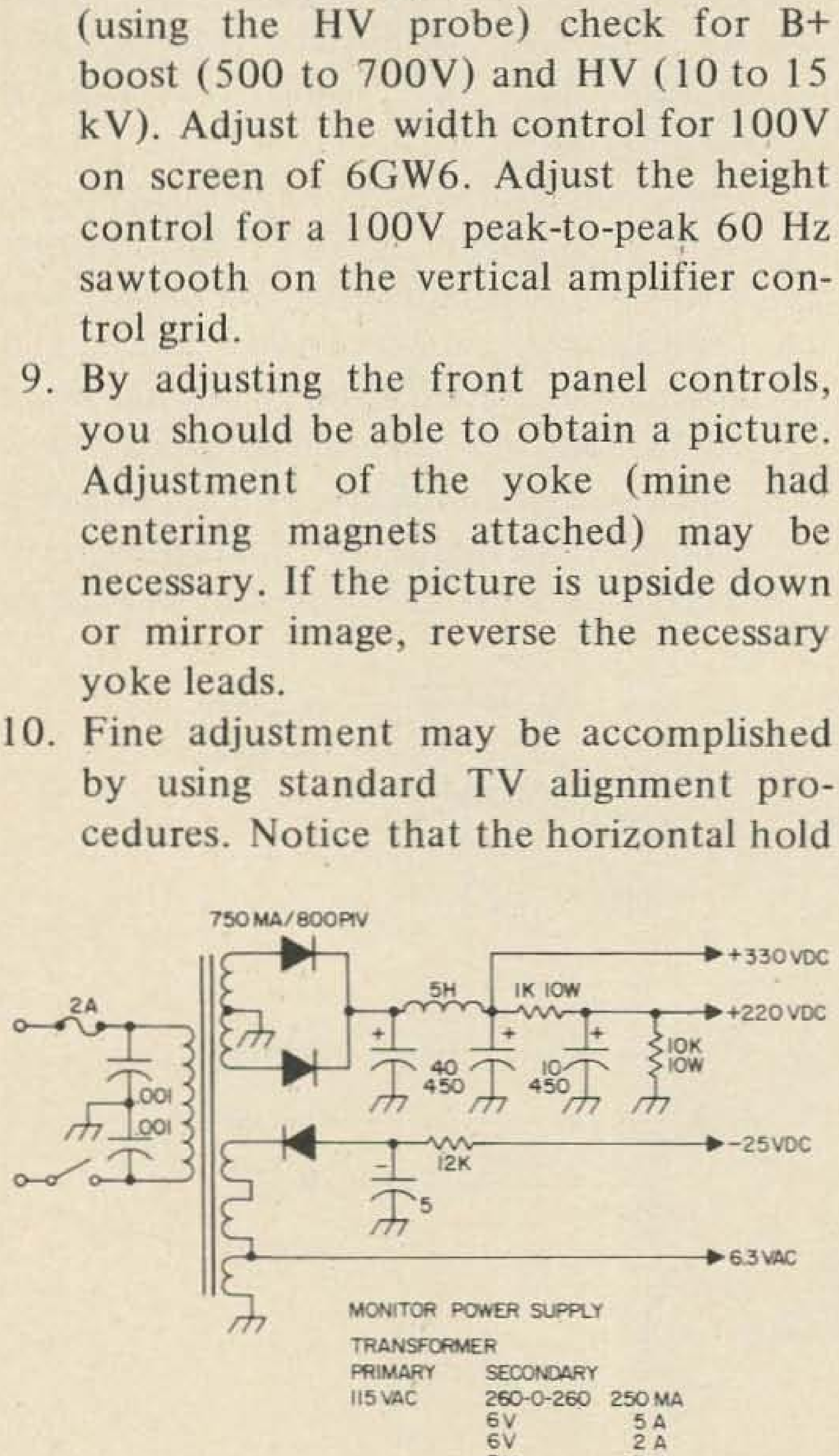


Fig. 8. Monitor power supply.

I get carried away using silicon diodes. Originally I used a 3000 PIV 200 mA diode for the damper. After two frustrating failures, I used a 6V3A. If any of you more persistent types desire to try a silicon diode, use at least a 5 kV PIV 200 mA diode. If you use a 6V3A remember that it has a cathode cap and not a plate cap. It won't work the other way!

As for substitution of tubes, a 6BQ6 could be used in place of the 6GW6. However, with the high B+ boost voltage present (700V) I used a 6GW6.

I used an 8XP4 universal test tube, although any one of several CRTs may be used. An 8YP4 may be used if 110° deflection components are used. An 8KP4 may be used if correct focus voltage is supplied to the focus anode. An 8DP4 may be used also; however, it requires – in addition to a focus voltage – a single field ion trap. A 5 in. tube such as a 5AXP4, 5AHP4 or a surplus 5FP4 could also be used. The 5AXF4 requires no external focus supply. The 5AHP4 requires a focus supply of 0 to 250V. The 5FP4 is an electromagnetic focus tube. Figures 4a and 4b show methods of supplying focus voltage/current for other CRTs.

This monitor was designed as a basic building block for future projects. For those with a master sync generator, a *sync only* input may be desirable. A suggested modification is shown in Fig. 5. Other changes/adaptations may be made to the basic design to fill the requirements of the builder.

. . .KØMOC/4

73 Tests

THE ICOM IC-21 TRANSCEIVER

The word has leaked out around the U.S. about the Japanese IC-20 and IC-21 transceivers, fueled by a handful of units brought back by visitors to Japan and returning servicemen. Now, at last, these goodies are being made available through a U.S. importer.

Adirondack Radio was kind enough to lend their first sample for a test and it certainly was impressive. The most spectacular aspect of the rig is the 24-channel frequency switch, complete with an easy-to-get-at board for the 24 crystals and tweaking capacitors immediately at hand.

Now, while you may live in an area which only has one or two repeaters, those of us in the northeast are living in an entirely different world, one jammed with repeaters on just about every pair of channels. Though the 73 HQ is in a remote corner of lower New Hampshire, there are now about 17 repeaters that can be used with a simple antenna. Three miles away, from the top of Pack Monadnock mountain, where we test out new equipment, there are a whole bunch more within easy reach. A 24-channel transceiver looks awfully good for a spot like this.

The IC-21 has so many nice features that it is difficult to decide which is the most desirable. It has an ac supply built in and will operate from either 115V ac or 13.6V dc, making it a dandy unit for both base and mobile applications . . . and particularly valuable to the operator who wants to be able to use one rig both in the car and at home.

The transmitter puts out 10 watts on the high power position of the output switch and one watt on the low position, making it possible to save on battery power when operating through most repeaters.

Experienced FM operators will appreciate the variety of meters on the IC-21. Just above the channel switch is a deviation meter which indicates how much off frequency the incoming signal is. This meter is calibrated plus and minus 5 kHz. There is a control on the front panel to compensate for this off-channel stuff . . . a Receiver Incremental Tuning control which swings the receiver back and forth about 5 kHz. Since not all 94 repeaters are on 94 and not all 76 repeaters are exactly on 76, this is a handy control to have when you are moving from one area to another.

The S-meter on the receiver comes in handy when you want to identify which of several repeaters you are hearing and there is no identification at the moment. At our mountain lab site we hear W1ALE in Concord on 94 at umpteen over 9, WA1MHN in Somerville, Mass., at S-9, WA1KGR in Holyoke, Mass., at S-8, and W1KOO on Mt. Mansfield, Vt., at S-1, so you can tell from the S-meter reading exactly which repeater is being heard at any time. On 88 the S-meter permits instant identification between W1ABI, WA1KFX, K1AOI, W1ZAW, WA1JTB, and WA1KHK.

The S-meter becomes a plate tuning meter on transmit or an SWR-meter, with a flick of the front panel switch. There is a plate tuning control on the panel, permitting the plate to be peaked on any channel, thus overcoming the serious drop in power you suffer with some rigs when you change frequency from one end of the band to the other.

The mike gain control on the front panel is useful for setting your deviation to match the repeater you are using. Some are wideband, some narrow, and some compromises. With a little fiddling around you can find out what works best with each repeater and use that deviation from then on.

Some of the statistics, briefly: weight 14 lbs; size 4½" high, 9" x 10", will obviously fit under most dashboards; draws 0.2 A on receive, 2.1 A on high power, and 1.2 A on low power; uses 18 MHz crystals for the transmitter and 15 MHz for the receiver; i-f is the usual 10.7 and 455 kHz.

An automatic protection circuit disables the driver transistor if anything happens to the antenna, thus keeping the final transistor from going west when the antenna is shorted or opens up.

A low-pass filter on the output is designed to keep interference down to neighboring television sets.

The IC-21 is designed to be mounted by means of a bracket in the car and a built-in folding foot stand angles it for use on the operating table.

An external vfo may be used with the IC-21. It plugs into one side of the cabinet. There is a jack in the back for an external speaker, which is very handy for car installations where you would prefer to listen to the regular car radio speaker than the smaller one on the transceiver.

Since the transmitter and receiver units are independent of each other, a good technician might be able to convert this rig rather easily into a repeater. It wouldn't take a whole lot of work. The modular construction of this rig would make such a "conversion" much easier than with most transceivers. The fact is that you can get at almost everything on the IC-21.

The IC-21 is being imported by Adirondack Radio, Amsterdam, New York and sells for $389.00.

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73 Tests The REGENCY Transcan FM Transceiver

A scanning transceiver was the obvious next step in two meter FM transceivers. There are so many repeaters in action today, even in the more remote parts of the country, that the FMer needs some way of keeping track of which are being used. Back in the old days, a year ago, when there was only one repeater in most areas, a simple monitor receiver was all that was needed to keep in contact.

As 1972 unfolds we find that most major urban areas have four to six repeater channels perking and, unless the FMer has his hand on the channel switch a whole lot, he misses out on most of what is happening. It gets to be quite a drag to reach up and switch through all the channels every few minutes. It is a lot better to have a couple of ICs and some transistors doing that for you, automatically.

Regency has married their scanning VHF receiver and their very popular HR-2 two meter FM transceiver and come up with a package which does everything for you except keep the log. The receiver scans eight crystal controlled channels and, when any one becomes active the light turns on, the scanning stops and the squelch turns off so you can hear the station. Each of the eight receive channels may be locked out of the scanning function by pushing a button over the channel lamp. This is handy when one channel is active and you want to scan all but that one . . . or two, etc.

There are six crystal transmit channels which are selected by the buttons under the receive channel lamps, which leaves two receive channels which can share any of the six transmit channels with another receive channel. Pushing the transmit button locks the receiver to that channel until you push the "scan" button which disconnects all transmit crystals and sets the receiver to scanning again.

This setup is ideal in the areas I frequent, fitting the six repeaters we use in New Hampshire and southern Vermont. When I head down Boston way I change the crystals for the six active repeaters down there (W1QFD, WA1KGS, WA1MHN, WA1NJR, W1HWK, and WA1KGO). If I'm driving to New York, which happens often, I load up for WA1KGQ, WA1KGR, WA1KGD, WA1KGK, WA1KHK, and WA2SUR. And so it goes, with my being able to talk through a selection of repeaters no matter where I am.

The Transcan is extremely handy at 73 HQ where I monitor not only the six fairly local repeaters, but also listen for calls on 76 and 94 simplex from passing FMers. We have a pot of coffee at the ready for visiting amateurs and do appreciate the company. The Transcan has also alerted me to several band openings which have permitted me to talk down into New York and even points further away.

The scanning function is accomplished by a couple of ICs which switch the receive channels by means of diodes and sample the channels, stopping when the squelch is operated by a carrier. There is automatic protection of that expensive output transistor too, with a little circuit that senses if the antenna opens or is shorted and turns off the drive to the final.

All in all, Regency has come up with one of the best fun-makers for two meter FM yet. I don't have time to switch through all the channels while I'm driving to see who might be coming through. The Transcan does it for me and even the shortest blip of a carrier stops everything and lights up the active channel. The price is $319 for the mobile model and $349 for the desk model with built-in 117V ac power supply.

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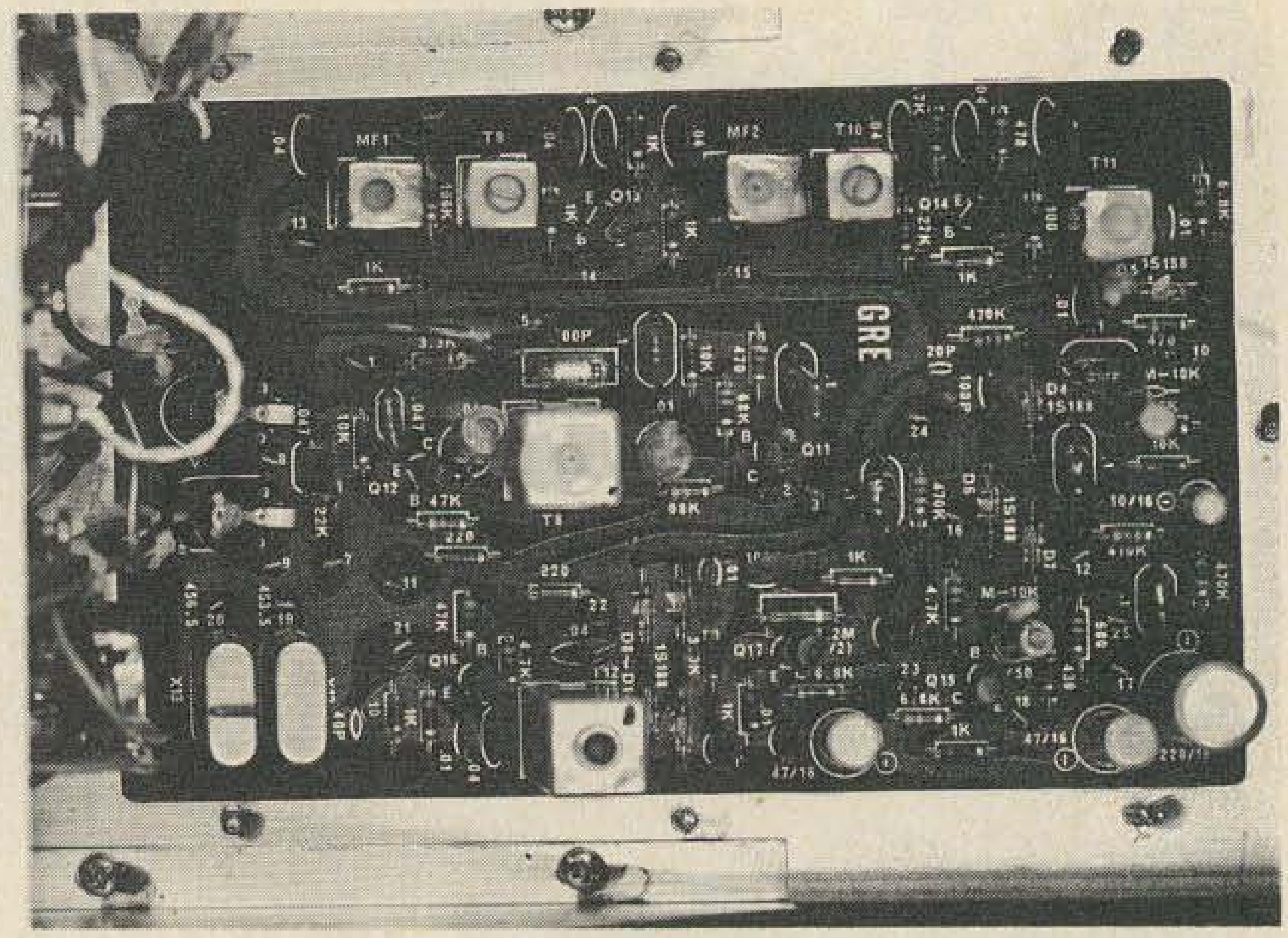
73 Reviews The Allied AX-190 Ham Receiver



If all receivers performed as well as they looked, a ham would have no trouble in obtaining a good one. The trick is finding the good receiver that is behind the pretty panel. The Allied AX-190 is such a one. Behind the brushed aluminum front are five printed circuit boards that hold all components in very neat arrangements. On one of them is the four FET front end which is rated at 0.5 μV sensitivity at 10 dB S/N. Our test unit performed very well with no more than a longwire, and we have no reason to doubt the accuracy of the manufacturer's statement. This receiver picked up many weak stations that other radios could not hear. The preselector is very sharp and sensitive and really peaks up signals while rejecting interference from strong off-frequency stations. The receiver covers eighty through all of ten meters in 500 kHz bands. There is also provision for adding another segment of the 3.5 – 10 MHz range.

For those strong signals that cause QRM, the Q-Multiplier does an excellent job of eliminating heterodynes and peaking the desired signal. This feature is certainly a desirable one for CW and SSB ops. Signals here were raised by thirty to forty decibels, and when the rejection mode was selected, annoying whistles were eliminated.

CW and SSB are received well by means of a four diode balanced modulator circuit. The first oscillator and bfo are crystal controlled for sharp and accurate tuning. The audio is clean and pure, and almost hi-fi – in short, very comfortable. Dual conversion and ceramic filter add measurably to easy listening.

For those who might want to listen to AM stations that are outside the ham bands, an AM position and AM with ANL are provided on the function switch. Incidentally, the diode noise limiter performs very well to take out ignition and electrical noises (i.e., the fluorescent light on my desk).

As for minor features that add to the pleasure of owning the AX-190, there is a 25 and 100 kHz calibrator for accuracy of the smooth tuning vfo knob which has one kilohertz markings on the resettable skirt. The rig also has provision for operation directly off of 12V dc, making the rig valuable for mobile, Field Day, emergency, and portable use. Antenna input is a common SO-239 chassis connector, provision for muting, and vfo output round out the features of this receiver. One other valuable feature of the rig is the accompanying instruction manual. It is complete with an excellent theory of operation section that includes excerpts of the complete schematic showing the various stages in their individual and combined design states.

For the ham who is looking for a good receiver, portable, or emergency receiver, at $249.95 this receiver needs careful consideration. Novices in particular should keep in mind that a few extra dollars on the receiver purchase can add proportionally greater enjoyment to his operating experiences. And when upgrading his license, this receiver will keep its value in the station.

Martin Bradley Weinstein WB8LBV
1260 Richmond Road
Lyndhurst OH 44124

PHONE PHREAKS VS Ma BELL

"Little Box Blue, get on the horn" is the call of a new band of public nuisances, the self-styled "Phone Phreaks" who have been using a small electronic device, known as a "Blue Box," to defraud the telephone services of an estimated half million dollars a year.

73 talked with Dennis Mollura at the Bell headquarters in New York about these Blue Box activities.

First, Mr. Mollura described Blue Box operation:

"They are used to call the network signalling function on the telephone network. If you build a Blue Box that has the proper tones and you know how to use it you could tap out the right tones to give the network its command; then you'd be able to avoid our automatic billing equipment."

These tones are the twelve dual-tone combinations of six frequencies used only for network calling frequencies, and are not the same as a standard Touchtone® phone would produce. You may have noticed, after dialing a long distance call, a rapid succession of higher-than-Touchtone® frequency tone-pairs lasting about a second. These are the network control tones.

A Blue Box user first seizes a long distance line by phoning a toll-free long distance number, most often a directory assistance or IN-WATS (area code 800) number, then hanging up on the callee while retaining the circuit by generating his own 2600 Hertz "disconnect" tone. The 2600 Hertz tone would normally not appear on line until the caller has hung up, and once sensed, is regarded by switching equipment as a signal to disconnect. The captured line is then used to call anywhere in the world at the caller's whim. Most "Phone Phreaks" figure they're getting away with it, but the feeling is usually ephemeral.

"There are three ways which we use to try to detect Blue Box fraud; number one would be plant service center testing (with very common electrical testing equipment) . . . another way is traffic pattern analyses . . . then the third way is computer programming. The computers are watching the networks and they . . . can spot trouble . . . and kick out a trouble report card."

It would appear that most of the current users of Blue Boxes are now at this point in telephone company investigations. They have some unpleasant surprises in store for them if they should be so naive as to think that this is as far as the investigations go.

"When we suspect a case we can put on sophisticated electronic gear . . . which can help us track down the people.

"We've . . . begun a nationwide crackdown. In 1970 there were six people arrested, two convicted, four cases pending. So far this year (September), thirty-three arrests, eighteen convictions, fourteen pending, one dismissed. In the Montana area, a group of ten people . . . were using Blue Boxes. We (actually, the FBI) moved in on them . . . they were indicted . . . and arraigned, and the evidence was so overwhelming that seven of the ten pleaded guilty right off the bat, two of the cases are pending, and one is dismissed."

Naturally, the Blue Box users aren't hurting anybody, unless you feel that having to pay their way yourself is an imposition.

"People are trespassing on the telephone network. They're literally stealing service, and actually increasing the cost of telephone service for people who do pay. I can describe this as like a guy getting on a turnpike and not stopping at a toll booth. He's creating a demand for service, but he's not contributing his share. "Our losses due to Blue Box fraud . . . we're estimating at about five hundred thousand a year."

With a half million dollars a year at stake, why not just clamp right down?

"One of the reasons that we gather evidence for so long, like in the Montana case, is to establish what the person's calling pattern is, to try to determine when he got the box, how often he used it, and where he called. Once we establish a pattern and can pinpoint when he got the box, then we go for full restitution. In cases we've been able to get it."

So far, no amateur radio operators have been involved, but the people who were involved might well have become hams.

"Of the thirty-three people arrested this year, twenty of them were students, one was a private detective, one was a communications man, and most of the rest had electronics background interest."

What is the phone company position on the use of these devices?

"We consider this a very serious matter. People are trespassing on the telephone network. We do have means of detection, and we are confident that we are eventually going to catch them all. When we get them, we are going to press to the fullest extent of the law, and we're going after full restitution of the money we've lost so far."

Amateurs who have been using 2600 Hertz notch filters and 3400 Hertz roll-off low pass filters in conjunction with phone patching have most of the protection necessary to prevent accidental interference with telephone service.

'The Blue Box enables you to place calls without charge. There's another electronic device which would enable people calling you not to be charged. I'm sure you're very familiar with this. I have an article written by you in the September 73. There was some concern. Someone in the telephone company spotted the article and was somewhat concerned about it. I checked it through and it's a legitimate article. It has a disclaimer at the end . . .there's no problem."

Chester County (PA) Detective Ronald Johnson (right) displays an illegal "blue box" used to bypass toll charges and seize long distance telephone circuits. Johnson and Chief of County Detectives Eugene Sharpe (left) were part of a law enforcement team (September 27, 1970) which raided several Chester County residences of suspected "phone phreaks." The "phreaks" use homemade electronic generating devices such as the "blue box" to place free long distance calls all over the world, sometimes for hours at a stretch. Four persons were arrested in connection with charges ranging from toll fraud to impersonation of telephone company employees and, in one case, wiretapping. Authorities said "several carloads" of illegal equipment were confiscated, some of which is shown here.

Most of the details concerning the particulars of design of the equipment used by the phone company in tracking down the Blue Box Banditos must, of course, remain confidential for the moment. 73 will continue to monitor developments in the case of the Phone Phreaks versus Ma Bell, and will release pertinent new developments as they become available.

. . .WB8LBV

References:
ESQUIRE, October, 1971, p. 116 "Secrets of the Little Blue Box" by Don Rosenbaum.
73, September, 1971, p. 117, "A D.C. Isolator for Phone Lines" by Martin Weinstein.

Q-5 signals 100% of the time! Regardless of band conditions!

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AFSK REVISITED

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9412 Adelphi Road, Apt. 202
Adelphi MD 20783

Many hams are lured into the wonderful world of Teletype by the promise of unattended autostart, automatic message handling, or the ability to send fancy holiday greetings. They often find, however, that such operation is practical only on VHF, where non-drifting, non-fading signals make such transmissions easy. Such a finding is not wholly true. Although sophisticated converters can work wonders on the lower frequencies, advanced circuitry is hardly the answer a newcomer to Teletype needs. Unfortunately, that is about all he has gotten – until now. Unlike earlier circuits, the audio frequency shift keying (AFSK) generator described here uses a bare minimum of parts. It gives a reasonably good sine wave output and – using the keying technique included – a minimum of transits or bias. The keying technique referred to is the application of a new device, the magnetic reed relay, to a Teletype keyer. The reed relay can be used not only to key this AFSK generator, but standard FSK units as well.

Simple circuits published previously have contained at least two transistors and a reasonable amount of other software. A look at the schematic, Fig. 1, shows this oscillator to have only one transistor and a minimum of other components. The actual audio shift is accomplished by switching an additional capacitance in parallel with the toroid to lower the tone on "mark." On "space," the switch is open and a higher tone (from less parallel capacitance) is generated. Although Cs and Cm are shown as one capacitor each, they are in reality several capacitors paralleled to give the desired resonant frequency. For such work, you cannot rely solely on the marked value of the capacitor. Tolerance variations can play havoc with combinations set up in that manner. Rather, true trial and error should be used to determine the values after the rest of the circuit is completed.

For newcomers, the use of Lissajous Figures is the most practical method of

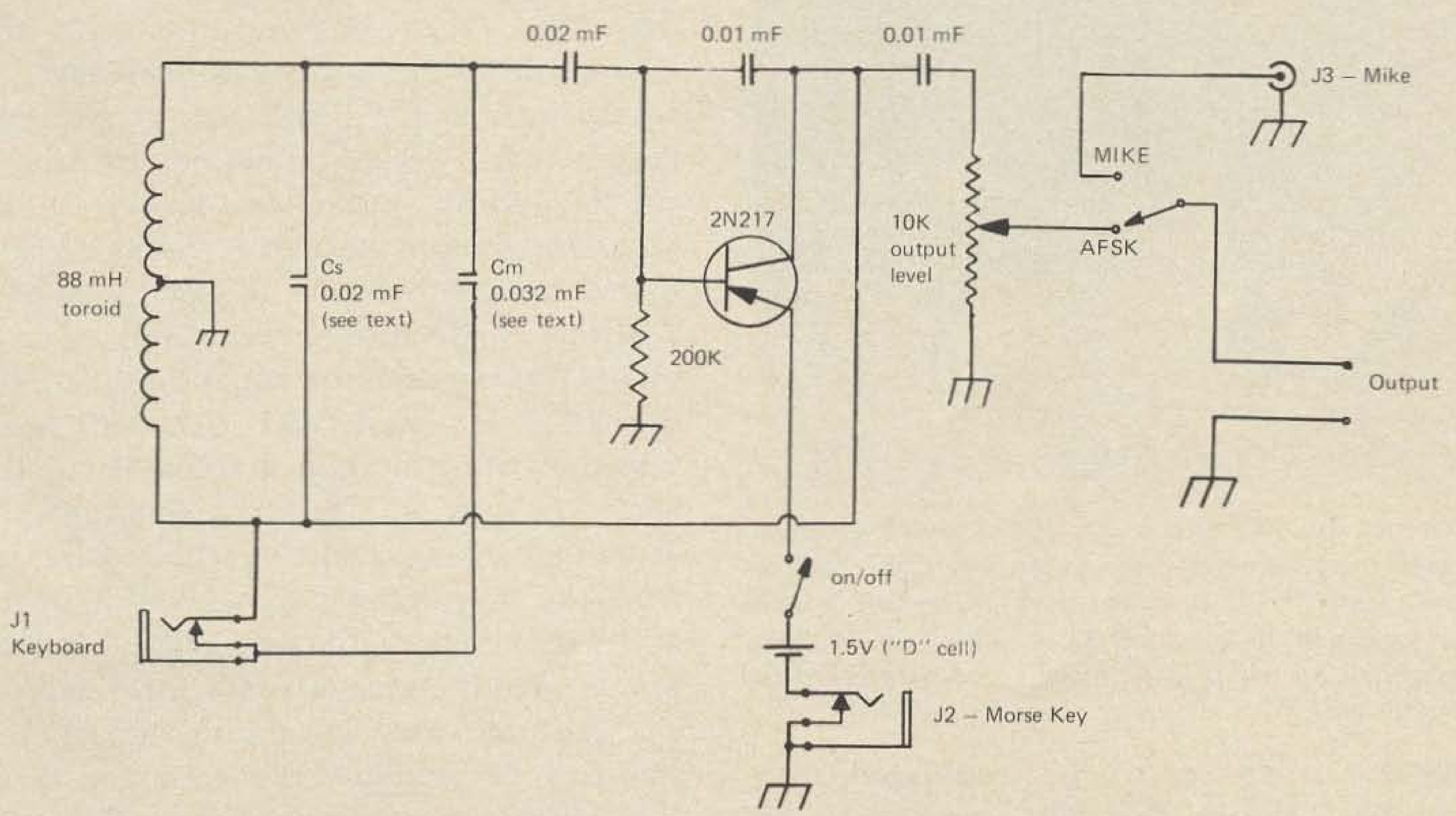
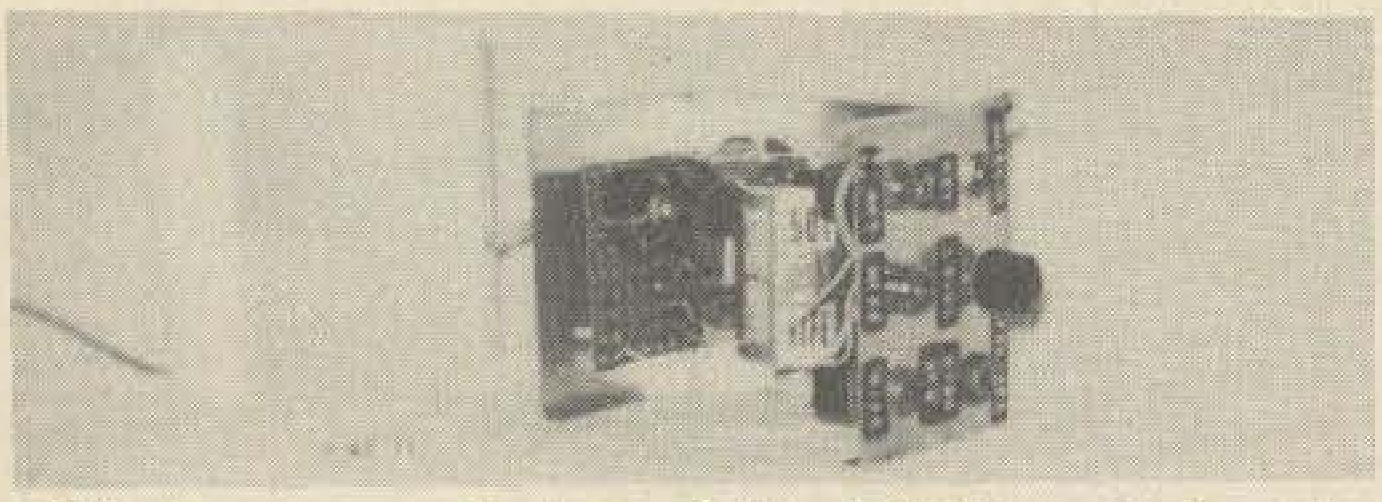


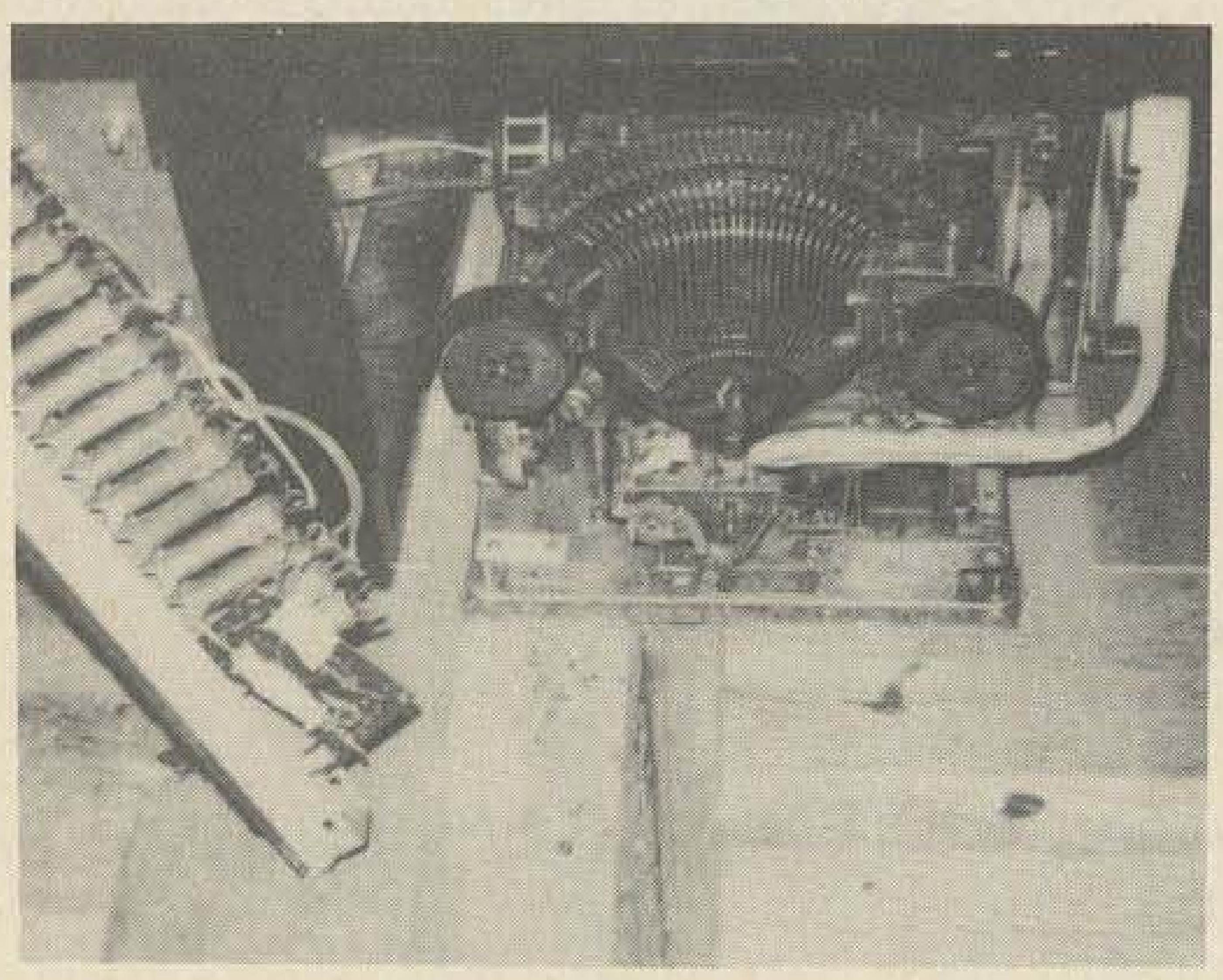
Fig. 1. Schematic of AFSK tone generator.



This is an overall view of the AFSK unit, showing front panel and interior circuitry.

audio frequency determination. Briefly, setting up the circuit shown in Fig. 2 will allow frequency matching to within a small percentage. The source of the standard frequency will be investigated later. For the time being, such a standard is merely a known-to-be-accurate signal source. While observing the scope face, try various small capacitors of the approximate suggested values (or use a capacitor decade box if one is available) until a circle or ellipse appears on the screen. When that happens, the two audio sources are within one hertz of each other.

Another method may be used for those lacking an oscilloscope. This technique, almost forgotten in amateur circles, is one using audio beats to match frequency. It permits matching to within one hertz, and gives a better result than Lissajous Figures for tones separated by several hertz. The audio beat method involves feeding the standard tone into a loudspeaker and the



This is the Teletype patch (jack) panel with the reed relay assembly shown on the right end of the strip. The relay is enclosed in the coil, which is wrapped in masking tape. The unit is then attached to the printed circuit board referred to in the text.

AFSK generator to be calibrated into another (both through amplifiers, of course). As the generator frequency is adjusted to that of the standard, using trial capacitors or a decade box – as above – audio beats, that is, variations in amplitude, will be heard. When the beat frequency is less than one or two per second, the two audio tones are matched within one hertz.

Since exact frequency tolerance is not needed – it makes little difference to the receiving operator whether your "mark" is 2125.0 Hz or 2126.7 Hz – the audio beat method is perhaps better suited to the newcomer with only a limited audio refer-

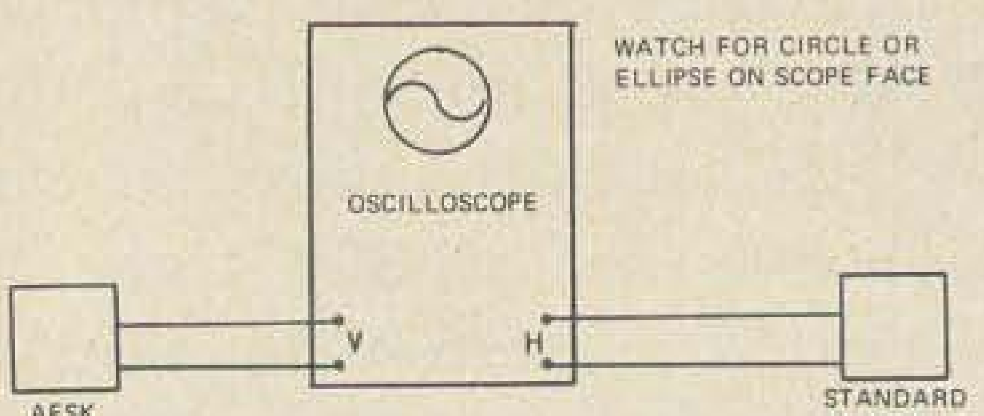


Fig. 2. Simple frequency matching setup.

ence source. At, say, five hertz separation between tones, the oscillographic Lissajous Figure will be a meaningless blur, while audio beats will be present at a rapid rate. Thus, adjusting the tones by the beat method, once slow beats are obtained, the frequency is within fair limits.

Although much has been said so far about the "standard" frequency, details have not yet been given. Such a standard should be capable of supplying the mark frequency, 2125 Hz, and the space frequency, 2975 Hz, at a reasonable level of accuracy, stability, and sine waveform. Perhaps the easiest standard to use is another AFSK generator, known to be accurate. Such a generator could be borrowed from a friend or its signal used over a strong VHF link. Alternatively, a calibrated audio generator could be set up for the 2125 Hz mark and 2975 Hz space tones. A third method is available to the ham who has an operating demodulator. Tune in a strong carrier on the receiver, as from the transmitter's spot function or the 100 kHz crystal calibrator, and adjust the bfo to give the proper tones for Teletype. To calibrate the generator, adjust the standard to produce the tone for space (2975 Hz). Adjust Cs until the AFSK unit produces the correct space frequency, as measured by either of the frequency matching methods above. Close the switch grounding Cm and move the standard to the mark tone (2125 Hz). Adjust the value of Cm for the correct mark tone. Recheck the space tone to be sure interaction has not changed it. Feed the signal of the AFSK generator into the mike input of your transmitter, adjust the level control for 100% modulation, connect a key at J2 or a mike at J3 (for the CW or phone identification required), and you are on the air.

If you connect this directly to your keyboard contacts you may have some problems. First of all, the generator must be keyed "dry." That is, there can be no current or voltage on the keying line. Second, the contacts used to key must be clean. While not so much of a problem with a keyboard, the rotating contacts of few T-Ds are clean enough to key this circuit without hash. The solution to these problems is to key through a set of contacts separate from the Teletype loop.

For years, the only accomplished way to do this was by a polar relay. Other, spring-returned, mechanical relays differed too much in their make vs. break current to key without bias (changing the length of the 21 msec Teletype pulses). Recently, however, a new device – the magnetic reed relay – has come upon the scene. Literature has described this device as being able to operate upwards of 2000 Hz. If a 2000 Hz signal were fed to the activating coil, the contacts would make and break 4000 times a second. Each actuation would be 0.25 msec long. It appears, therefore, that the relay could operate on the 21 msec Teletype pulses. Such a relay was procured from a local supply house, and a coil wound on the form enclosed with the

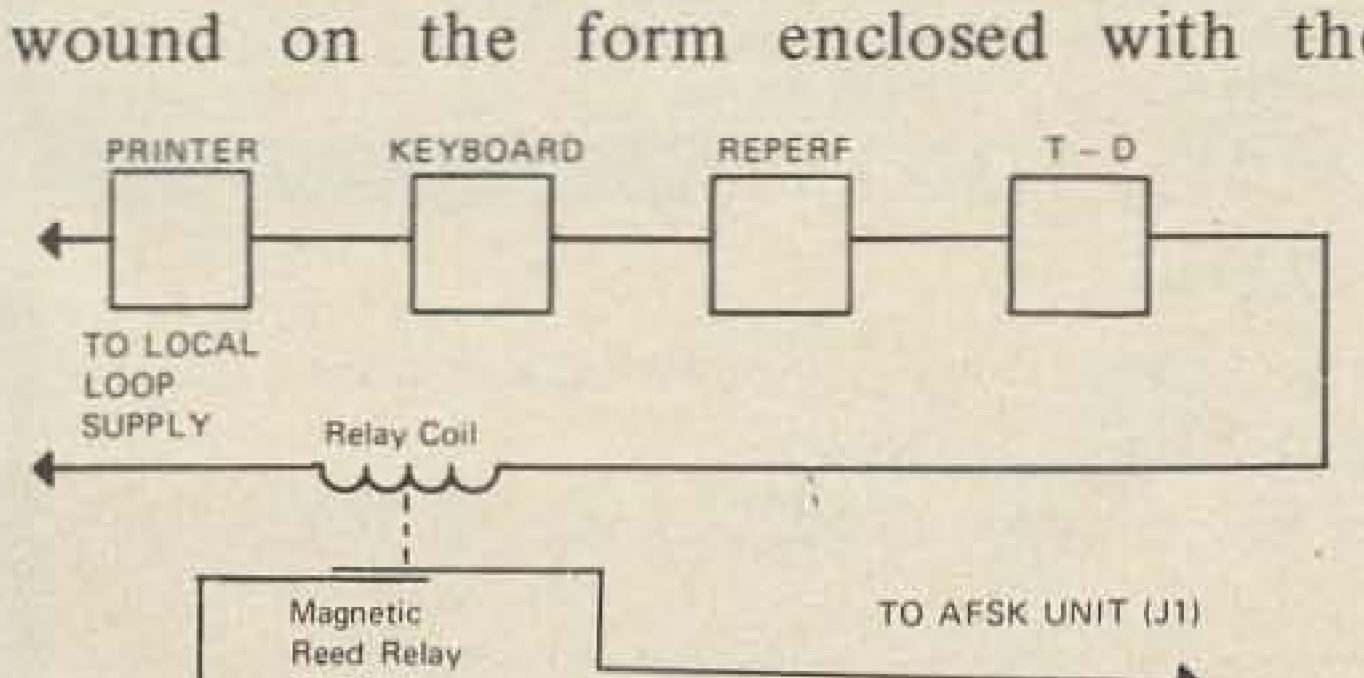


Fig. 3. AFSK keying arrangement installed in loop.

relay. The coil has several thousands turns of 32-gage wire, and a dc resistance of 45Ω. It readily pulls in on 40 mA, thus the 60 mA local loop current assures positive action.

Transmitting tests using the relay to key the low frequency FSK rig showed no detectable bias. The relay was then installed into the loop as shown in Fig. 3. For mounting convenience it was fastened to a small printed circuit board, origin and original function unknown. The magnetic relay is now used for keying both the AFSK and FSK rigs, with excellent results.

Construction techniques are entirely up to the builder. At WA3AJR, the AFSK oscillator is built on a small piece of perf-board and mounted in a minibox with its complement of jacks and switches. The magnetic reed relay, as noted, is attached to a piece of printed circuit board for support, then mounted behind the Teletype patch panel.

The circuit shown here is, to me, a fast and easy way to transmit on VHF Teletype. It is not recommended that the output of this particular AFSK generator be fed to a sideband transmitter to attempt low frequency FSK. The output of this circuit, while a reasonably good sine wave, is not perfect, and some spurious sideband generation may result. The relay keying circuit is applicable to all phases of Teletype, and can be used in preference to a standard polar relay. If reversal of the tones or keying mode is desired – not necessary, but perhaps desirable in some cases – SPDT reed relays are available. The total elimination of a bias supply (needed with a polar relay) and the ability to separate receiver and transmitter from the same frequency and still maintain local copy are easily appreciated.

Several modifications to this circuit are readily apparent. One amateur who built it added an extra transistor as a switch to further isolate the keyboard, instead of the relay. Another built the unit on a printed circuit board. Each, however, has retained the simplicity of the tone generation circuit and discovered the fun in VHF Teletype

. . .WA3JR

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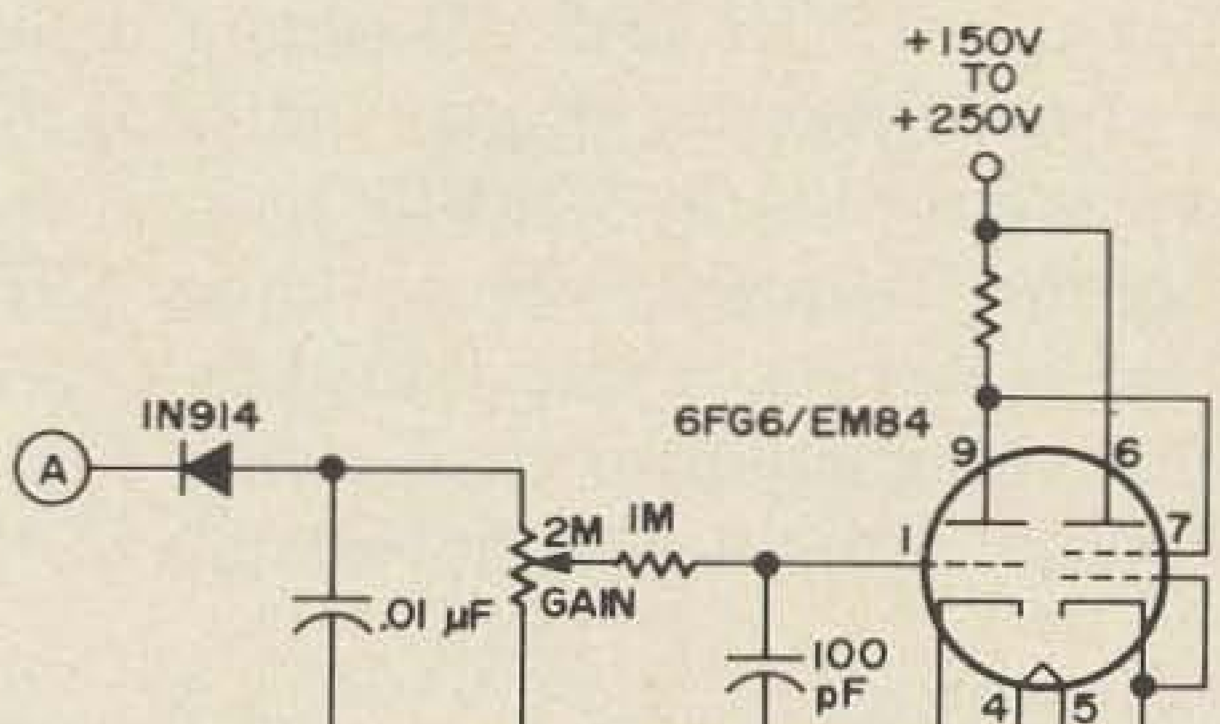
Tuning Indicators for SSTV Monitors

For several years I have been experimenting with SSTV and have realized that there is a need for a device to aid in tuning the SSTV signal to provide the correct audio output tones from an SSB receiver. I've developed and tested tuning indicators for SSTV monitors in both solid-state and tube-type designs. The type used with tube model monitors incorporates a 6FG6 light bar indicator, and a light emitting diode (LED) is used with solid-state designed monitors.

Solid-state and tube-type SSTV monitors equipped with tuning indicators are shown in the photograph of Fig. 1. The monitor on the left is a tube-type based on the design by MacDonald (QST, March 1964). The light-bar tuning indicator is located just below the CRT screen. The monitor on the right of the photograph is a solid-state, magnetically deflected design based on a circuit by Make Tallent W6MXV. The LED tuning indicator is installed just below the vertical reset pushbutton.



Tube-Type Tuning Indicator

The signal diode on the indicator input (point A of the schematic diagram) should

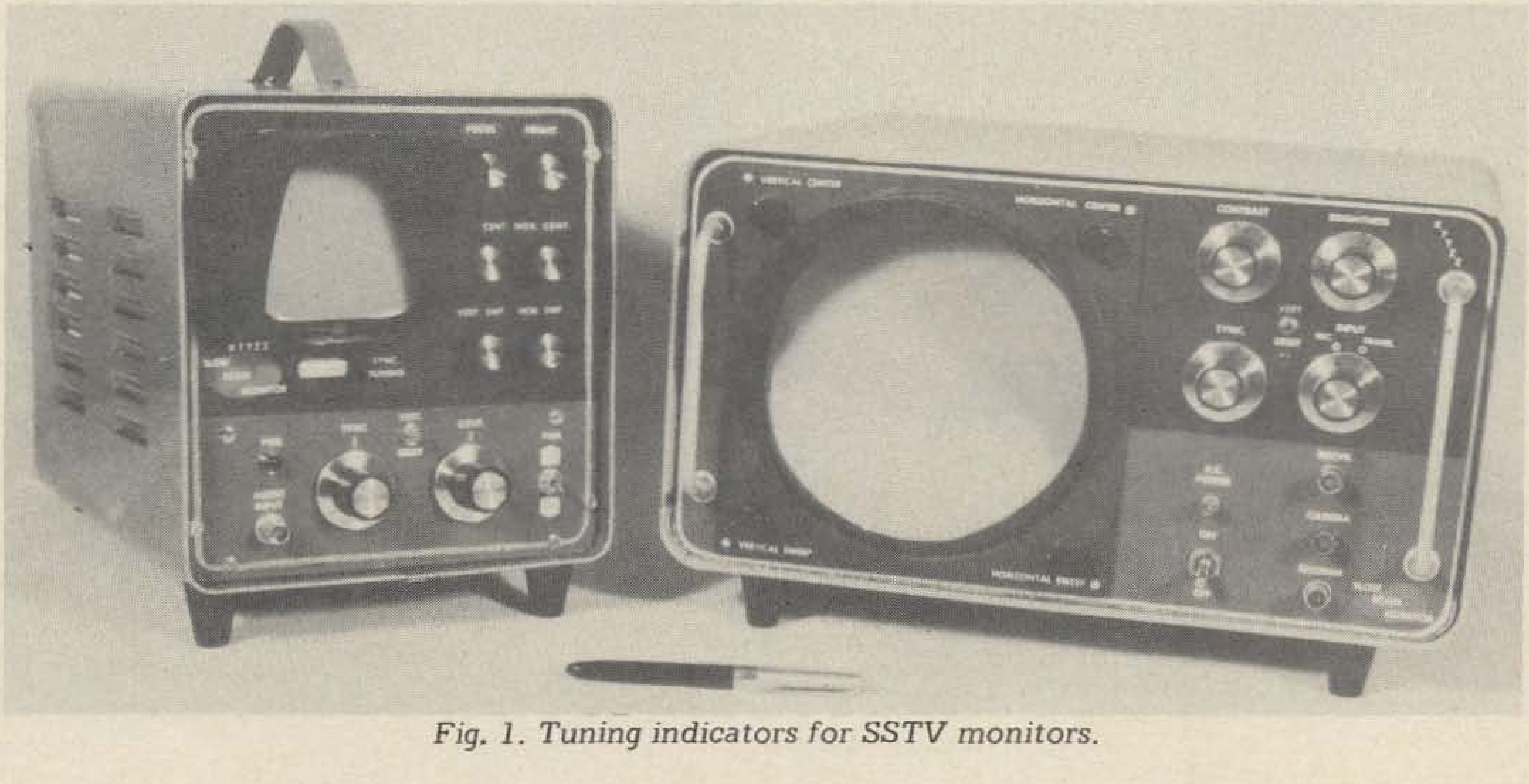


Fig. 1. Tuning indicators for SSTV monitors.

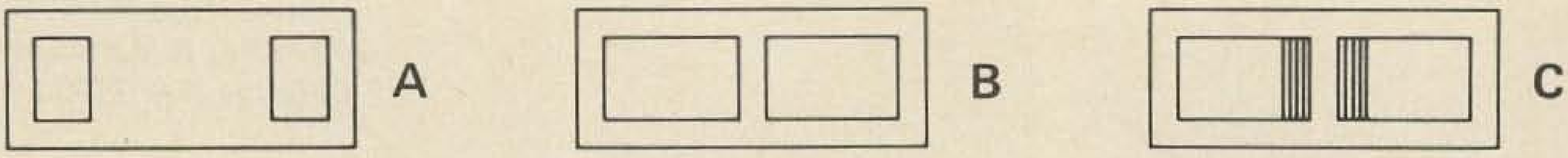


Fig. 2. Tuning indicator displays. The no-signal state is shown in A. B shows presence of a steady 1.2 kHz signal; C is a 15 Hz flickering to indicate that the SYNC signal is in tune.

be connected to the high side of the SYNC gain control (R1 of the MacDonald circuit). High voltage for the indicator is taken from the same voltage as that supplied for the 12AX7 limiter. With a 1200 Hz test signal connected to the input of the monitor, of sufficient level to fully saturate the limiters, the gain control on the tuning indicator is adjusted until the two light bars in the display tube almost close. When a 1200 Hz SSTV SYNC signal is being received, the display on the 6FG6 tube will flicker at a 15 Hz rate. Maximum deflection of the flickering display indicates that carrier reinsertion by the SSB receiver is at the proper frequency for optimum SSTV picture reception. Typical displays as seen on the tuning indicator are shown in Fig. 2.

Figures 3 and 4 are photographs of the tube-type monitor showing the installation of the light-bar SSTV tuning indicator. The small circuit board just below the base of the tuning indicator tube is used to mount the gain control, bypass capacitor and rectifier. The remainder of the components are mounted on the tube socket.

LED Tuning Indicator

The components for this circuit were mounted on the plug-in circuit card containing the limiter and FM detector circuits. The 88 mH toroid and associated parts for the tuning indicator circuit are shown in the photograph of Fig. 5. When the circuit assembly is finished, power is applied to the circuit and a 1200 Hz test signal is connected to the input at point B

Fig. 3. Tuning indicators for SSTV monitors.

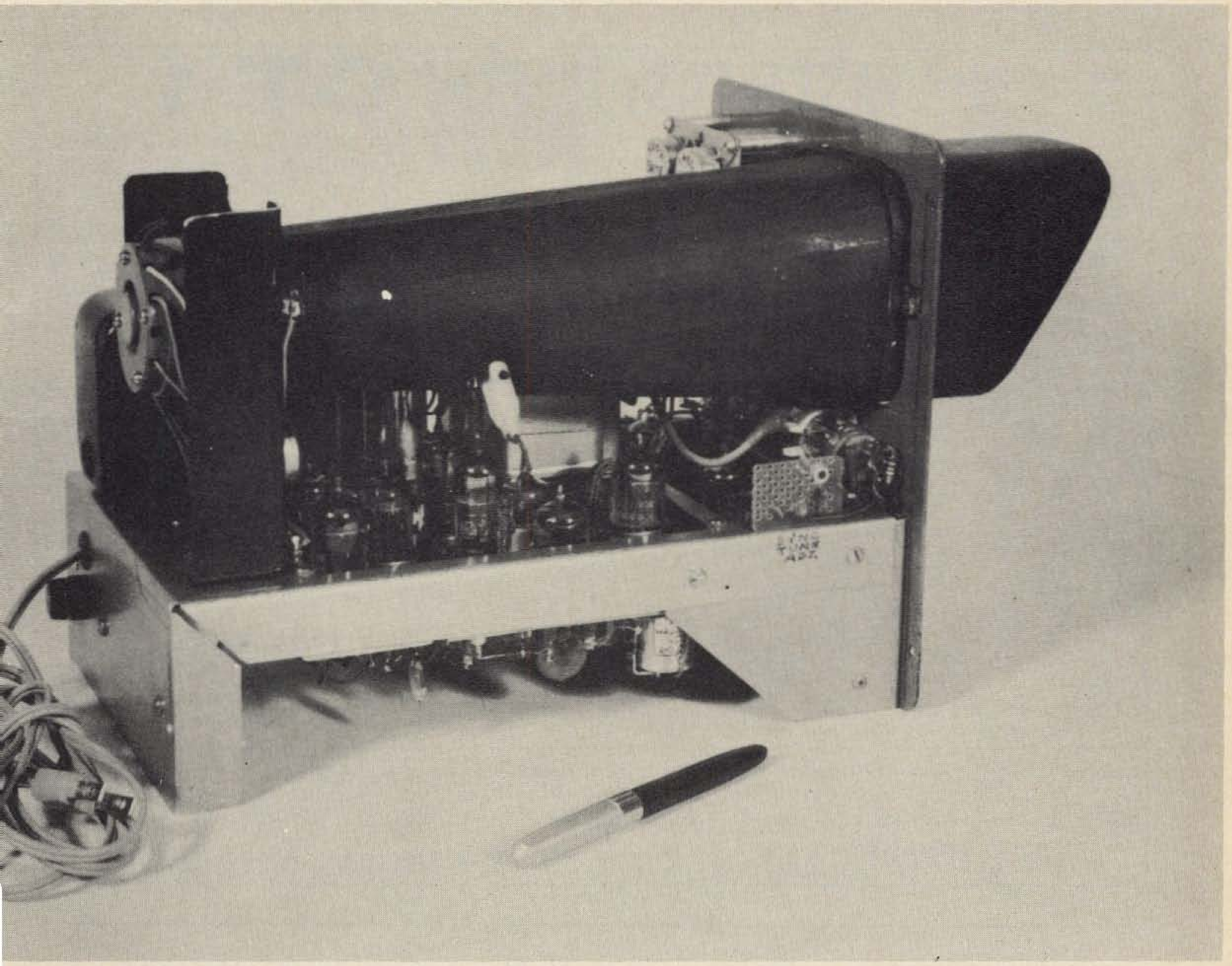


Fig. 5. Tuning indicators for SSTV monitors.

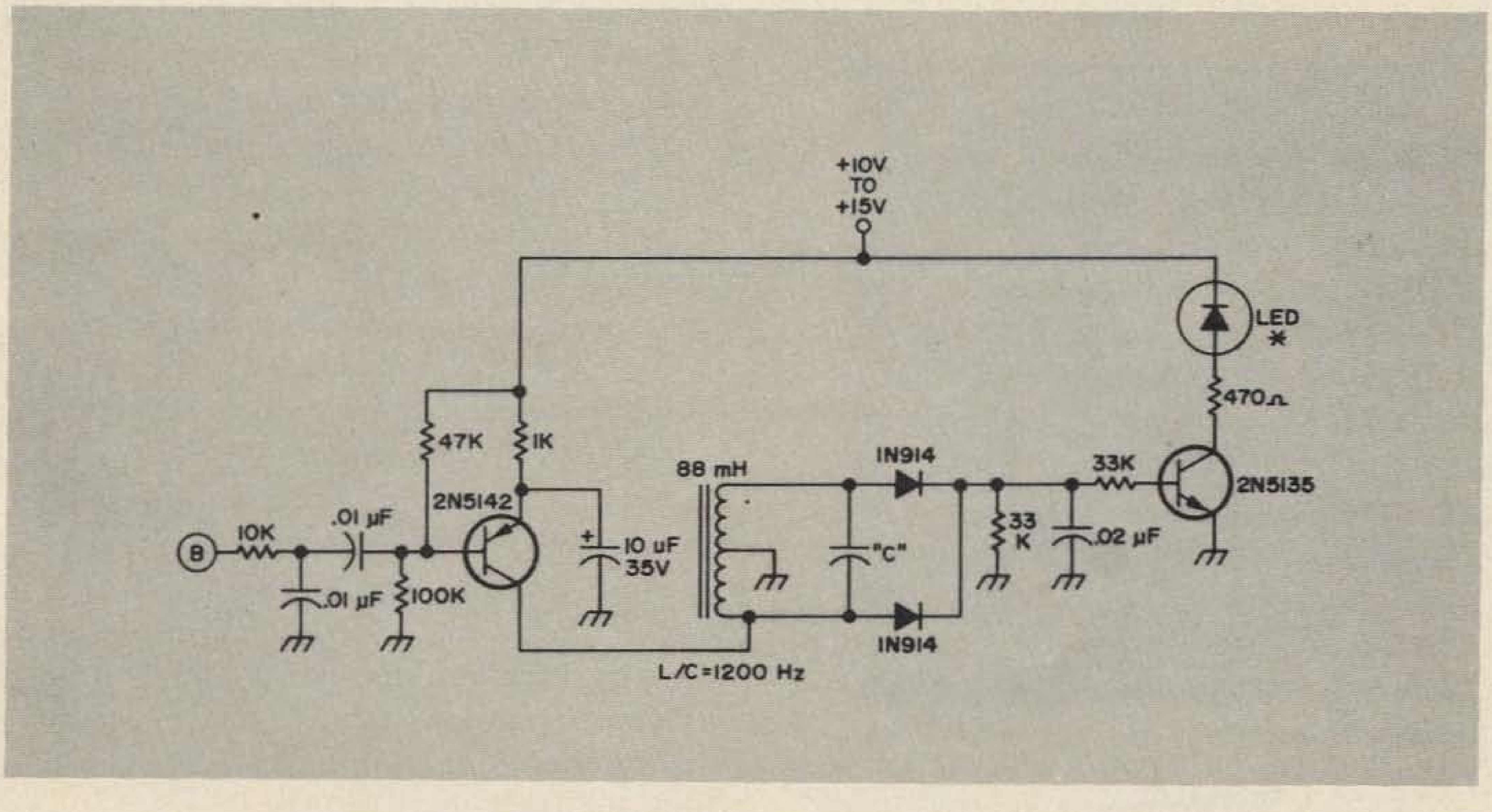


Fig. 6. SSTV LED tuning indicator for solid-state type monitors.

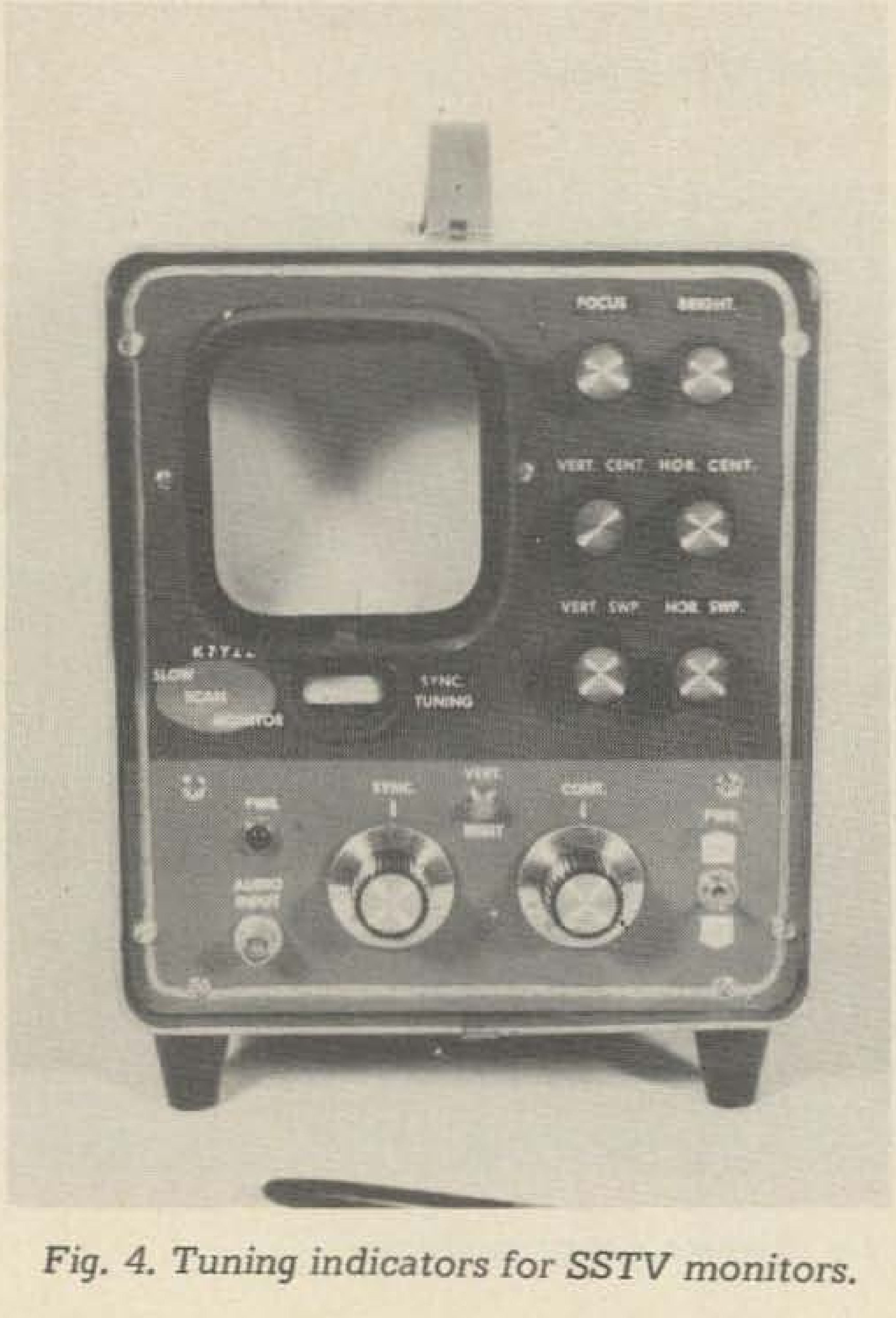


Fig. 4. Tuning indicators for SSTV monitors.

on the schematic (Fig. 6). The capacitor is selected to resonate the 88 mH inductor to 1200 Hz by monitoring the output voltage developed across the diode load resistor with a VTVM.

To install the LED tuning indicator in a solid-state monitor such as the model by W9LUO described in the March 1971 QST, connect input point B to the collector of transistor Q2. A 1200 Hz SSTV SYNC signal will cause the LED to flicker at the 15 Hz rate. The indicator will be dark if the SYNC signal is absent. When the receiver is mistuned to the point that SSTV video or noise is appearing in the tuning indicator, the LED will flicker at a random rate.

From a study of the schematic of the Model 70 Robot SSTV Monitor it looks like the input to the LED SSTV tuning indicator (point B) should be connected to pin number 6 of the integrated circuit U1 709C limiter.

. . .K7YZZ■

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LET'S REVISE The MORSE CODE

I've just read Ford's article of the same title in the November issue of 73 and it is wonderful, well thought out, logical and should be adopted immediately; also we should end poverty and war. In other words, no matter how good an idea is, if it involves something new or different it is a dirty communistic plot to violently overthrow the status quo.

What we need is a system that will take the present equipment and make it work more efficiently. Now, although I could have thought of this all by myself, if given time, the credit should really go to some other guy. Let me explain. When I bought my TG34 code machine there were four tapes with it and one was a skip tape. A skip tape is one where every letter is sent at the 20 wpm rate but there is about a four second pause between letters so the Novice can say, "What the hell was that?" and have time to think about it before the next letter rushes at him. As Ford points out, code is an audio response phenomenon and letters sent slowly do not sound anything like letters sent fast. But it is just as easy to learn the fast letters as it is to learn the slow letters – in fact I think it is easier.

Now hear this – here is the secret of the Morse code – free. To send code everyone should set his bug or IC keyer to the 20 wpm speed. To send five words per minute you pause between letters to allow time to think, and you wait longer between words for the person copying to take a breath and all this time he is learning what the 20 wpm letters sound like. Believe me, it is easier to receive with this system because the complete letter goes into your mind's shift register very rapidly and you have more time to search your memory before the next letter arrives. It works; you will be astounded at the rapid progress you will make. Try it with the next Novice you work and see for yourself. . . .WB6JNI

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Tom Yocom WAØZHT
1530 Country Club Drive
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If you are a regular reader of 73 Magazine, you have undoubtedly noticed that a large number of articles have appeared covering the various aspects of amateur 2 meter FM operation. The intent of these articles has been to entice you to give FM a try. Many people have been involuntarily bitten by the FM bug. I am no exception. I have found a large amount of personal satisfaction in designing and building digital circuits for use in conjunction with a 2 meter repeater. Through this endeavor I have been able to learn about several different fields: Touch-Tone, discrete components, and integrated circuits.

Perhaps one of the more surprising things that happen when you start to investigate a new field is the large number of new techniques you are compelled to investigate and learn. My pursuit of control circuits for an FM repeater has lead me into several textbooks dealing with the subject of switching theory as it applies to the design of digital circuits.

The repeater that I have been working on for the past 6 months consists of a large number of Sylvania TTL integrated circuits that were purchased on the surplus market at a cost of 10 cents per flatpack.

There is more to building a device than removing the components from the original circuit board.

In digital design I have found that one frequently starts with a rather simple block diagram of the device desired and then proceeds to draw the detailed logic diagram consisting of the various *nand* and *nor* gates required to accomplish an objective. It is frequently useful to express some of the relationships mathematically using Boolean algebra. If you have mastered the subject you can then apply simplification rules to the equations to produce a less complicated statement of the problem. This is desirable because as you reduce the complication of the equation, you are in effect reducing the number of devices that will be required in the final circuit you construct. A simplified equation will lead to several benefits which come about as a result of less components:

1. Lower cost
2. Decreased construction time
3. Smaller area through less wiring and interconnection
4. Increased reliability
5. Simplified schematics
6. Lower power consumption

The September 1970 issue of 73 described P. J. Ferrell's digital circuit that was used to automatically generate the CW identification for a repeater located in Seattle, Washington*. His call-letter generator consists of a five-digit ripple counter which is used to control the characters generated. When you design the unit, you are basically saying things like this:

1. I want a dot when the counter equals 0.
2. I want a dash when the counter equals 1.
3. I want a dash when the counter equals 2.
4. I want a space when the counter equals 3.
5. I want a dot when the counter equals 4.
6. I want a space when the counter equals 5.
7. Etc.

If you examine the above statements you will be able to see that what has been specified is the sequence dot dash dash blank dot dash . . . in terms of a sequential counter. The basic logic problem becomes one of specifying when the dots, dashes, and blanks are required as a function of the value existing in the counter. One way is to use a lot of gates or diodes to in effect say, "If the binary pattern in the counter is 1 1 0 1 1 then I want a dash; if the binary pattern is 1 0 1 0 0 then I want a dot." This would imply that you would need a lot of gates with 5 inputs if you wanted to get the job done. When I was faced with this problem, I went to the textbooks and was glad to discover that someone else had already faced the problem and solved it for me!

The original article suggested the use of a Karnaugh map for minimizing the number of diodes required in the read-only diode memory. Karnaugh maps are helpful in many instances, particularly when the number of variables is four or less. Many people find that when there are more than four variables the map becomes rather difficult to understand. Of course, the world does have map experts but what amateurs need is a simpler approach to the

CHARACTER STREAM	DECIMAL COUNT	FF-A	FF-B	FF-C	FF-D	FF-E	FF-F	1's
				COUNTER FLIP-FLOPS				
blank	0	0	0	0	0	0	0	0
—	1	0	0	0	0	0	1	1
•	2	0	0	0	0	1	0	1
•	3	0	0	0	0	1	1	2
blank	4	0	0	0	1	0	0	1
•	5	0	0	0	1	0	1	2
blank	6	0	0	0	1	1	0	2
blank	7	0	0	0	1	1	1	3
blank	8	0	0	1	0	0	0	1
•	9	0	0	1	0	0	1	2
—	10	0	0	1	0	1	0	2
—	11	0	0	1	0	1	1	3
blank	12	0	0	1	1	0	0	2
•	13	0	0	1	1	0	1	3
—	14	0	0	1	1	1	0	3
blank	15	0	0	1	1	1	1	4
—	16	0	1	0	0	0	0	1
—	17	0	1	0	0	0	1	2
—	18	0	1	0	0	1	0	2
—	19	0	1	0	0	1	1	3
—	20	0	1	0	1	0	0	2
blank	21	0	1	0	1	0	1	3
—	22	0	1	0	1	1	0	3
—	23	0	1	0	1	1	1	4
•	24	0	1	1	0	0	0	2
•	25	0	1	1	0	0	1	3
blank	26	0	1	1	0	1	0	3
•	27	0	1	1	0	1	1	4
•	28	0	1	1	1	0	0	3
•	29	0	1	1	1	0	1	4
•	30	0	1	1	1	1	0	4
blank	31	0	1	1	1	1	1	5
—	32	1	0	0	0	0	0	1
blank	33	1	0	0	0	0	1	2
blank	34	1	0	0	0	1	0	2
blank	35	1	0	0	0	1	1	3
—	36	1	0	0	1	0	0	2
•	37	1	0	0	1	0	1	3
—	38	1	0	0	1	1	0	3
blank	39	1	0	0	1	1	1	4

Fig. 1. Basic count values and other data.

*"Integrated Circuit CW ID Generator, P.J.Ferrell 73 Magazine, September 1970, p. 16.

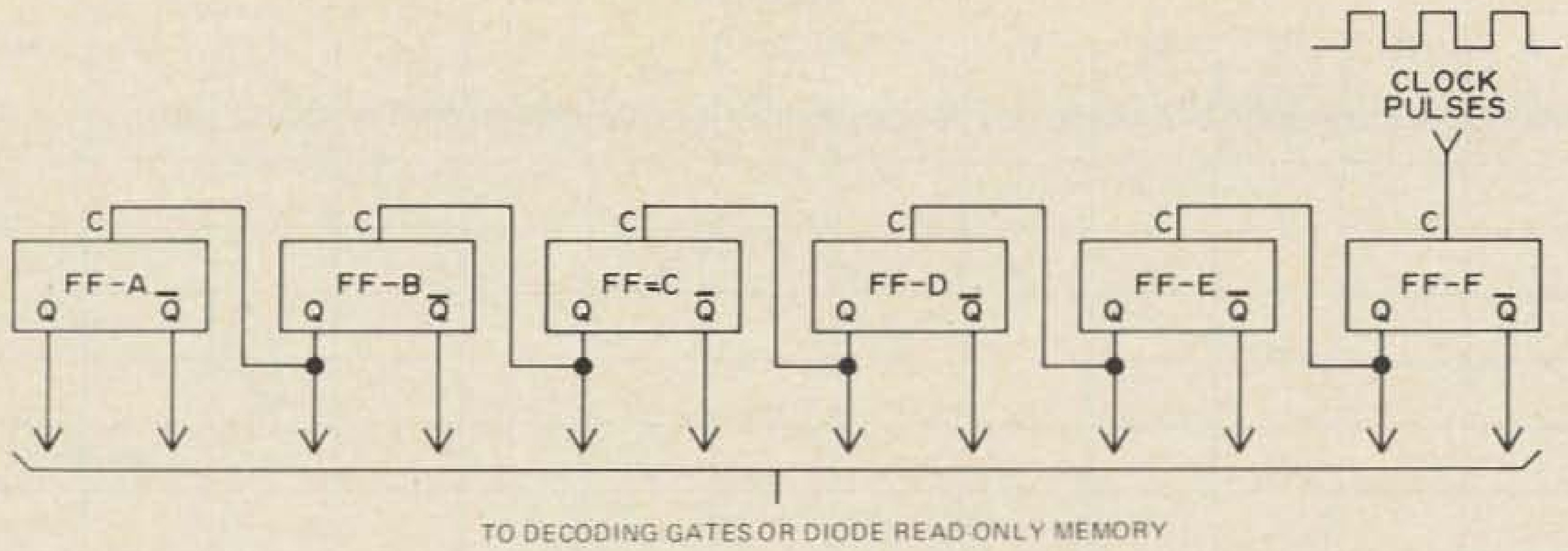


Fig. 2. Ripple counter described in text.

problem of simplification of counter decoders.

The Tabular Method

Several textbooks describe a method that requires a fair amount of clerical work but only a limited amount of real thinking. I chose to use that method. The discussion that follows is aimed at showing you how to apply the "Tabular Method" to simplify counter decoders. (An excellent discussion of the method, with some sophisticated extensions, exists in "Switching Circuits for Engineers," by Mitchell P. Marcus.)

So that you can better understand the relevancy of the Tabular Method, let us analyze the decoding necessary for constructing a digital CW code identifier having a 6-bit counter. Although most amateur calls can be described without resorting to more than 32 different characters (dots, dashes, and blanks), let's generate a fancy message. (Note that *any* message could be generated, e.g., RST 589 IOWA K.)

When the call is to be transmitted, your system will probably cause a push-to-talk relay to be activated. Consequently, it would be nice to begin the message with a blank to give the relay time to pull in. If the identifier is used in a complex system that supplies dial tone to its users, it may also be desirable to have a blank at the end so that the CW does not "run into" the dial tone. If you put these thoughts together, you will have a message that closely resembles the one described in Fig. 1.

Figure 1 contains additional information that will be referred to in different stages of our discussion of the simplification procedure. You should notice at this point that each character that composes the message has been paired with the value that would be in the counter when the character was to be generated. The value of the counter is shown in decimal and also in binary for your conversion convenience.

The zeroes and ones in Fig. 1 represent the binary equivalent of the decimal numbers shown in the "decimal count" column. A zero means that the associated flip-flop is *reset* while a one means that the flip-flop is *set*. (Some manufacturers refer to the outputs as Q and $\overline{Q}$, corresponding to true and false; Q = true = 1 and $\overline{Q}$ = false = 0.) For convenience in referencing the flip-flops that compose the various stages of the counter, the flip-flops are designated as A, B, C, D, E, and F (See Fig. 1). If flip-flop A is in the set, or true, state, we will write the letter A; however, if flip-flop

Original	New-A	New-B
000000✓	000x00✓	00xx00*
------	00x000✓	~~00xx00~~
000100✓	------	
001000✓	0001x0*	
------	00x100✓	
000110✓	001x00✓	
001100✓	------	
100001✓	00011x*	
100010✓	1000x1*	
------	10001x*	
000111✓	------	
010101*	00x111*	
011010*	x00111*	
100011✓	100x11*	
------	------	
001111✓	0x1111*	
100111✓		

011111✓		

Fig. 3. Values and reduction for blanks.

	BLANKS													
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	000000	000100	001000	000110	001100	100001	100010	000111	010101	011010	100011	001111	100111	011111
0001x0		√		√										
00011x				√				√						
1000x1						√					√			
10001x							√				√			
00x111								√				√		
x00111								√					√	
100x11											√		√	
0x1111												√		√
00xx00	√	√	√		√									
010101									√					
011010										√				

Fig. 4
Tabular display for blanks.

A is in the reset, or false, state, we will write $\bar{A}$ (read "A not"). Figure 2 shows the simple counter used in our discussion.

You should notice that the binary expression of the count shows that a 6-stage counter is being used. This means that you could have as many as 63 characters in the message (saving the last value of the counter for stopping the sequence). The counter has 64 unique states, 000000 through 111111.

The Tabular Method can be used to help simplify logical states for various applications but if we address our attention just to the CW identifier previously mentioned, then what we want in this case is a simplified statement of when we need dots and when we need blanks (the character generator circuitry produces dashes unless programmed to generate something else). The equations that result from the simplification can be used to specify the gates that must be used if you choose to decode the counter with integrated circuits. Since W7PUG's system used a read-only diode memory, I will address this discussion to that mode of implementation and show you how the Tabular Method will minimize the number of diodes required and produce a wiring map for use in constructing the decoder. For this example I chose a "fancy" message so that the counter would have to be composed of 6 stages rather than only 4 or 5.

Since the circuitry generates dashes automatically, we have to generate expressions for only the dots and the blanks. The Tabular Method proceeds as follows:

Expression for Blanks

We begin by extracting from Fig. 1 the binary values of the counter corresponding to when we need to have blanks generated. This produces the list of values shown in Fig. 3. As the list is made, we arrange the values so that values with the same number of 1's are grouped together. (The rightmost column in Fig. 1 is used to facilitate this listing.) The values are segmented with broken lines to show those numbers having no 1's, one 1, two 1's, etc. In the case of the blanks you see that there are six basic groups of values.

The method now requires that each of the values in a particular group be compared to each value in the next group. In Fig. 3, this means that 000000 will be compared to 000100 and 001000; 000100 and 001000 will be compared to 000110, 001100, 100001, and 100010. The comparison operation consists of seeing if it is possible to derive the second number from the first number by changing only a single digit position. When 000000 is compared to 000100 you should see that you can get 000100 from 000000 by changing the digit that is in the fourth position from the left. Consequently, these two values give rise to a new value written as 000x00 (The x shows the position that was changed to make the second value.) This new value is written into a new list shown in Fig. 3 as new-A. Comparing 000000 with 001000 yields a new entry of 00x000 in list new-A.

When a value is used in one of the comparing operations, and an entry is made in a new list, the original values are checked off. You will note that Fig. 3 shows that all but two of the original values were used in this combining operation. Each time a new group of numbers are used as "the first number," a separating line is drawn in the new list. Additional new lists are made until no further combinations can be made. Figure 3 shows the complete set of lists for the analysis of blanks. The values that do not combine are not checked but have been suffixed with an asterisk (*) to indicate that they are to be used in the next step of the simplification.

When the comparisons have been completed, a tabular display such as that shown in Fig. 4 is prepared. The column headings consist of the original counter values that were supposed to produce blanks. A row is added for each value that was suffixed with an asterisk when the comparisons were made. For each of the values shown to the left of a row, we now make an examination to determine the original terms which can be "generated" from the terms identifying the rows. The "generation" consists of

Rule 1 . . . A column, a, can be eliminated from the table if it has checks in every row that some other column, b, has checks. (The subset is saved.)

Rule 2 . . . . A column, a, can be eliminated if it has checks in the same rows as another column, b. (Given two identical columns, one can be eliminated.)

Rule 3 . . . . A row, z, can be eliminated if some other row, y, has checks in every column that z has, AND the number of 0's and 1's in z is equal to or greater than the number of 0's and 1's in y.

Fig. 5. Simplification rules.

replacing the x or x's with both 0 and 1 and then checking off the original terms created. For example, if we take the first row, with 0001x0 we can generate 000100 by substituting 0 for x and we can generate 000110 by substituting 1 for x.

We now place check marks beneath the original terms generated; 000100 and 000110. Applying the same process to an entry such as 00xx00 would produce these original terms: 000000, 001000, 000100,

BLANKS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	000000	000100	001000	000110	001100	100001	100010	000111	010101	011010	100011	001111	100111	011111
0001x0		✓		✓										
00011x				✓				✓						
1000x1						✓					✓			
10001x							✓				✓			
00x111								✓				✓		
x00111								✓					✓	
100x11											✓		✓	
0x1111												✓		✓
00xx00	✓	✓	✓		✓									
010101									✓					
011010										✓				

Fig. 6. Tabular display for blanks after application of reduction rules.

and 001100. The columns corresponding to each of these original values has a check mark opposite 00xx00. If the term contains no x's, for example 011010, then you place a check mark in only one column. When all of the check marks are in place, the table is ready to be simplified by the application of a few simple rules. Figure 4 shows the table with all of the check marks entered properly.

Figure 5 lists the rules that are applied to the table to perform the actual reduction. Let's apply these rules to Fig. 4 and produce the slightly modified form shown in Fig. 6.

For ease of identification, the columns in Figs. 4 and 6 have been labeled with letters of the alphabet. Rule 1 can be applied to columns L and N thereby eliminating column L. Rule 1 can be applied to columns G and K thereby eliminating column K. Rule 1 can be applied to columns A and B, thus eliminating column B. Rule 2 can be applied to columns A, E and C, thereby eliminating columns C and E.

Figure 6 shows with shading the columns that have been removed from the table. The object of this last step is *hopefully* to eliminate rows in the table. In this particular case, no rows were eliminated. Had rows been eliminated, the corresponding terms would be dropped during the next step of our simplification.

The final step in the simplification is to write a statement for the quantity of interest. This simplification was for blanks so we will write a statement which combines the terms opposite rows that were *not* eliminated from the table. The result that we get is as follows:

BLANKS = 001x0 or 00011x or 1000x1 or 10001x or 00x111 or x00111 or 0x1111 or 00xx00 or 010101 or 011010

You should recall that the binary values correspond to the state of the flip-flops A, B, C, D, E, and F. We can thus rewrite the statement by replacing the 0's and 1's with the appropriate flip-flop designator and simply dropping the x's. Doing this, 0001x0 becomes $\overline{A}\ \overline{B}\ \overline{C}\ D\ \overline{F}$. The resulting equation for blanks is thus:

	New-A	New-B
000010	00001x*	0x1x01*
- - - - - -	- - - - - -	0x1x01
000011	00x101*	011x0x*
000101	x00101*	011x0x
001001	001x01	
011000	0x1001	
- - - - - -	01100x	
001101	011x00	
011001	- - - - - -	
011100	0x1101	
100101	0110x1*	
- - - - - -	011x01	
011011	01110x	
011101	0111x0*	
011110		

Fig. 7. Values and reduction for dots.

BLANKS = $\overline{A}\overline{B}\overline{C}D\overline{F}$ or $\overline{A}\overline{B}\overline{C}DE$ or $A\overline{B}\overline{C}\overline{D}F$ or $A\overline{B}\overline{C}\overline{D}E$ or $\overline{A}\overline{B}DEF$ or $\overline{B}\overline{C}DEF$ or $A\overline{B}\overline{C}EF$ or $\overline{A}CDEF$ or $\overline{A}\overline{B}\overline{E}\overline{F}$ or $\overline{A}B\overline{C}D\overline{E}F$ or $\overline{A}BC\overline{D}E\overline{F}$

In order to implement this equation, one diode will be required for each of the *or*'s for a total of 10 diodes. For each of the terms in the equation, there will be one diode per flip-flop named. Thus $\overline{A}\overline{B}\overline{C}D\overline{F}$ will require the use of 5 diodes. There will thus be 56 diodes for the terms and 10 for the *or*'s for a total of 66 diodes. If we had not simplified, there would have been one diode for each value of the counter (14) plus 6 diodes for each value (6 x 14 = 84) or a total of 84 + 14 = 98 diodes. Application of the Tabular Method has thus reduced the number of diodes by approximately 30% – a 30% savings in parts and wiring! The savings that you will realize varies with the complexity of the message.

Expression for Dots

To be sure that you understand the simplification method, let's apply the technique to the values for dots.

Figure 7 shows the binary values that have been removed from Fig. 1 and listed in groups based upon the number of 1's in the values. You will notice that this time we have only 4 groups of values. As in the

DOTS

	A	B	C	D	E	F	G	H	I	J	K	L
	000010	000011	000101	001001	011000	001101	011001	011100	100101	011011	011101	011110
00001x	✓	✓										
*00x101			✓			✓						
x00101			✓						✓			
0110x1							✓			✓		
0111x0								✓				✓
0x1x01				✓		✓	✓				✓	
011x0x					✓		✓	✓			✓	

*=ROW HAS BEEN ELIMINATED BY APPLICATION OF RULES

Fig. 8. Tabular display for dots.

previous example, the simplification begins by comparing 000010 to 000011. This comparison yields the entry 00001x in the second table. None of the remaining values in the second group can be derived from 000010 by changing only a single digit. The simplification continues by comparing all of the values in the second group to the values in the third group. These comparisons generate the new values 00x101, x00101, etc. In this case, by the time all of the group comparisons have been made, all of the original values have been used at least once and are therefore suffixed with a check mark. The values in the new table (new-A in Fig. 7) are then compared and used to generate new values when possible. You should note that when values involving x's are compared, it is necessary that the two values contain x's in the same positions *before* you check to see if the second value can be derived from the first value by changing a single zero or one. Figure 7 shows that the final result consists of 7 terms with asterisks. The next step is to construct the tabular display of the original values and the asterisked values derived from the comparisons. Figure 8 shows such a table.

The next step is to place a check mark in the column or columns corresponding to the original values that can be derived from the asterisked terms. Figure 8 shows the completed table. Once again we must now apply the three rules shown in Fig. 5 to check marks in the tabular display.

Rule 1 can be applied to columns C and I thereby eliminating column C. Rule 1 can be applied to columns D and F thereby eliminating column F. Rule 1 can be applied to columns E, G, H, and K thereby eliminating columns G, H, and K. Finally, rule 2 can be applied to columns A and B thereby eliminating column A. We can now write a statement for dots in terms of the asterisked terms that still have at least 1 check mark in their row. The statement is:

DOTS = 00001x or x00101 or 0110x1 or 0111x0 or 0x1x01 or 011x0x

The statement is next written in terms of the flip-flop designators previously defined (A, B, C, . . .).

DOTS = $\overline{ABCD}E$ or $\overline{BC}D\overline{E}F$ or $\overline{A}BC\overline{D}F$ or $\overline{A}BCD\overline{F}$ or $\overline{A}C\overline{E}F$ or $\overline{A}BC\overline{E}$

As in the case for the blanks, one diode will be required for each term to be *or*ed

	WITHOUT SIMPLIFICATION	WITH SIMPLIFICATION	REDUCTION
BLANKS	98	66	30%
DOTS	84	34	60%
TOTAL	182	100	45%

Fig. 9. Diode count.

plus one diode will be required for each flip-flop mentioned in each term. The decoding for the dots will therefore require 6 + 28 = 34 diodes. Without simplification, the decoding would have required 84 diodes (12 + 72). Notice again that the

	FF-A	FF-B	FF-C	FF-D	FF-E	FF-F
00001X	0	0	0	0	1	X
X00101	X	0	0	1	0	1
0110X1	0	1	1	0	X	1
0111X0	0	1	1	1	X	0
0X1X01	0	X	1	X	0	1
011X0X	0	1	1	X	0	X

Fig. 10. Wiring map for dots

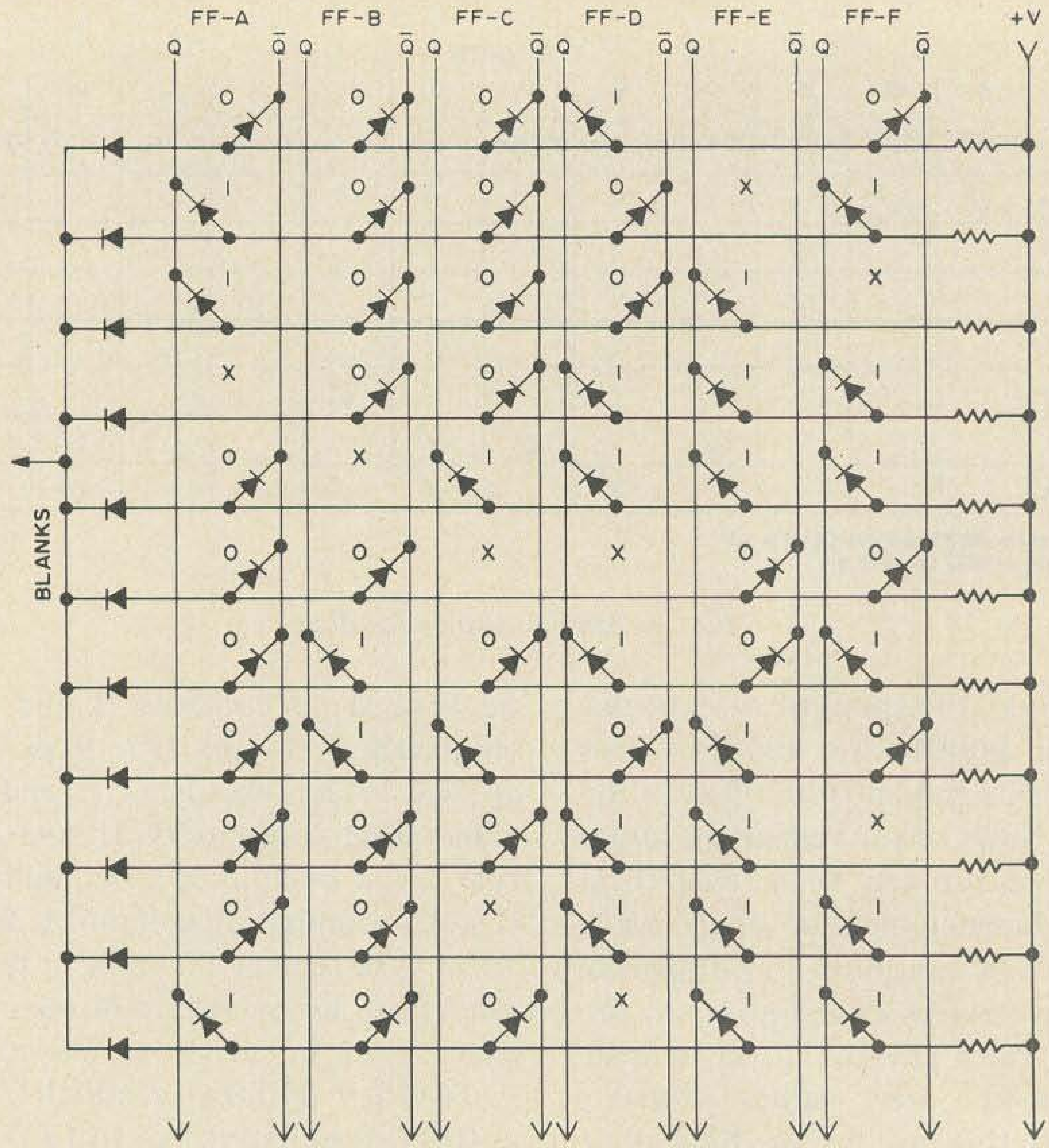


Fig. 11. Wiring map for blanks.

simpliciation has been well worth the effort!

If we take a look at the total problem we see that simplification has been very worthwhile. Figure 9 shows the diode count with and without simplification.

To complete our discussion, let us address ourselves to the proper interpretation of the equations as they apply to the actual wiring of the read-only diode memory. It is helpful to construct a "map" that will help you find your way around the wiring details.

Figure 10 is the wiring map for dots. Across the top of the map you will see the flip-flop designators. The various rows correspond to the individual terms that are in the reduced equation. Take an equation such as:

DOTS = 00001x or x00101 or 0110x1 or 0111x0 or 0x1x01 or 011x0x

For each of the terms, enter one row into the map. The 0's represent a diode connected to the false output of the flip-flop while the 1's represent a diode connected to the true output of the flip-flop. Where there are X's, no diodes are required. The map can thus be described by simply displaying the terms of the equation in a list! Such a wiring map is useful when you start to construct your decoder. Figure 11 shows the map with the diode wiring schematic superimposed to help you see the map's usefulness for wiring the blanks decoder.

In this discussion I have introduced you to a method of simplification that is not difficult and yet is flexible enough to allow easy simplification of count registers having many digits.

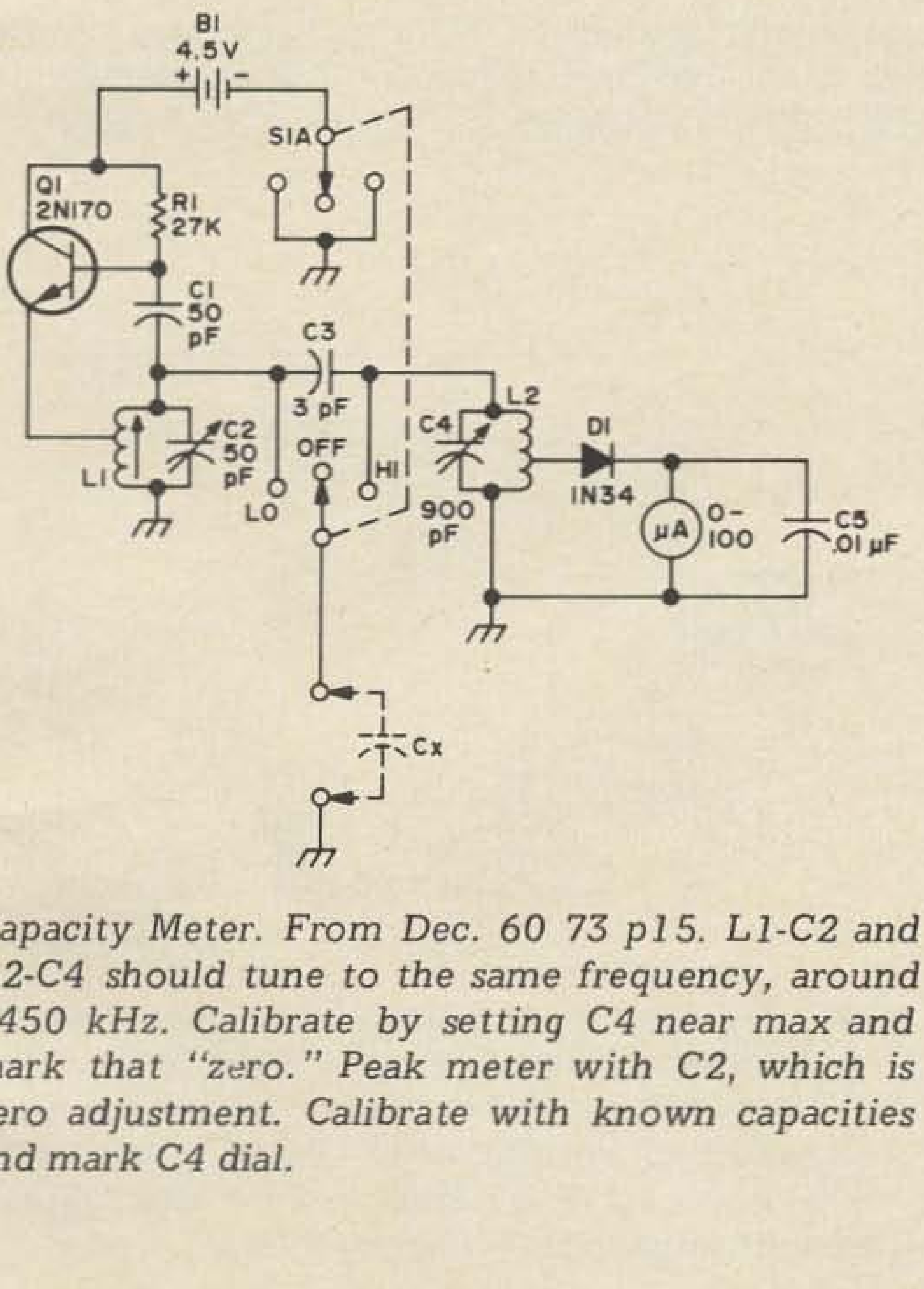
As a final testament to the method's utility, I have applied the principles described herein to my 5-digit counter and have an identifier running that flawlessly generates my call! Why not build yourself an identifier? You might include several decoders to generate signal reports, ARRL section, etc. for field day use!

. . .WAØZHT

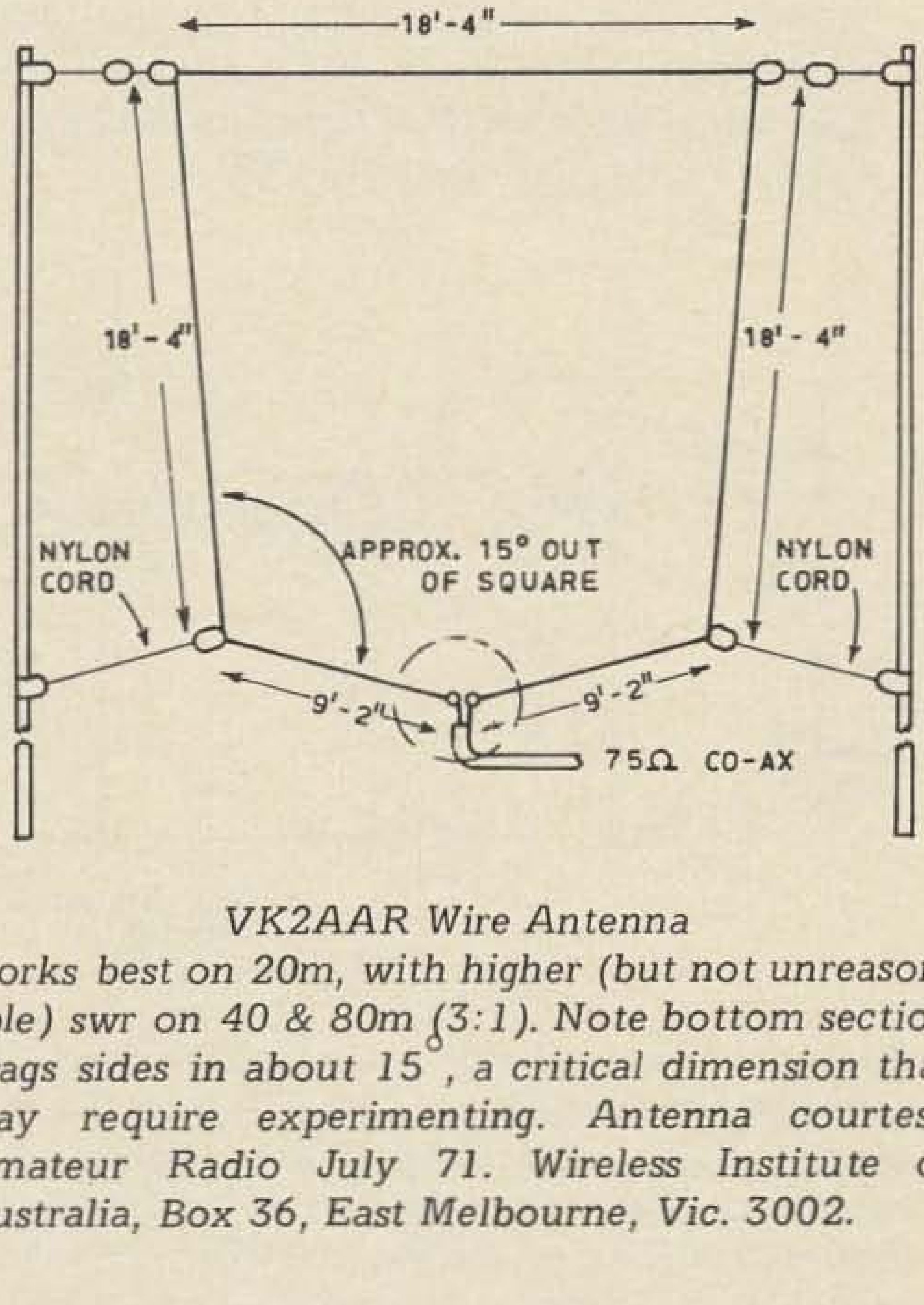
CIRCUITS, CIRCUITS, CIRCUITS...

The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.

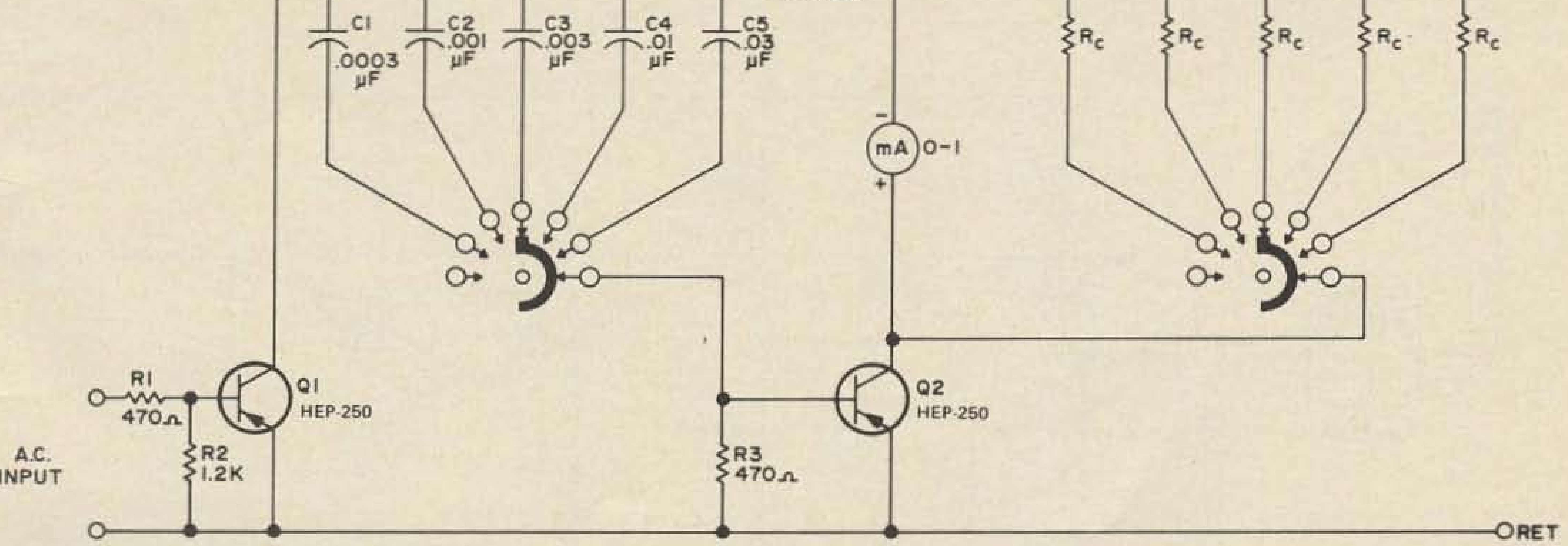


Capacity Meter. From Dec. 60 73 p15. L1-C2 and L2-C4 should tune to the same frequency, around 1450 kHz. Calibrate by setting C4 near max and mark that "zero." Peak meter with C2, which is zero adjustment. Calibrate with known capacities and mark C4 dial.

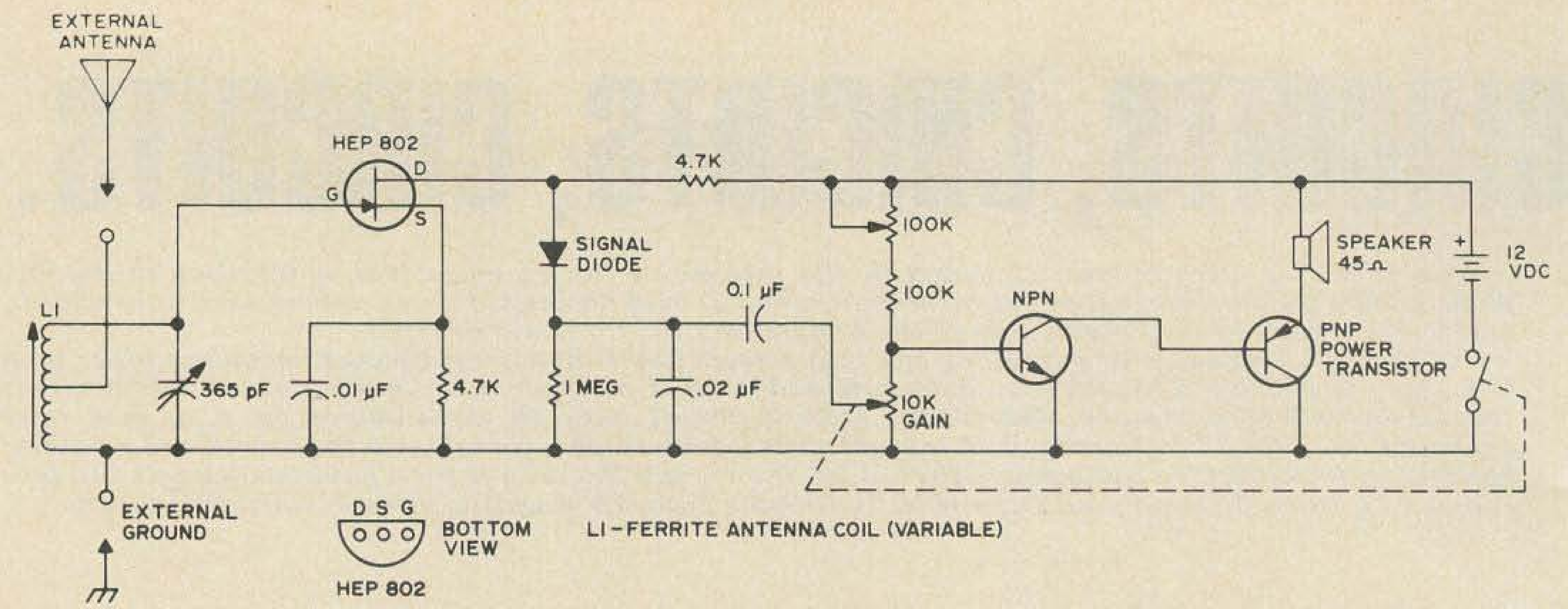


VK2AAR Wire Antenna

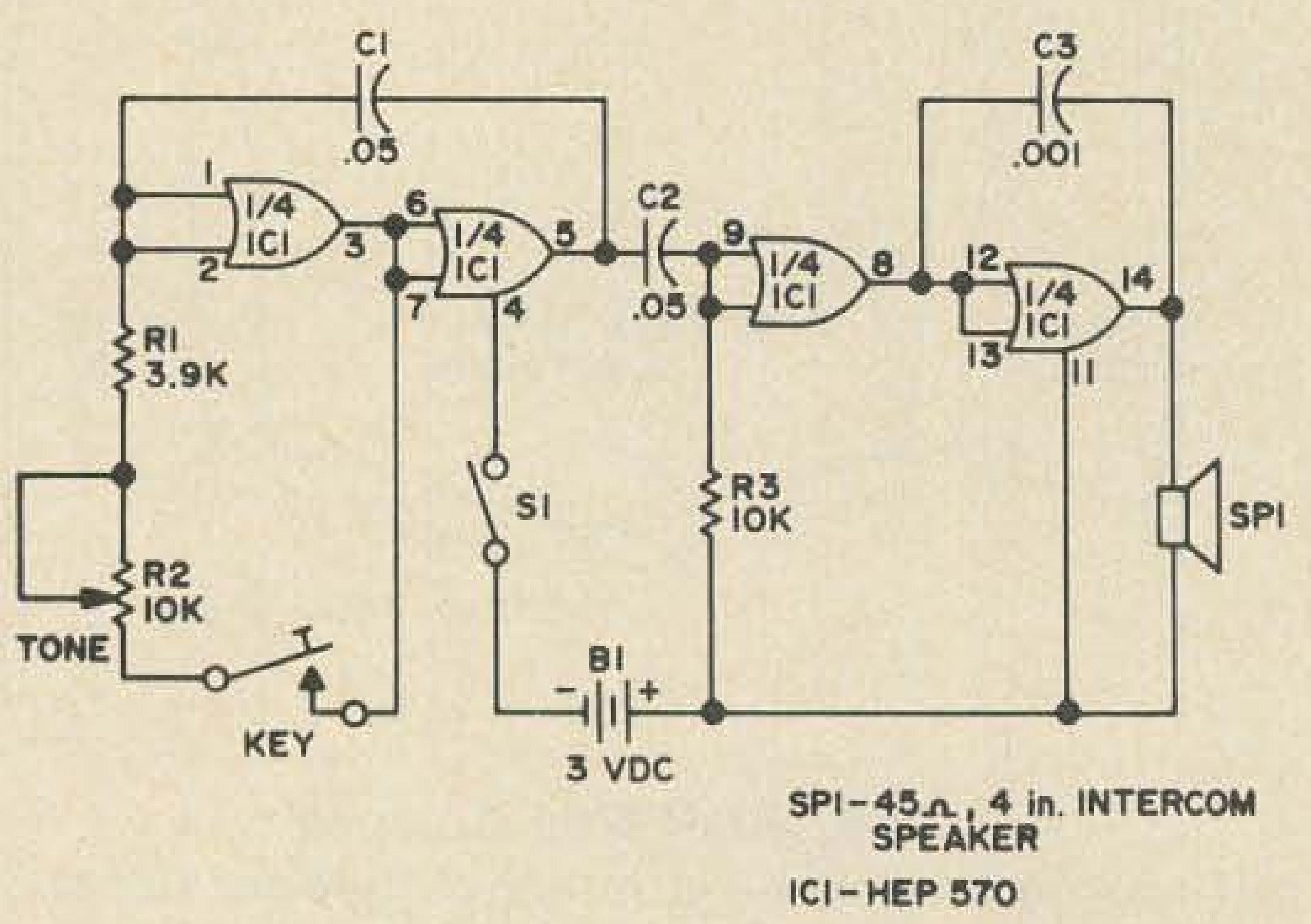
Works best on 20m, with higher (but not unreasonable) swr on 40 & 80m (3:1). Note bottom section drags sides in about 15°, a critical dimension that may require experimenting. Antenna courtesy Amateur Radio July 71. Wireless Institute of Australia, Box 36, East Melbourne, Vic. 3002.



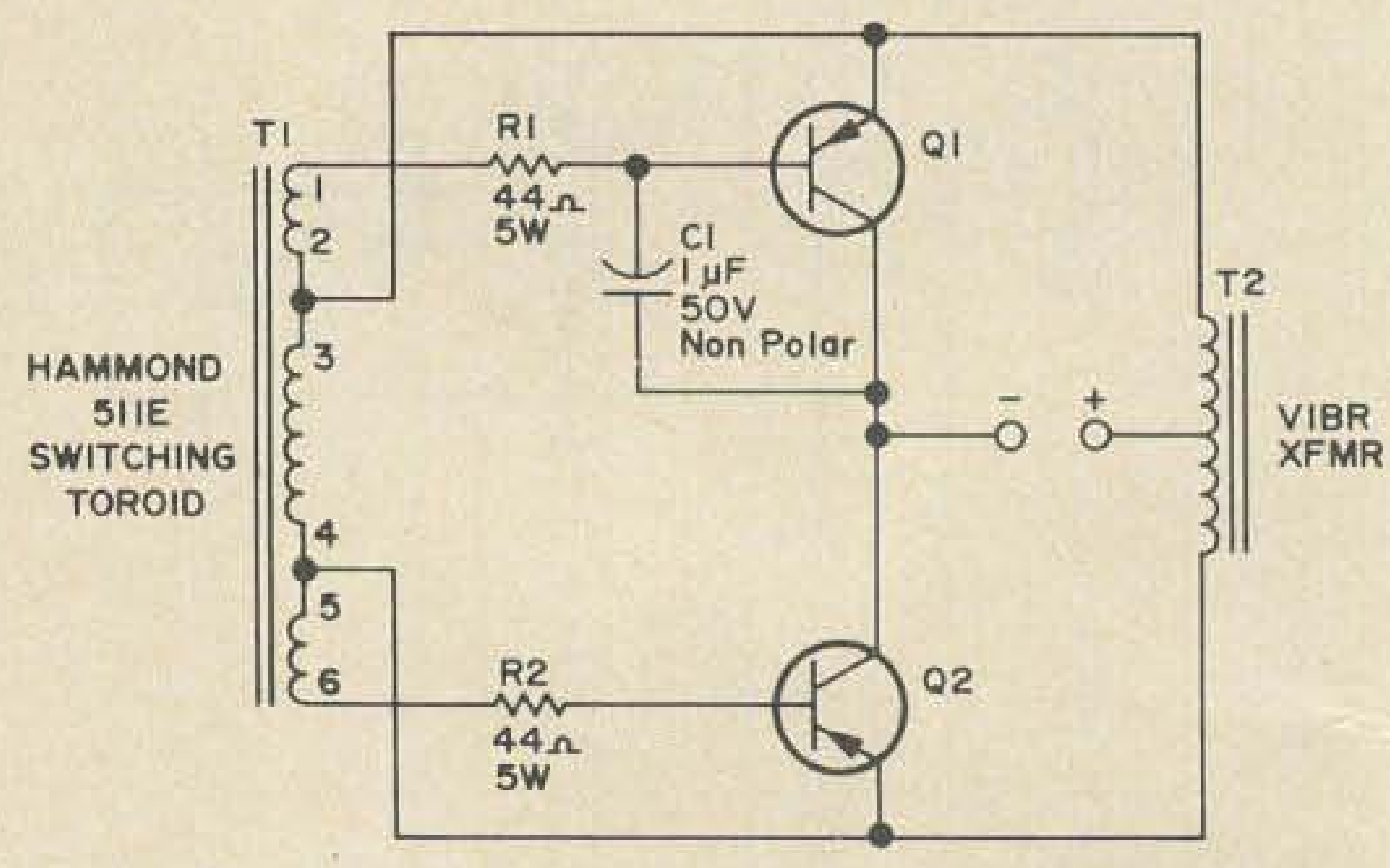
From 73 Magazine, November 1960, this schematic gives the basics for a simple, inexpensive audio frequency meter. For the cheapie special version, omit all switches and components associated with them. Connect a capacitor of proper value in place of SIA. Ranges are: OFF, 30 kHz, 10 kHz, 3 kHz, 1 kHz, and 300 Hz. Meter is 0–1 mA.



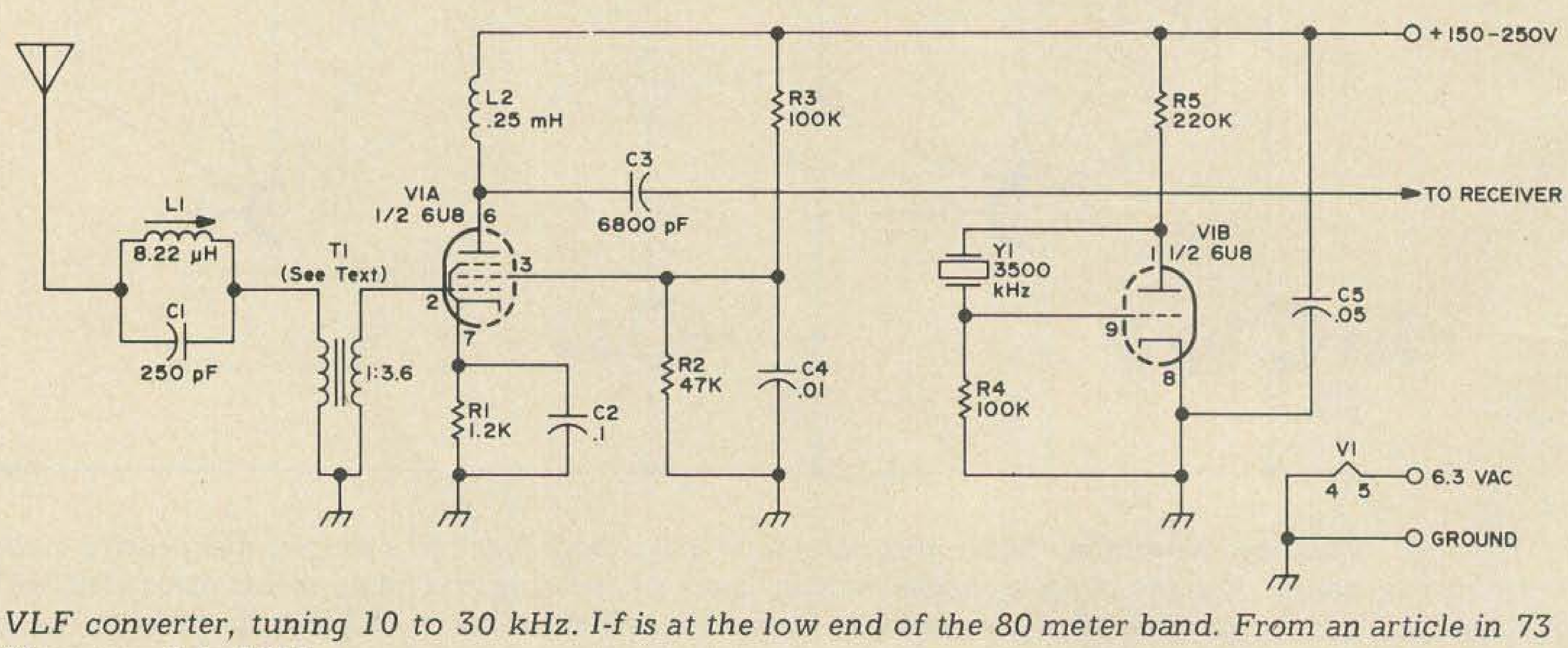
Three transistor radio (AM). Adjust R4 so voltage across speaker is 1/2 supply voltage. Works surprisingly well. Circuit courtesy Calectro Handbook. L1 is a ferrite antenna coil (variable) (Calectro #D1-841); Q2 is an NPN transistor (Calectro #K4-506); Q3 is a power PNP (Calectro #K4-521); D1 is a signal diode (Calectro #A1-227).



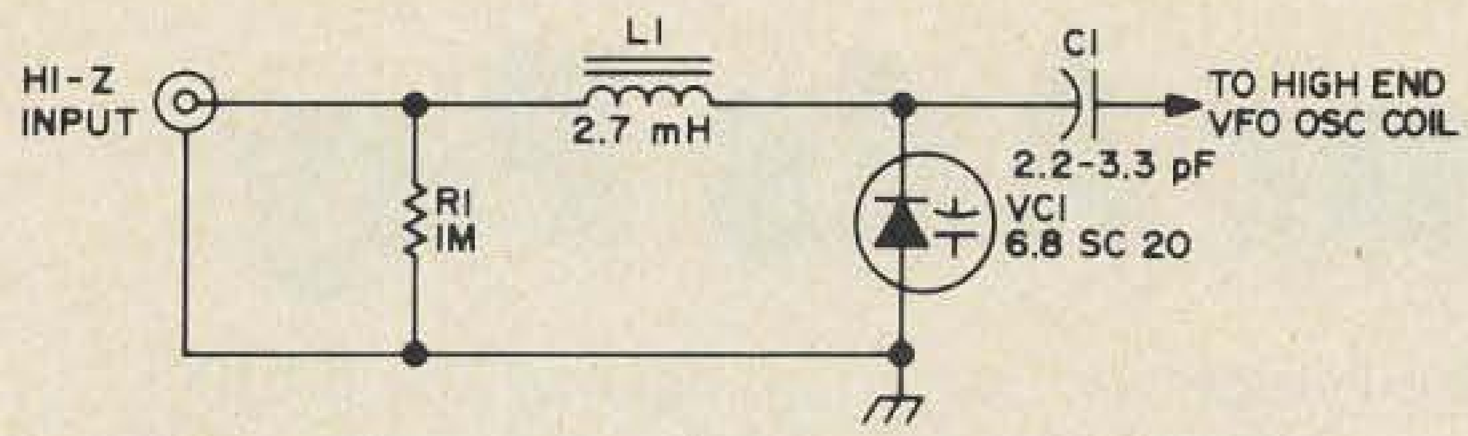
Code practice oscillator using one IC, loud. Intercom speaker may be replaced with a regular 4–8Ω speaker if a transformer is used to match the impedance down from 50Ω to 4Ω. Circuit is from Motorola HMA-36, Radio Amateur's IC Projects, available free from Motorola, Dept. 73, Box 20924, Phoenix AZ 85034.



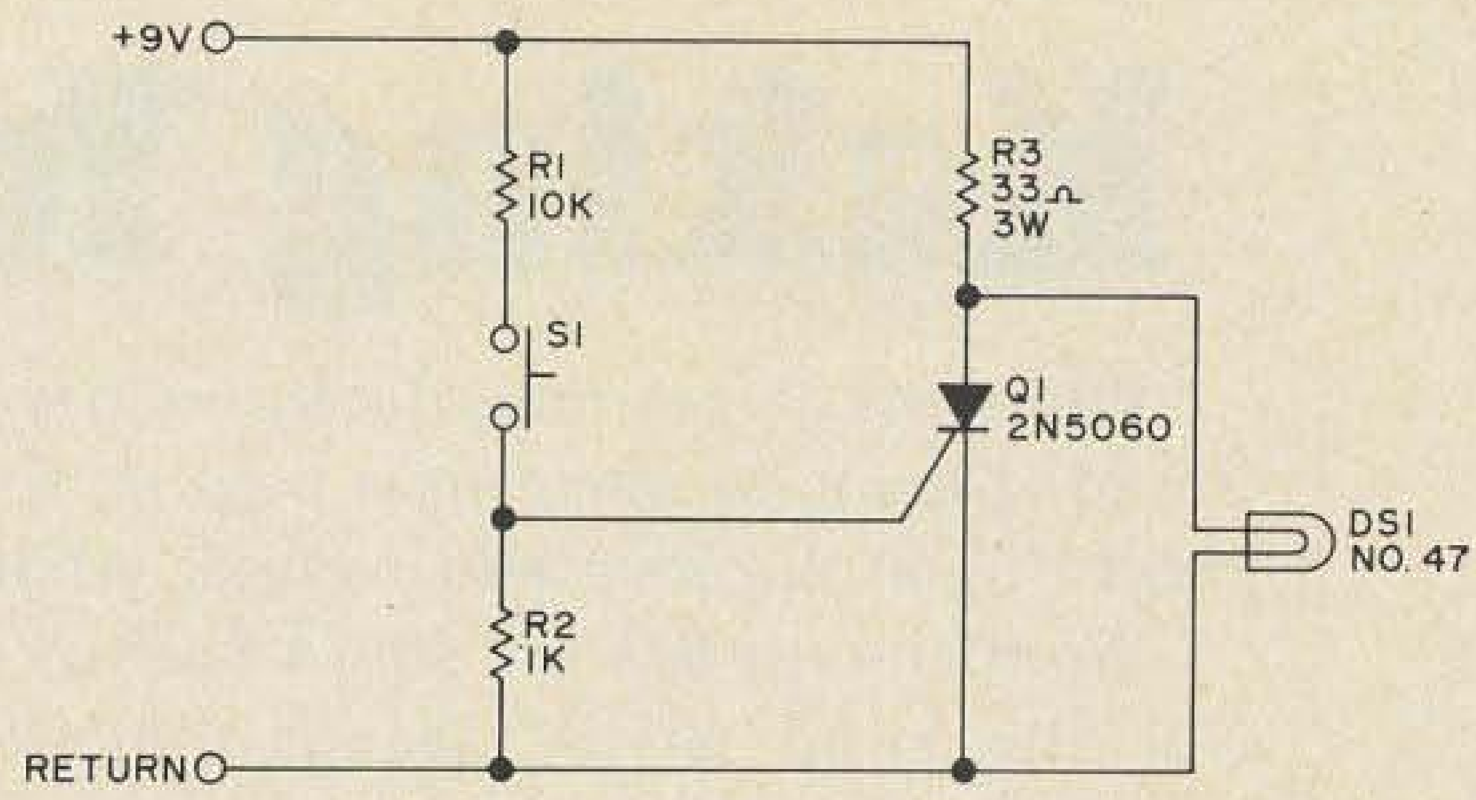
A transistor power supply for a vibrator-powered mobile rig. Called a "Plug-In Solid-State Vibrator Eliminator" by its designer, Vern Epp, it first appeared in FM Magazine, and is reprinted from The Best of FM, *available from Radio Bookshop, Peterborough NH 03458, for $4.95.*



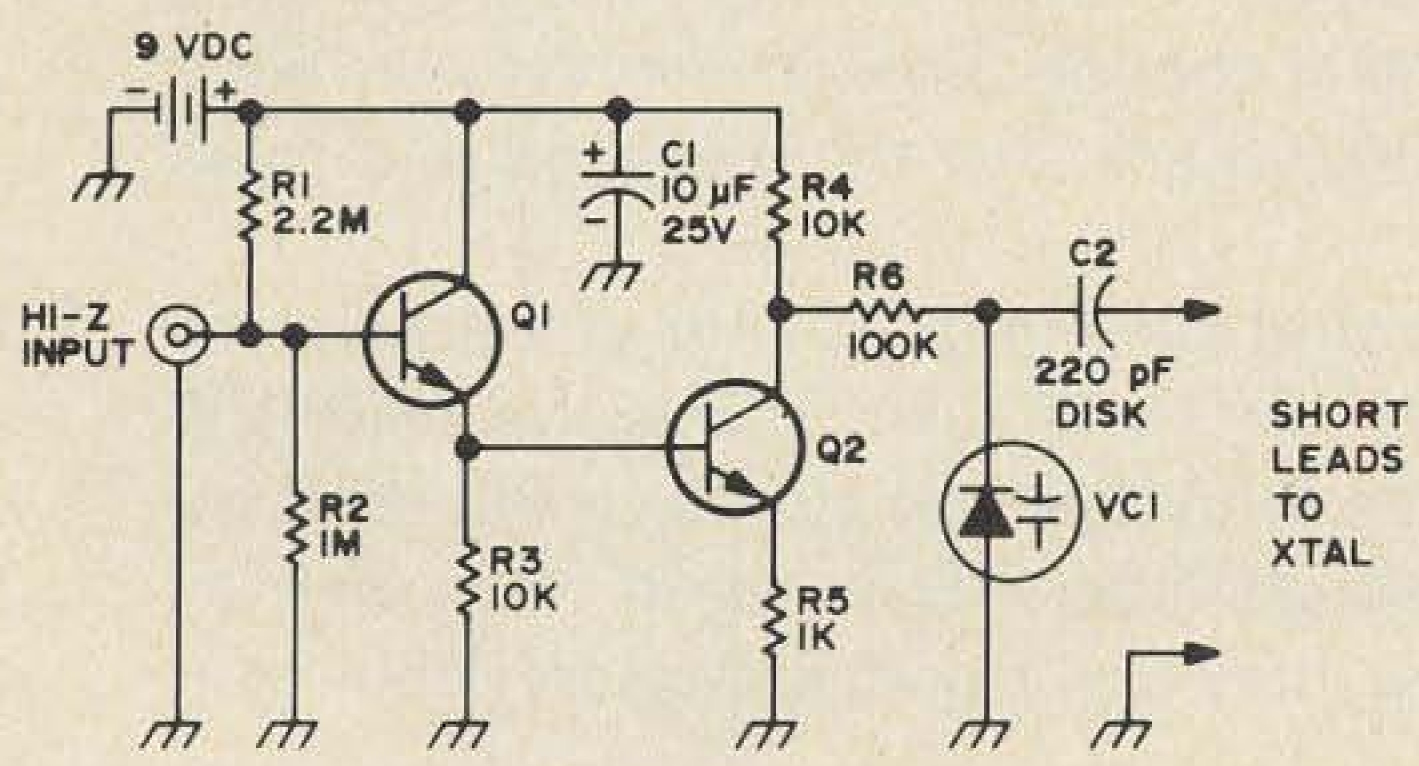
VLF converter, tuning 10 to 30 kHz. I-f is at the low end of the 80 meter band. From an article in 73 Magazine, July 1961.



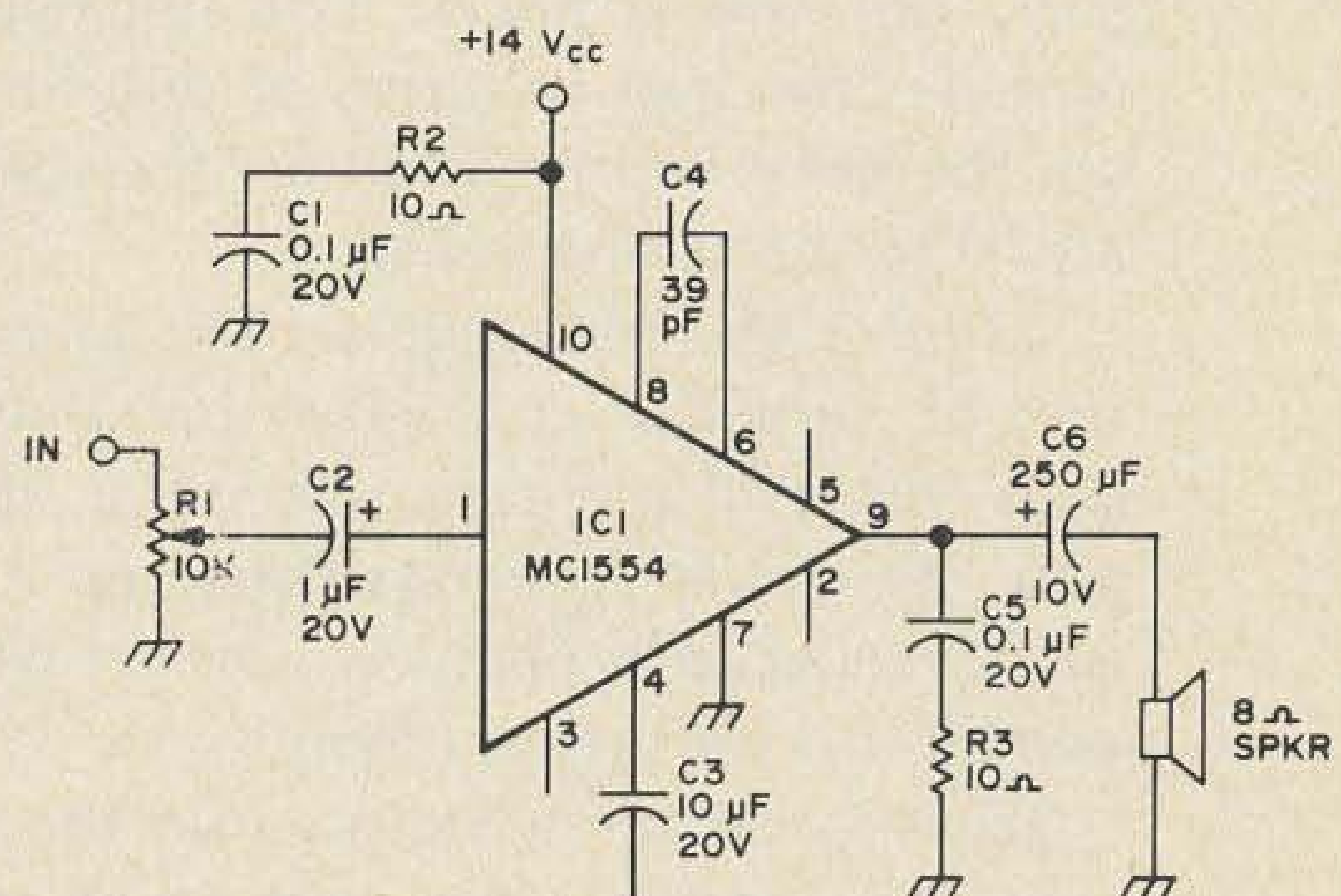
This varactor modulator will put your vfo-operated AM transmitter on FM in ten minutes. Assemble it on a standard three-terminal phenolic tiestrip and tuck it into a corner of your chassis. Both this modification and the one below for crystal controlled rigs should be driven with a high output, high impedance crystal or ceramic mike.



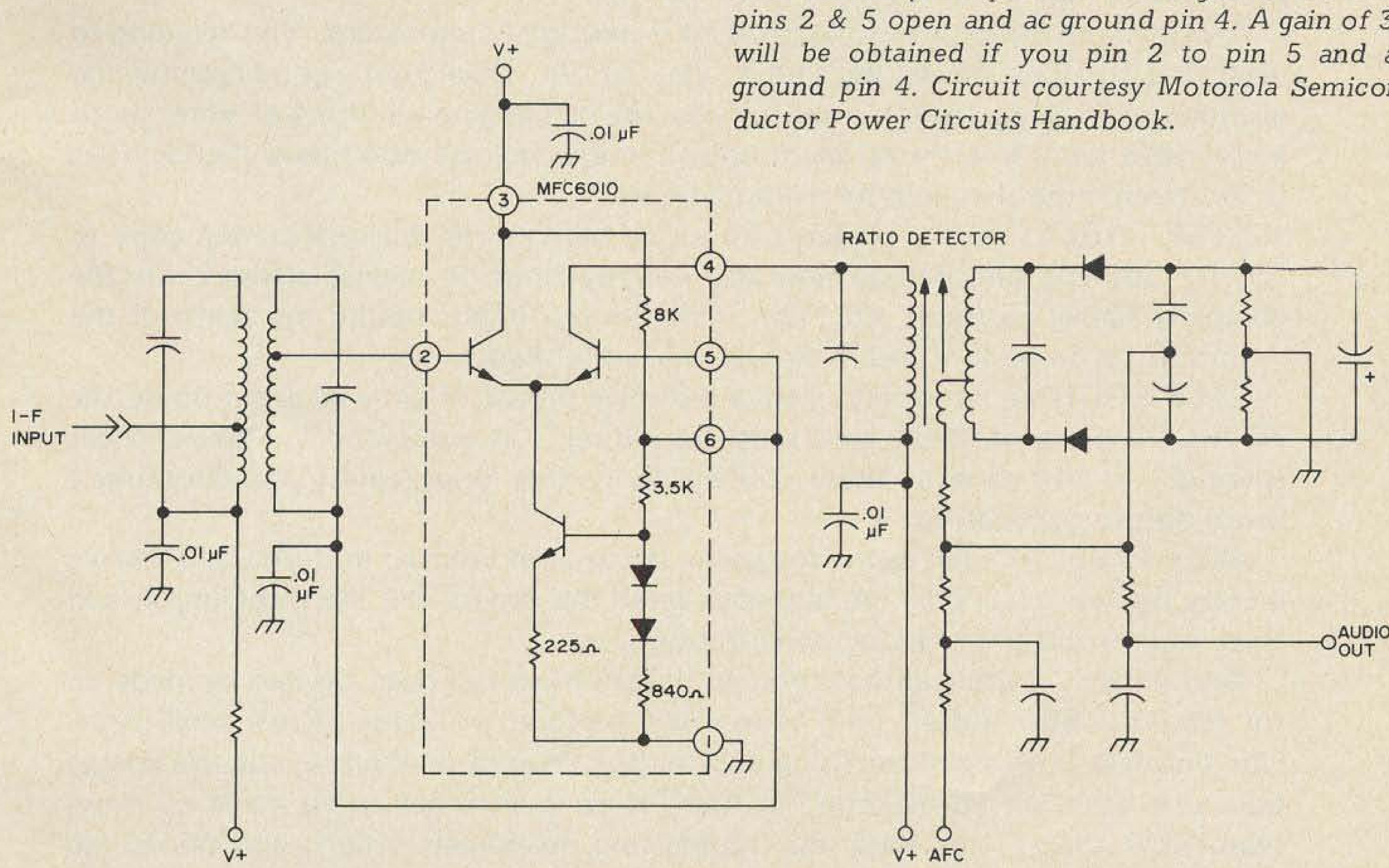
Interrupted-Power Indicator. Circuit courtesy Motorola Semiconductor Power Circuits Manual.



Use this device to put your crystal-controlled AM rig on FM. Both this schematic and the one above are from the 73 Inc. book, The Best of FM, *reprints from the now defunct* FM Magazine.



One watt audio amplifier using one IC. For a gain of 10 leave pins 2 & 4 open and ac ground pin 5 with the 10 µF capacitor. For a gain of 18 leave pins 2 & 5 open and ac ground pin 4. A gain of 36 will be obtained if you pin 2 to pin 5 and ac ground pin 4. Circuit courtesy Motorola Semiconductor Power Circuits Handbook.



10.7 MHz limiting amplifier, using the Motorola MFC6010, a monolithic silicon IC especially designed for 10.7 MHz i-f applications. Typical application schematic courtesy of Motorola Functional Circuits product bulletin.

Making Your Ads Pay

While the larger manufacturers have the budget to pay an ad agency the $100 or so it costs to make up a page ad for a ham magazine, most smaller companies find this prohibitive and wonder what they can do to get the job done for less.

We make up ads for about half of our advertisers and it costs them very little for this extra service. We go that extra mile to make 73 a better advertising medium.

STEP ONE. Throw the engineers out of the art department and keep them out. Sit yourself down in the chair of a user of your product and make a list of the many ways in which your product provides advantages to the user. . .the user, not the engineer. The engineer thinks in terms of the bandwidth of a receiver, the user in terms of only one signal coming through the receiver. What are the benefits, not what are the specs. Oh, you can list the specs too, but these are NOT the selling points.

STEP TWO. In laying out the ad you should keep in mind that you need some sort of "grabber" to make sure that your ad, once seen, is actually read. VW does this with a big picture and a clever caption. Perhaps a picture will do it for you. Or maybe you can think up a good one-liner. Every ad in 73 is seen by every reader, but many go unread because they don't grab attention. Your ad is wasted if it isn't read, obviously.

Work your selling points into the copy and don't be afraid of running all the copy you need to get your point across. Once you have the attention of the reader you want to be sure that he understands why he cannot go another week without buying your unit, why he will have so much fun with it is worth all the problems he may have in getting it by the wife.

A professional picture of the product is extremely important. You're going to need that for spec sheets, brochures, etc., so you should get a good commercial photographer to do the job right for you. We can, if you are short of time, shoot a workable picture with our giant copy camera, but we don't have the facilities to do much more than a good front panel shot.

STEP THREE. Send a sketch of your ad along with the typewritten copy to 73. Include the photograph and any ink drawings or special artwork for the company name, cartoons, etc. This is due in our hands before the tenth of the month if it is to be sure and make the next published issue.

STEP FOUR. In a few days you will receive proofs of your ad as set up by the 73 Art Department. Make sure that everything is as you want it. Make changes sparingly at this time as there will be no further opportunity for checking a proof before publication.

STEP FIVE. As soon as the magazine is out with your ad in it you will receive a copy by first class mail. A few days later the orders will start coming in and then your problem is keeping up with business.

And what will your ad cost you to make? Most full page ads can be made up for less that $50, if there aren't too many pictures or reams of real small type. Our business is selling advertising and magazines, not making up ads. We charge only our costs on ad makeup, so there is no way to get an ad made up more reasonably unless you have the typesetting, headliner, artists, and photo lab needed available.

Send your ads to Aline Coutu, 73 Magazine, Peterborough, N.H. 03458 and get ready to start filling orders.

W. Edmund Hood W2FEZ
223 Pullman Ave.
Rochester NY 14615

The Makings of a Modern Day Receiver

There was once a time – and when I first became a ham there were still a few oldtimers who could remember it – when the ham radio operator was, in fact as well as in name, an amateur of radio. His station was more than a mere investment of dollars and cents. It was the testimony of his skill. Rather than take the coward's way out, those hardy hams of yore built their rigs – from the ground up.

It's possible that I'm being a trifle unjust. Equipment has, since then, become far more complex, and construction techniques today require a costly array of tools and test equipment. Nonetheless, I feel that a ham isn't truly an amateur of radio unless he at least knows what's happening inside his rig. To the ham whose daily bread is earned in the electronics trade, such knowledge is a reality; but to the rest of the amateur world a twentieth-century receiver is nothing less than a magic box of mystery.

Now, it's a pretty safe assumption that even the Novice understands the operation of a basic superheterodyne. But what about the expensive complicated receivers now being advertised for the ham of today? Triple conversion, synthesizers, tuned i-f, product detectors, and other terrifying names go round and round in the head of a poor Novice struggling to comprehend the wiles and windings of the engineering marvel he just went hopelessly into debt to acquire. Oh, for the good old days when a guy could sit down and build an oscillator, an amplifier, or a mixer and not bother himself with such complexity.

Frankly, today's receiver still uses the same principles developed back in the dark ages when the ARRL vehemently objected to the use of the "new" superheterodyne. The block diagram shows a typical scheme of the up-to-date receiver. At first glance, it looks a little frightening, but it really isn't that bad if you just take one part at a time.

To most homebrew artists, there's nothing really too mysterious about a crystal-controlled converter, in which a whole band is converted to a range that can be covered more readily by whatever receiver may be available. Looking at the first part of the block diagram of the receiver, we find a broadband rf amplifier and mixer. If we ignore the fact that the local signal is coming from a synthesizer, and imagine it to be the output of a crystal oscillator, we have a block diagram of a typical crystal-controlled converter.

Taking a look now at the remainder of the receiver, except for the synthesizer, we have a dual-conversion receiver covering 9.0 to 9.5 MHz. The purpose of dual conversion is to combine the advantages of a high i-f with those of a low i-f. When a high i-f is used, image signal frequencies are so far removed from the desired signal frequency they are eliminated altogether. The disadvantage of a high i-f is that high selectivity is much more difficult to achieve. Bandwidth is a direct function of Q and frequency. If the Q of a tuned circuit is held constant while its frequency is varied, the bandwidth will be narrowest at the lowest frequency. For a really selective receiver, a low i-f is required. However, when the i-f is low, it is harder to reject image signals because they are closer to the desired signal.

The answer is two conversions. The first uses a high i-f, which gets rid of images. The first i-f passes through a tuned stage, then it enters a second mixer, where the heterodyne process is repeated all over again. In this case, when the incoming signal is of one frequency, and one frequency only, the local oscillator can be crystal controlled. The new i-f is only 240 kHz. (Some commercially built receivers went as low as 50 kHz.) At a frequency as low as this, a couple of tuned stages can give a bandwidth as low as 3 kHz (or less). Commercial receivers sometimes have the final i-f stages deliberately loaded to open

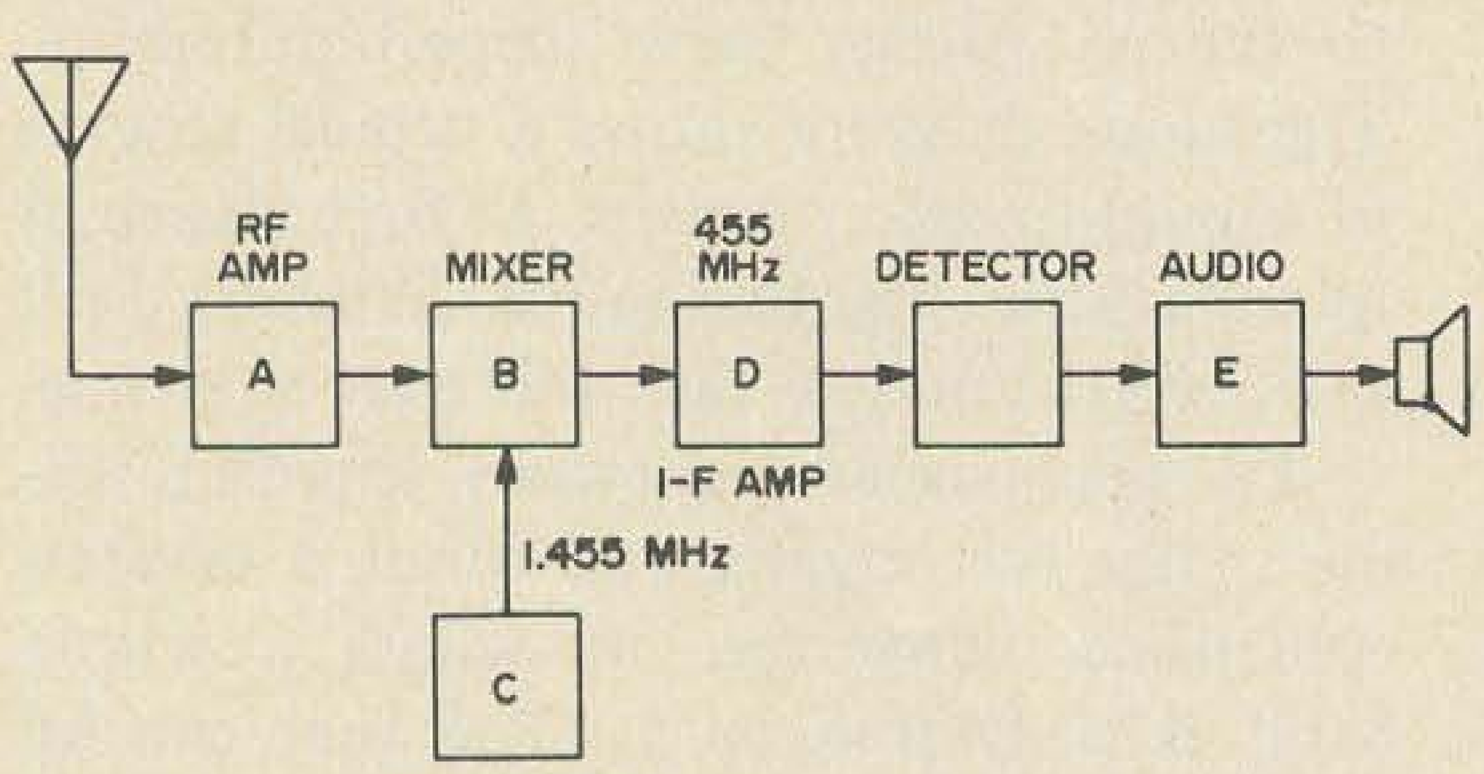


Fig. 1. A basic superheterodyne receiver block diagram.

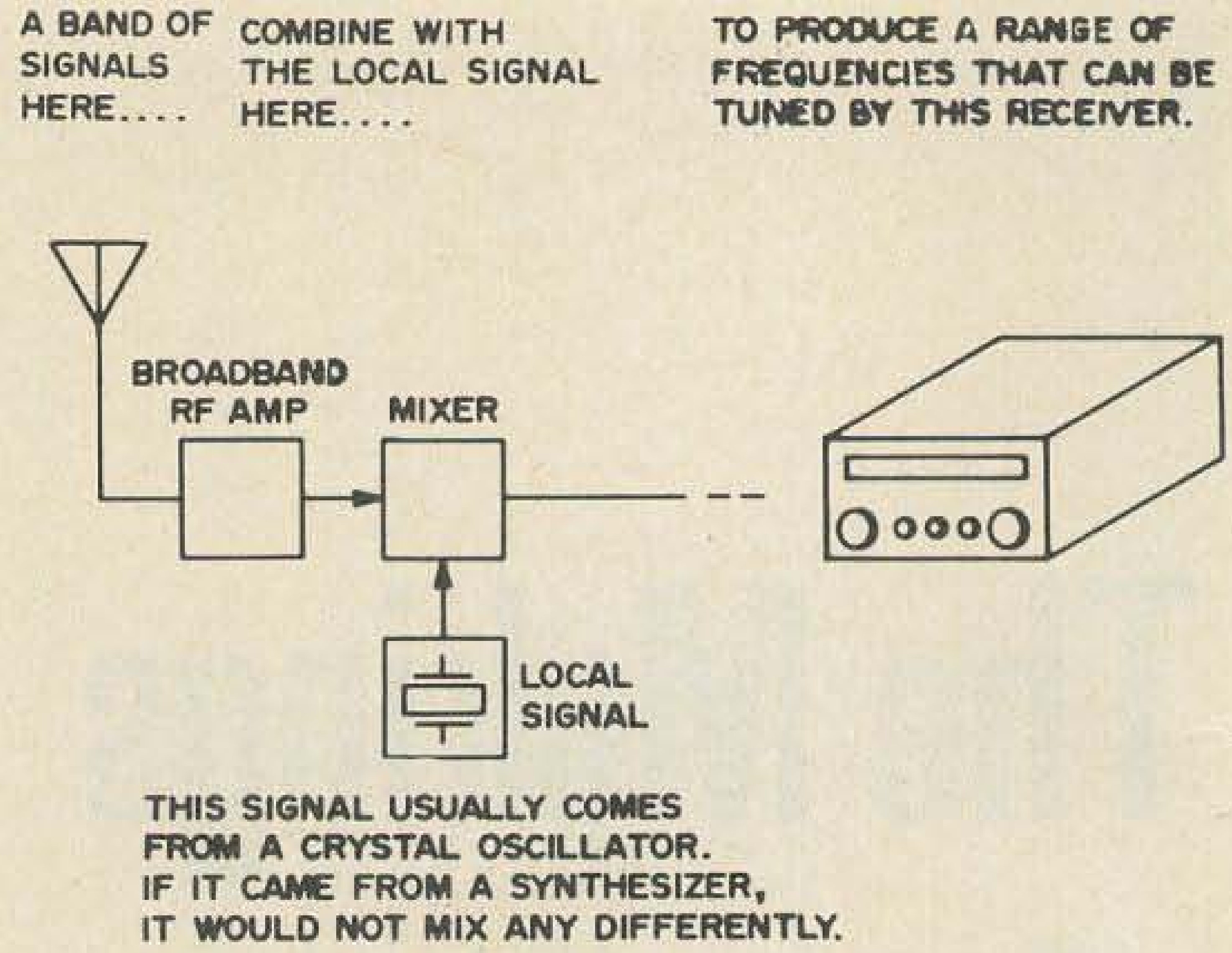


Fig. 2. Basic theory of a crystal-controlled converter. Nothing new to the ham – especially the mobile enthusiast.

up the bandwidth, then they insert a crystal or mechanical filter to give the bandwidth the desired shape.

Having explained the purpose and theory of double conversion, let us turn our attention back to the mixers. Nowadays, the best mixers are exactly the same thing as the balanced modulators used in SSB work. In fact, they *are* modulators and always have been. The advantage of using an SSB modulator is that it gets rid of the two original frequencies entirely, hence a quieter, more efficient mixer. Many of the commercial receivers that use vacuum tubes (and quite a few do) use the type 7360 beam-switching pentode as a mixer.

Some of the better solid-state receivers use a diode-bridge-balanced modulator for their mixers. The input transformer for such a mixer is very critical, however, if the best results are to be realized, so the ham who isn't too proud to use tubes will find the 7360 can't be outdone.

While we're on the subject of mixers and balanced modulators, it is a good time to mention a related circuit, the product detector. A product detector is exactly the same as a mixer or frequency converter circuit, except that the output is audio, rather than rf. The principle is the same as has long been used wherever a bfo signal is mixed with an incoming CW or SSB signal to produce audio. The difference is that the product detector gives no output at all unless both the i-f and the local signal are present. Here again, balanced modulator

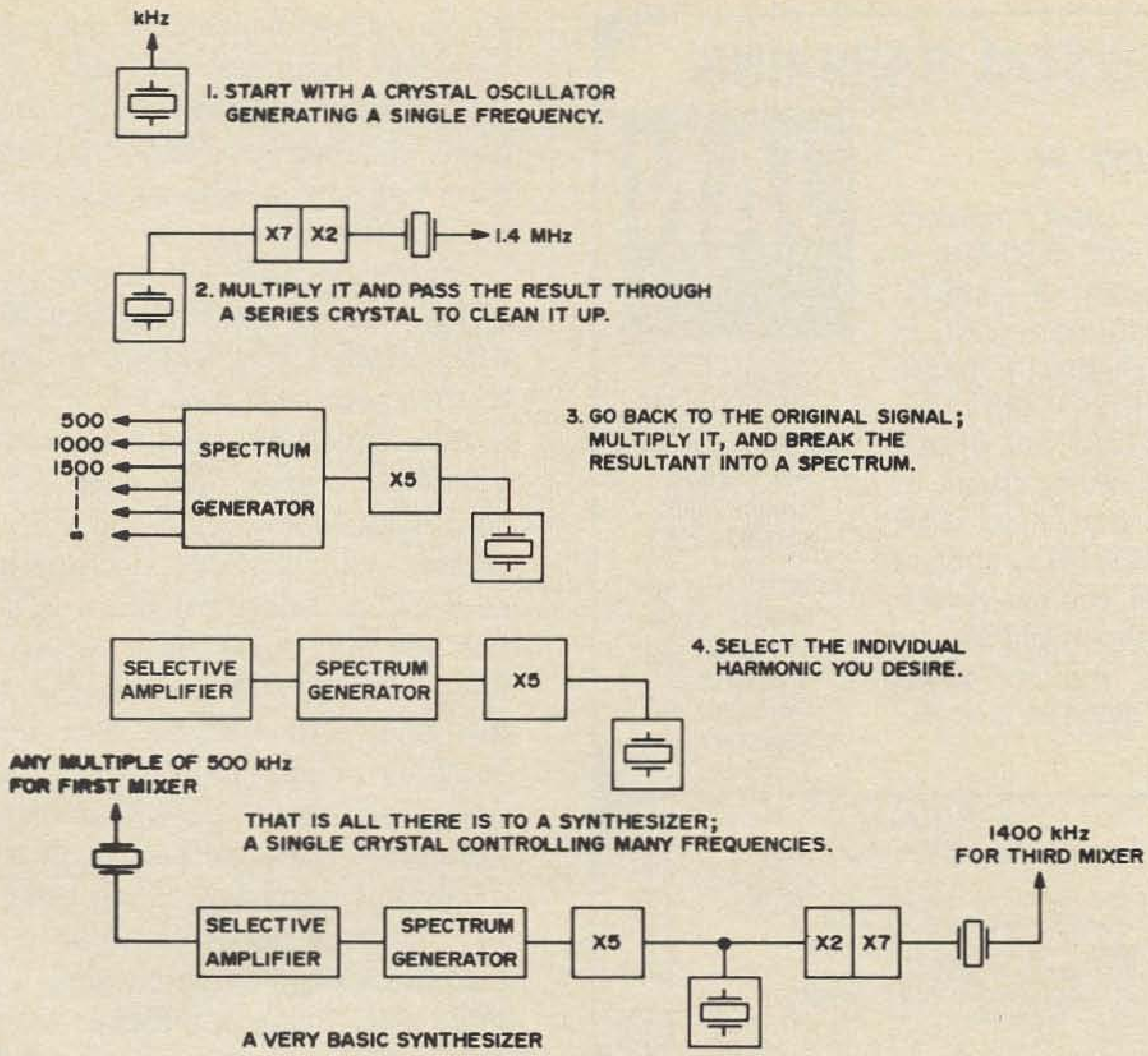


Fig. 3. A very basic synthesizer.

circuits are superior to pentagrid or triode mixers and their solid-state counterparts, since only audio is present in the output. (A pentagrid mixer product detector would have the two rf carriers present in the output, which could produce a little distortion or noise.)

Going back to the mixers, in the original superheterodyne circuit, the local signal came from a vfo. In dual-conversion receivers, a crystal oscillator is used. In the more sophisticated receiver, they use a synthesizer.

A synthesizer is a device that produces a signal at a frequency different from the input signal or signals. A frequency doubler is a simple form of a synthesizer; a mixer is another. Modern receivers use a synthesizer to produce the several frequencies required for the various conversions involved, all being produced from the output of a single crystal oscillator. That way, if the crystal should drift slightly, all conversion frequencies in the receiver would drift at the same time, and by the same percentage. The receiver, then, would continue to hold its calibration. The receiver discussed in this article uses a relatively simple synthesizer. A 100 kHz crystal is multiplied up to 1400 kHz in a basic frequency multiplier.

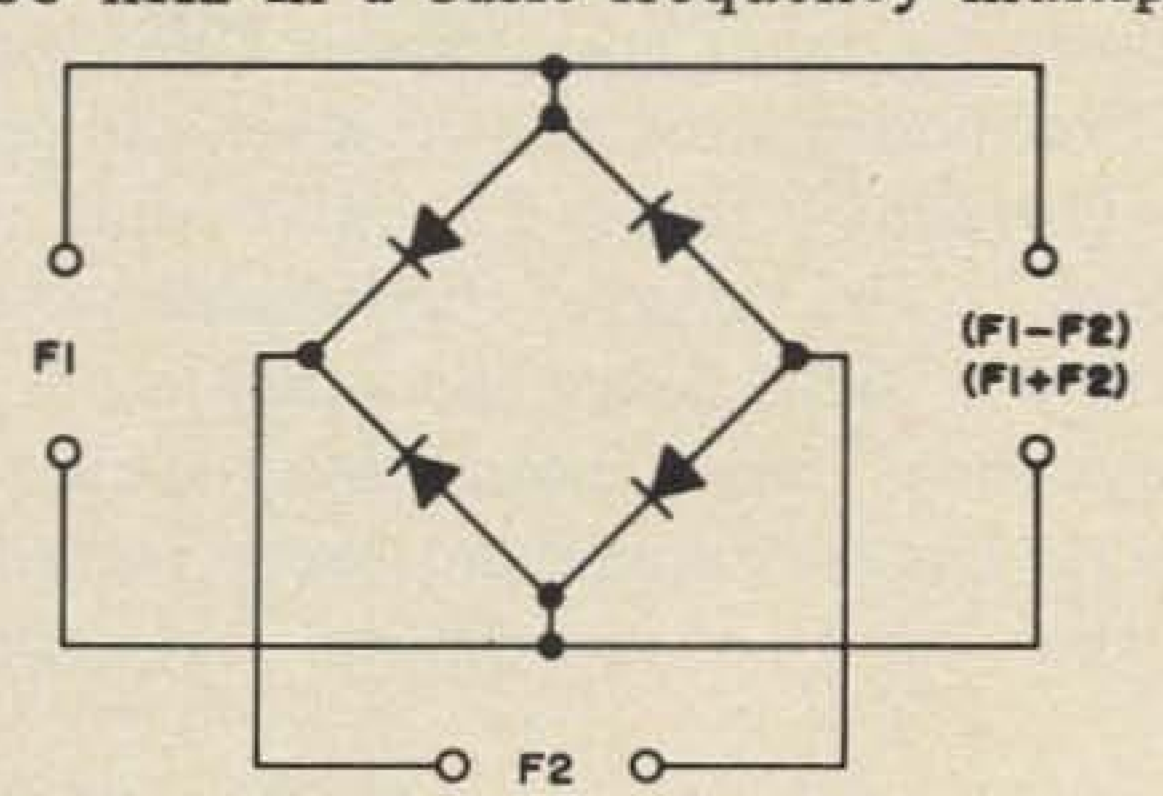


Fig. 4. A diode-bridge-balanced modulator used as a mixer.

The 1400 kHz signal passes through a series crystal and a tuned amplifier after which it is injected into the mixer for the final conversion. The original 100 kHz is also multiplied to 500 kHz and fed into a spectrum generator (the fancy name for a crystal calibrator). The spectrum, which consists of all multiples of 500 kHz, feeds into a selector, which isolates the desired multiple of 500 kHz, passes it through a crystal filter, amplifies it, and uses it as the local signal for the crystal-controlled converter (the first conversion).

By using exact multiples of 500 kHz for the first conversion, the receiver can select any frequency range 0.5 MHz wide, and convert to the range of the tunable portion 9.0 to 9.5 MHz. Since the tunable portion always tunes over the same frequencies, the receiver has the same bandspread regardless of the band of incoming frequencies.

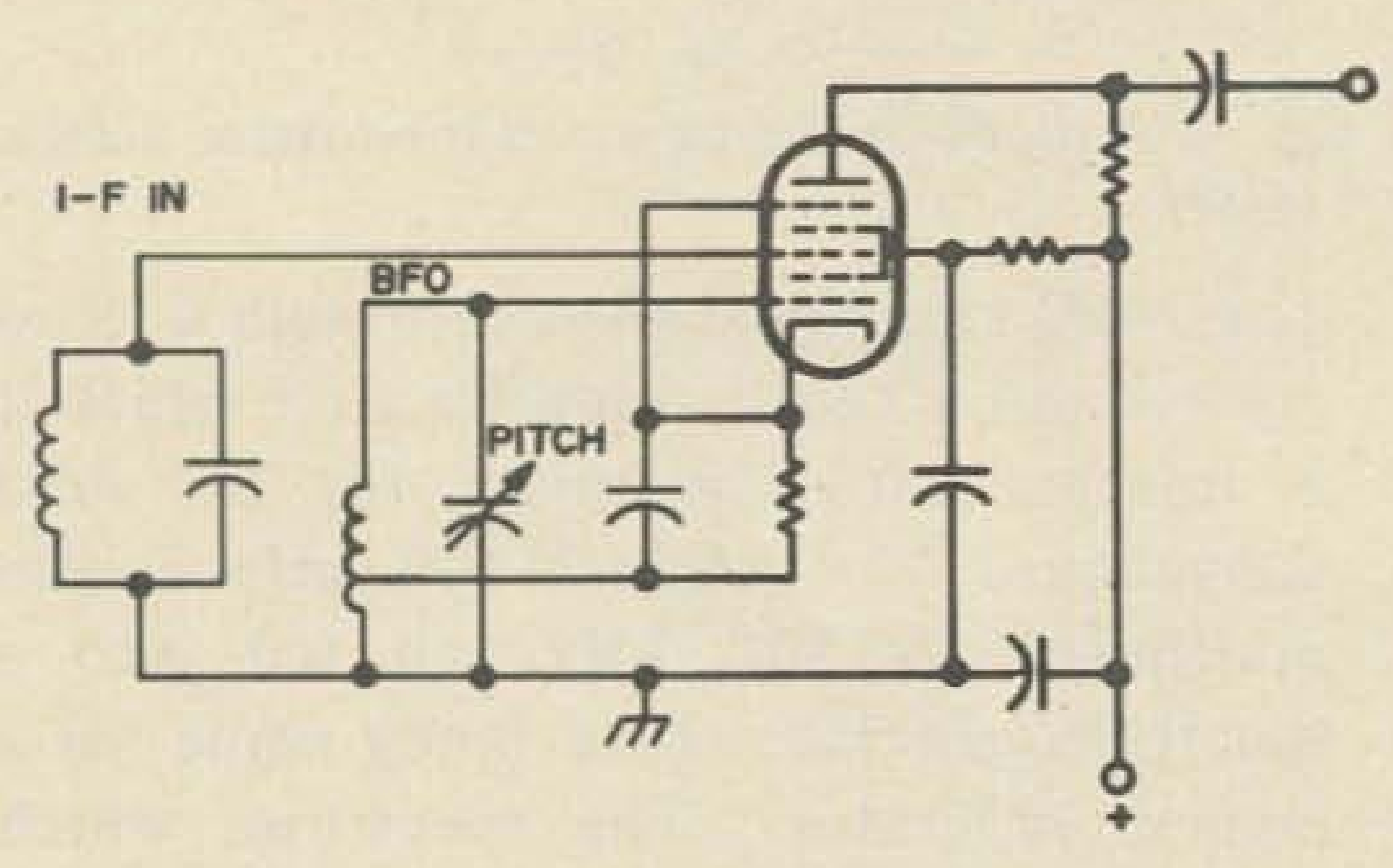


Fig. 5. A mixer circuit with audio output is a product detector.

(Some fancy mechanical manipulation by National engineers provided a dial that always have a 1 kHz per division calibration. The famous HRO 500 uses a spectrum conversion scheme very similar to the one I've described.)

Suddenly, now, the whole puzzle seems to fall together. Incoming signals are mixed with selected frequencies to convert them to the range of 9.0 to 9.5 MHz. This range is then tuned by a dual-conversion, 9.0 to 9.5 MHz receiver. The first and the third conversion come from the same 100 kHz crystal, while a stable vfo tunes the second conversion. Image rejection is achieved in the second conversion, which uses the 1640 kHz i-f, and selectivity is obtained in the final 240 kHz i-f. The receiver is a complex conglomeration of mixers, amplifiers, oscillators, doublers, and spectrum generator, but each part is, in itself, basic.

Several years ago, when financial adversity deprived me of a station receiver, and prevented my buying another, I decided to build one. Being employed, at the time, by National, I was immediately deluged with suggestions and the monster I have just described evolved. I chose to build it using tubes, rather than solid-state, simply because tubes are easier to scrounge. As time passed, my interest waned. Over the past couple of years, it has spent much more time on the shelf than on the bench.

Better times have come, now, and my interest in ham radio has gradually revived. I could easily go out and buy a receiver to get back on the air, but there is something about this project that bears a certain fascination. Perhaps I am a throwback, enslaved by my own stubborn pride. All I know is that I feel I must earn my place in the airwaves by producing that which gets me there. At any rate, come what may, I have completed my receiver, long ago humorously nicknamed the HRO .007 by a wisecracking National engineer and, so far, it works. With just the front end to go, I am determined that, by the time this article sees printer's ink, I'll be on the air once more, and I'll be one of the few hams of today who can truthfully say, "I made it myself."

. . .W2FEZ■

John Schultz, W2EEY/DL

SIMULTANEOUS MULTI-BAND TRANSMISSIONS

Simultaneous transmission on two or more bands has various technical advantages, and is allowed by the FCC under certain conditions. This article illustrates primarily simple combiner networks which will allow simultaneously the operation of two transmitters on different bands into one multiband antenna without transmitter interaction.

Simultaneous transmission of the same modulated signal on two or more amateur bands is permitted by the FCC under certain circumstances as discussed later. Such simultaneous transmission has various advantages in increasing the dependability of reception if a separate receiver is used on at least two of the transmitted frequencies and also an advantage in permitting reception on different single band receivers. The simultaneous transmission technique is often employed by shortwave broadcasters, commercial traffic stations, etc. Usually a separate transmitter and antenna is used for each band. However, for the amateur situation where multiband antennas are available and space for antennas restricted, it would be advantageous to have two transmitters operating on different bands coupled to one antenna for simultaneous operation. The networks which permit the use of transmitters in this manner are called "combiners." Many elaborate forms of such networks have been developed for commercial applications. However, the purpose of this article is to present various simple forms of "combiners" which can be quickly constructed for use with medium power transmitters, particularly where operation on two bands having a harmonic relationship is involved.

Legality of Simultaneous Transmission

It would be nice if one had the equipment available to send out something like a directional CQ or DX CQ simultaneously on several bands in order to have a better chance of making the desired contact. However, such operation, unless some emergency situation is involved, would be considered a waste of spectrum space by the FCC and therefore illegal. The sending of code practice transmissions simultaneously by stations such as W1AW is considered legal because of the large numbers of amateurs served thereby.

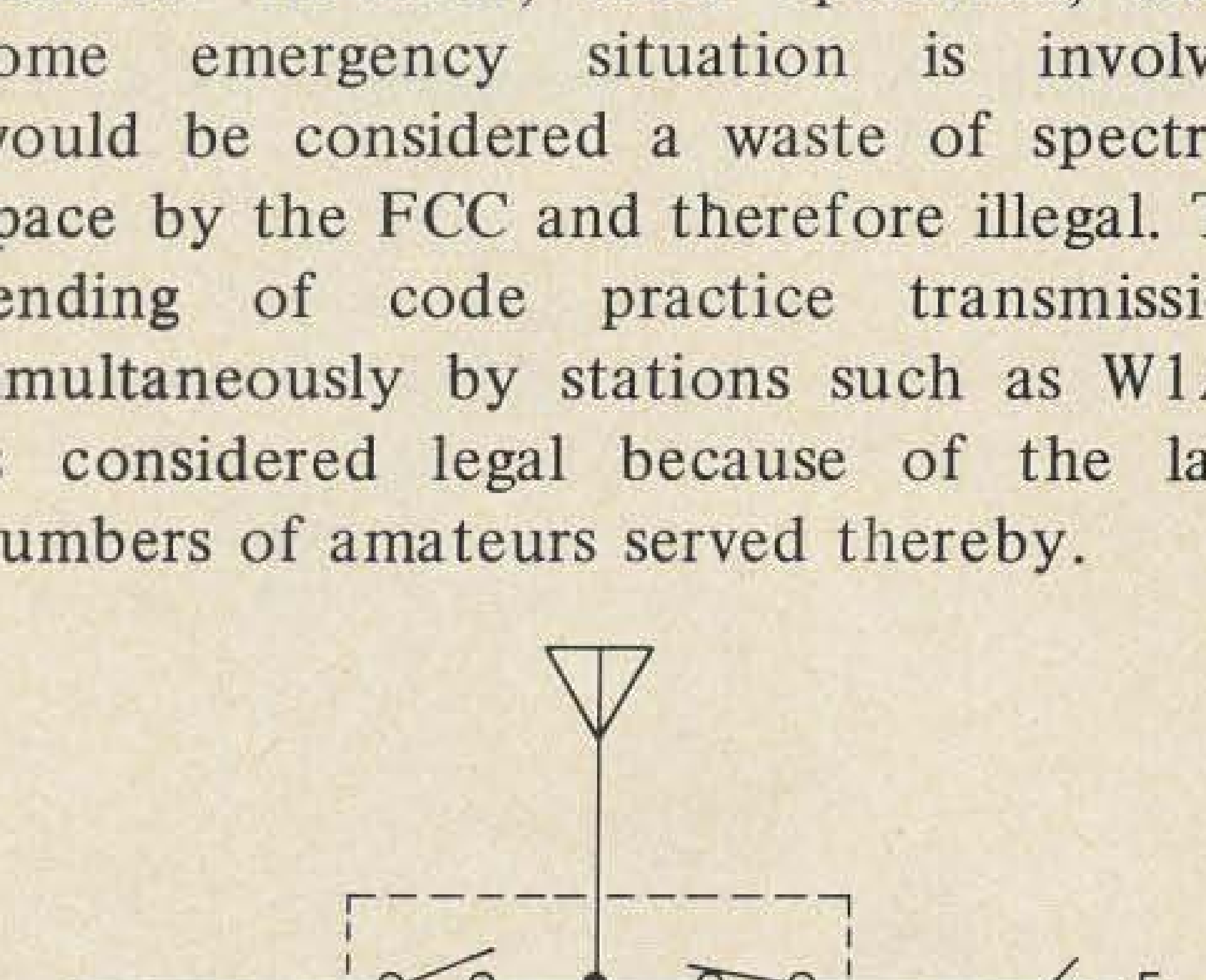


Fig. 1. Representation of the functions of a combiner unit (dotted lines) when either transmitting frequency alone is considered.

Various emergency and other communications that fall under Section 97.91 (b) and (d) of the Commission's Rules can be carried out using simultaneous multiband transmission. There is no hard and fast list of situations that one can specifically cite where such transmission is allowed. However, there are certainly many emergency communications situations and situations that serve the general amateur radio service where the technical advantages of simultaneous transmission is justified to the extent that it will be allowed by the FCC. No special license or permission is required for such operation as long as the basic operator's license is valid for operation on each frequency band used.

Combiner Operation

Fig. 1 illustrates the basic functions which a combiner network must perform. The antenna is assumed to be resonant at frequencies F1 and F2 (either broadband resonance or a trap-type antenna resonant at two different frequencies). When frequency F1 is considered as the output of one transmitter, the combiner network must act so the transmission line from the antenna is directly connected to the transmitter, but the transmission line to the other transmitter appears disconnected. When frequency F2 is considered, the transmission line from the F1 frequency transmitter must appear disconnected from the antenna.

There are a number of practical circuits that can be devised to implement the functions illustrated in **Fig. 1**. **Fig. 2** shows two simple basic approaches – a tuned circuit (A) and a transmission line stub switching arrangement (B). In **Fig. 2A**, F1 is assumed to be lower in frequency than F2. The frequencies in this case must not necessarily be harmonically related. C1 and L1 are chosen so series resonance is produced at F1, thus connecting the F1 transmitter directly to the antenna. C1A and L1 form a parallel resonant circuit at F2, so the F2 frequency cannot flow back into the F1 transmitter. On the other "side" of the combiner, C2 and L2 are series resonant at F2, thus directly connecting the F2 transmitter to the antenna. Since F2 is higher than F1, the L2, C2 circuit will provide a capacitive reactance at F1. This capacitive reactance is utilized together with coil L2A to form a parallel resonant circuit at F1. Thus, the F1 frequency cannot be coupled into the F2

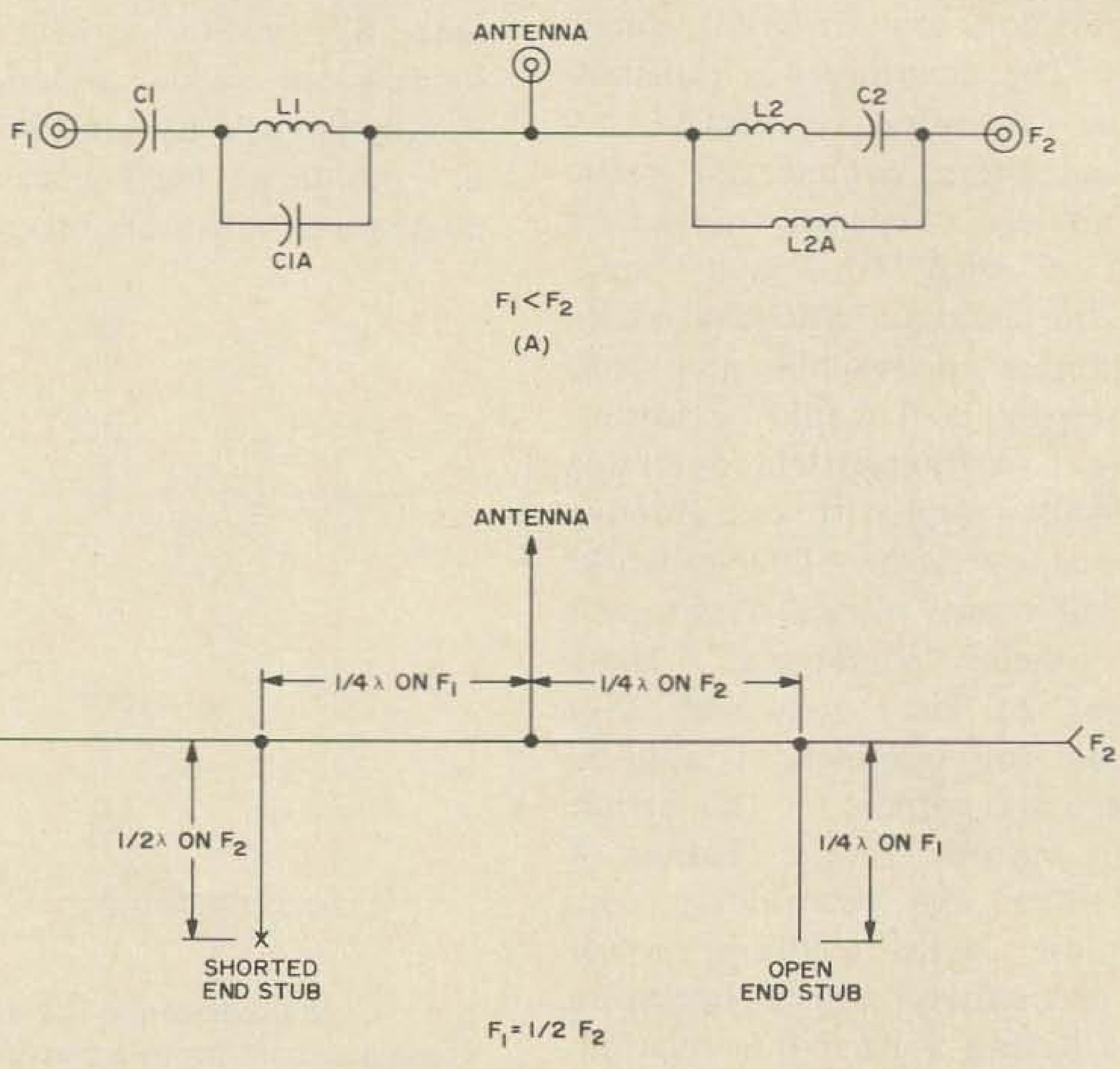


Fig. 2. Basic combiner forms discussed in text. Tuned circuit type (A) and stub type (B).

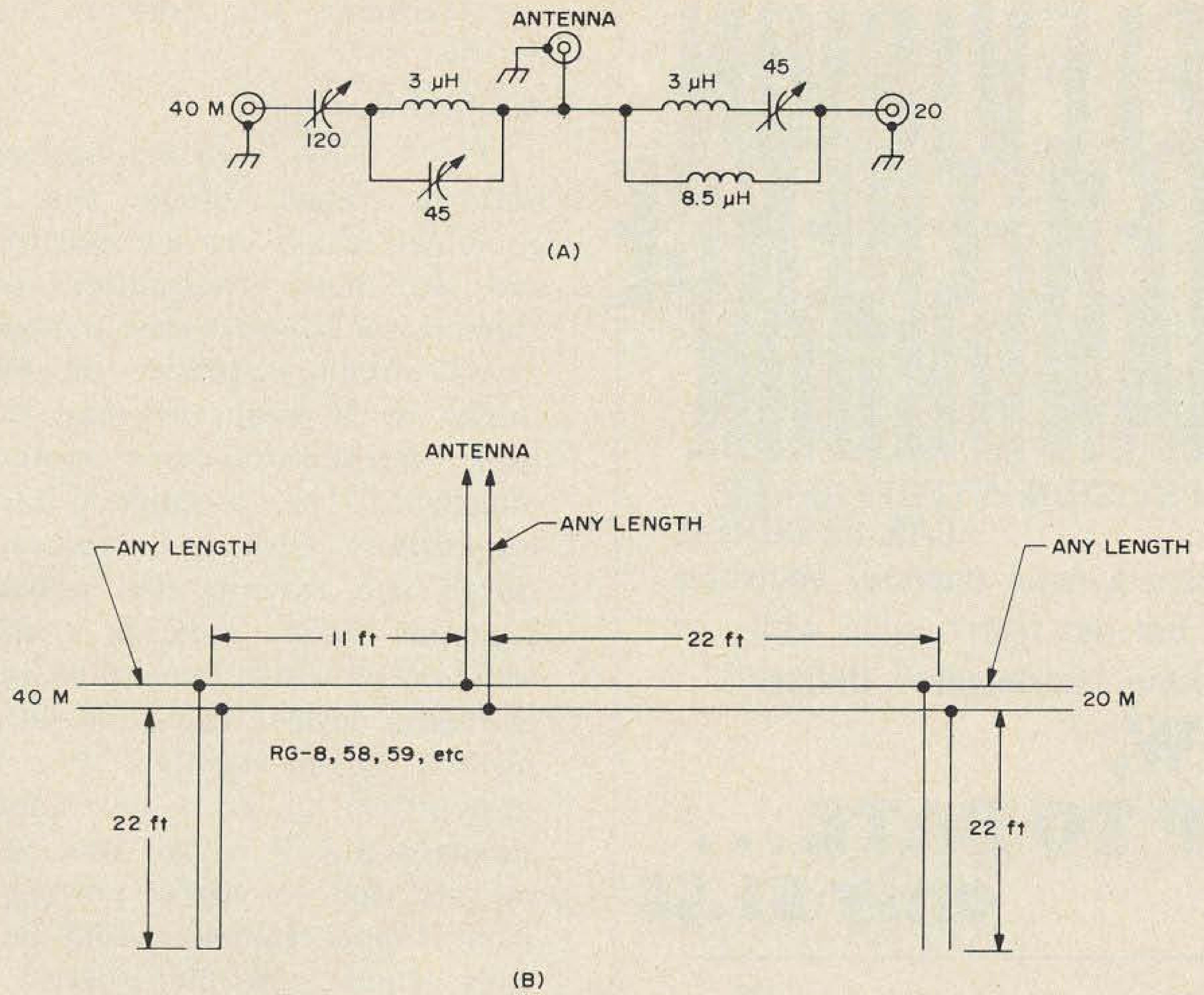


Fig. 3. Practical values for 40/20 meter combiner units. Similar combiners may be constructed for other combinations of amateur bands.

transmitter. The practical construction of such a network requires only the calculation of the component values using standard resonant circuit formulas or can even be done using a LC reactance chart. As high a Q as possible in the tuned circuits is desirable both to reduce losses and to provide maximum coupling isolation between transmitters.

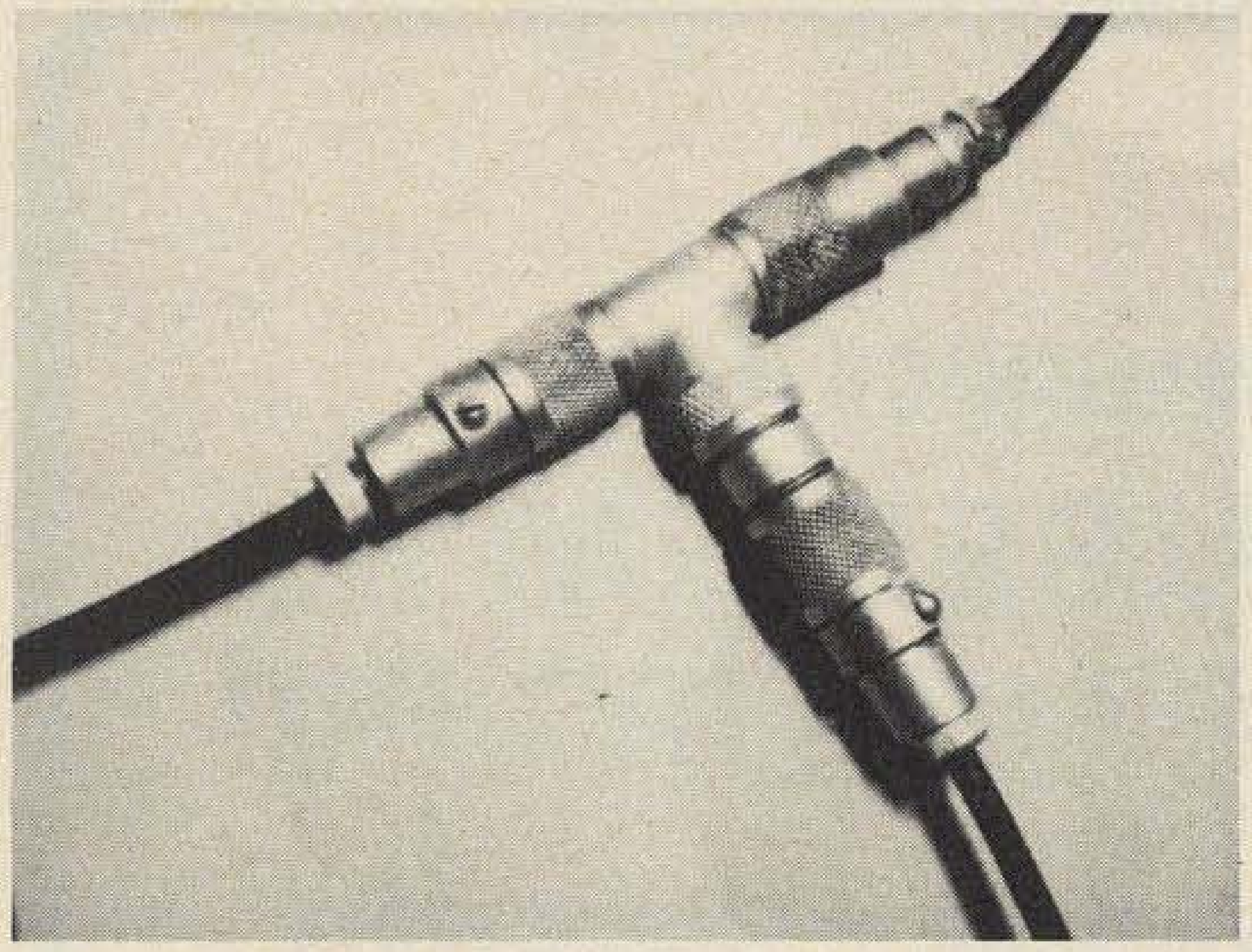
The simple transmission line combiner shown in **Fig. 3(B)** requires that frequency F be one half of that of F2. Normal transmission line (coaxial or balanced type) can be used for the entire construction. The operation can be visualized by first noting that both F1 and F2 transmitters are directly connected to the antenna. However, they are not interconnected to each other. On the F2 "side" of the combiner, the open end stub is ¼λ long at F1. Thus at F1, it reflects a short where it is connected to the transmission line. The length of line between this point and the antenna is also chosen to be ¼λ long at F1. Thus, the short is further reflected at F1 to be an open circuit at the point where the F2 transmitter line meets the antenna. Consequently, F1 cannot couple to the F2 transmitter line. The open end stub on the F2 "side" does not interfere with the F2 frequency because at F2 it is ½λ long and reflects an open circuit across the transmission line. At F2, the transmission line doesn't "know" the stub is there.

A very similar situation exists on the F1 "side" of the combiner. The shorted end stub being ½λ long at F2 reflects a short at the point where it joins the transmission line. From this point to the antenna, the line is chosen to be ¼λ long at F2. Thus, the short is further reflected to be an open circuit at the antenna terminals for F2. F2 energy cannot enter the F1 transmission line. The shorted end stub is ¼λ long at F1, and thus reflects an open circuit across the transmission line at F1. The combiner can be readily constructed from standard transmission line stock by taking into account the velocity factor of the line used to determine the correct physical line lengths.

Practical Examples

Fig. 3 shows two practical examples of both a tuned circuit and stub type combiner which can be used to couple 20 and 40 meter transmitters to a single antenna for simultaneous transmission. The tuned circuit combiner of **Fig. 3 (A)** is shown as it might be used in a coaxial cable transmission line system of any impedance. The transmission line from each transmitter must, of course, correctly match the antenna line impedance. The combiner serves only as a coupling and isolation network, but not as an impedance matching device. The coils should have as high a Q as possible. For low power transmitters up to a few hundred watts, standard B & W or Air Dux coil stock can be used; but for higher powers, coils made from copper tubing should be used. The coils should also be isolated from each other by mounting them at right angles to each other or using shields between them. With each connector dummy loaded by a small resistor corresponding to the impedance of the transmission line used, a grid-dip meter coupled to the 3 μH coil on the 20 meter "side" of the combiner, the 45 pF capacitor on that "side" is adjusted for circuit resonance on 20 meters. With the grid-dip meter loosely coupled to the 8.5 μH coil, that coil is trimmed for resonance on 40 meters. On the 40 meter "side" of the combiner, the grid-dip meter is loosely coupled to the 3 μH coil. The 120 pF capacitor is adjusted for resonance at the 40 meter operating frequency. The 45 pF capacitor is adjusted for resonance on 20 meters.

The stub type combiner of **Fig. 3 (B)** usually needs no adjustment if the stub lengths are carefully cut to length. The physical lengths shown, for instance, are based upon a velocity factor for the transmission line of .66, and would be correct for such cables as RG-8, RG-58 RG-59, etc. Standard coaxial cable "hardware" such as shown in the photograph can be used to make all the necessary cable interconnections or the cables can be carefully spliced together.



Standard "UHF" type coaxial hardware may be used to make all the necessary interconnections for a stub-type combiner. Shown are PL259 plugs used with a M-358T adapter and a PL258 female adapter in the middle leg.

The schemes shown can be expanded for more than dual-band operation, but extra tuned circuits and stubs would be necessary, resulting in rather complicated networks. If you did want to pursue this approach, it probably would be better to combine two transmitters operating on the lower frequency bands and two transmitters operating on the higher frequency bands in the manner shown. Then the outputs could be combined using a high and low pass filter circuit between transmitter groups for isolation.

No combiner network provides absolutely complete isolation between transmitters. When tuning up the transmitters, each transmitter should be tuned separately for proper loading with the other transmitter inactive. When both transmitters are tried, the slight interaction produced may require some transmitter retuning, but the amount necessary should be minor.

Summary

Used properly and legally for the right purposes, simultaneous multiband transmission can be very useful to better coordinate emergency nets operating on different bands, placing emergency traffic, etc. The proper use of the combiner circuits shown will permit the more useful utilization of the station equipment available which often greatly exceeds the antenna facilities which are available.

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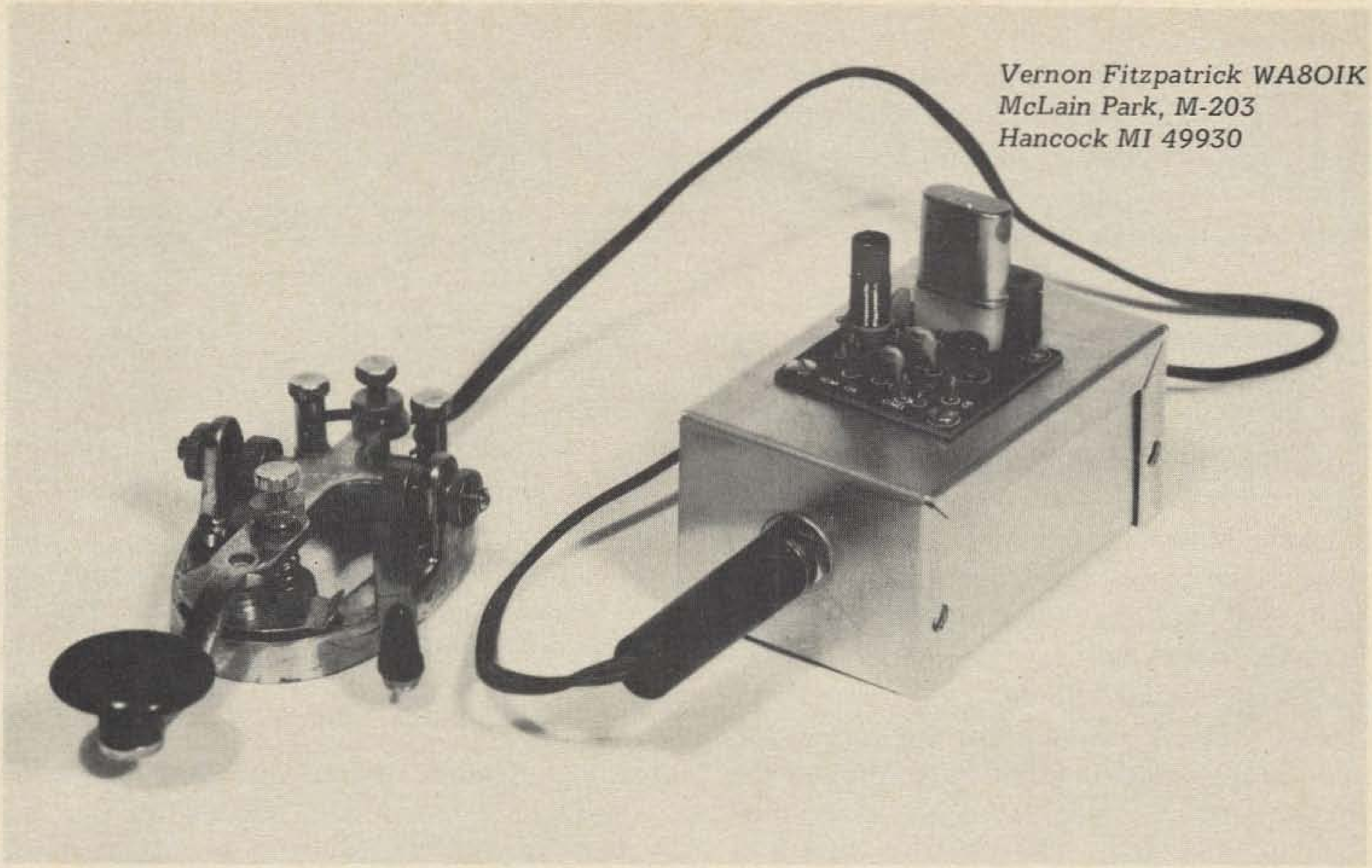
Vernon Fitzpatrick WA8OIK
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The pre-Novice "transmitter" with key.

A PRE-NOVICE TRANSMITTER

For most aspiring hams code practice is the most difficult part of getting the ticket. Copying practice can be quite diversified. There are the records or tapes for learning the characters, then the practice can be supplemented by listening to W1AW or Novices. Sending is generally limited to keying an audio code practice oscillator.

The following idea is not original or unique as the Signal Corps was using it as part of its radio operator training in 1948, when I took the course. As a diversion, and to add interest to our code practice, they had a receiver for two students and a Meissner signal shifter (a variable frequency oscillator) a few feet away. We would close the key and locate the signal on the receiver; then send to each other. We were transmitting less than 10 ft but it was our first time "on the air." It was quite a thrill.

Here is a simple building project and you will have a transmitter of across-the-room capability. The oscillator is an International Crystal Co. OX-LO kit*. Assemble the kit following the instructions for 3000–6000 kHz, as this will permit using 80 meter crystals. The oscillator can be mounted on a piece of wood, but a more professional job can be done by mounting it on a minibox. The OX circuit board has a crystal socket for HC-6/U crystals mounted on it. I mounted a Cinch-Jones 2KM crystal socket on the minibox, then connected it in parallel with the circuit board crystal socket. This arrangement permits using either HC-6/U or FT-243 crystals. All my CW transmitters have a standard ¼ in. phone jack for the key, so I mounted this type of jack on the front of the minibox. Whatever type jack you use be sure it is the open-circuit type as there is no power switch on the oscillator. The key turns it on and off. The battery is made by connecting four size N-cells in series, then taping them in a square. Be sure to tape the top and bottom so the battery can't be shorted. Connect a 3 in. red wire to the positive terminal and a 5 in. black wire to the negative terminal. If you use a larger minibox, a plastic or metal holder for four penlite cells can be used.

Final Assembly

Make all holes in the minibox before mounting the oscillator. Mount the oscillator board. The mounting screws supplied with the kit are quite long. 4-40 x ¼ screws will be neater. Mount the 2KM crystal socket. Mount the key jack. Clamp the battery in place. Using two pieces of wire 5/8 in., wire the 2KM crystal socket in parallel with the crystal socket on the oscillator board. Solder the red battery lead to the 6V terminal on the copper foil side of the printed circuit board. Solder the black battery lead to the insulated terminal on the key jack. The negative circuit is completed through the key and jack to the minibox, then to the copper foil on the PC board. If you use a painted minibox, be sure to scrape the paint away around the four PC board mounting holes so there will be a good electrical contact from the copper foil to the minibox. This completes the wiring of the "transmitter." Any 80 meter crystal can be used, but it is best to use a Novice band crystal as this will help you get used to this band on your receiver. Do not connect any type of antenna to the oscillator as it is capable of transmitting a signal several miles with an antenna.

If your key is not wired, two-conductor speaker wire is good, as it is light and flexible and one wire is marked. Connect the marked wire (it may have a tracer stripe on the insulation or one wire may be tinned and the other copper) to the key frame terminal. Connect the other wire to the insulated key terminal. Connect the marked wire to the phone jack outside or barrel terminal. Connect the unmarked wire to the phone jack tip terminal. If your key has a shorting bar be sure it is open.

Now is a good time to adjust the key. Adjust the pivot bearings so the key points are aligned; the bearings should be adjusted so there is no play or bind. Adjust the point gap so a piece of postal card will just pass through. The tension adjustment is for

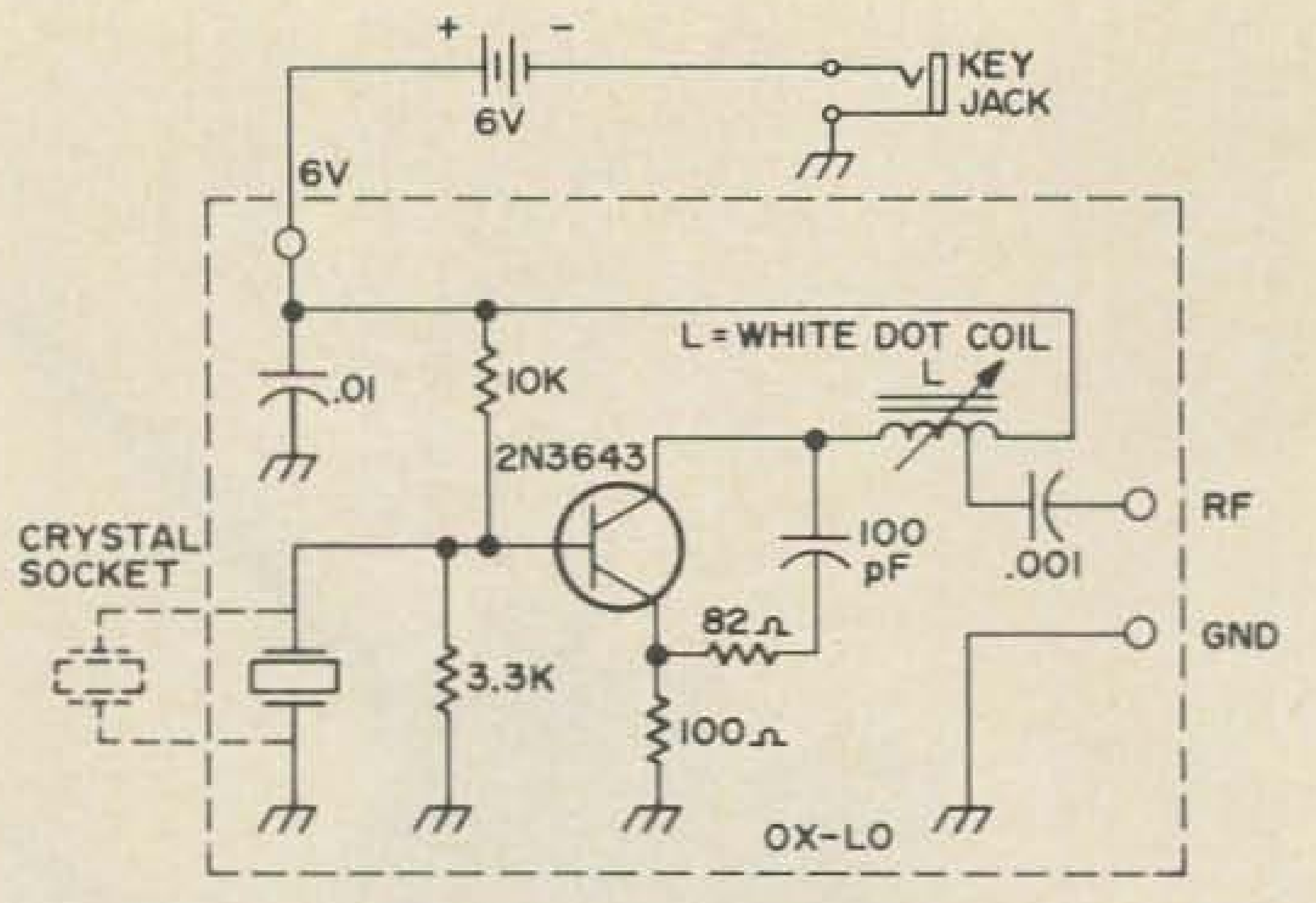

Fig. 1. OX-LO kit has all parts shown inside dotted line. OX-LO kit ($2.95) available from International Crystal Manufacturing Co., Inc., 10 North Lee, Oklahoma City OK 73102.

the individual fist. It should not be weak enough so your hand relaxed on the key will close it. Lightly grip the edge of the key knob with the thumb and large finger. Rest the index finger on the knob. Raise and lower your wrist to send. You cannot send with your fingers, as they will tire in a few minutes.

Connect 3–4 ft of wire to your receiver antenna terminal and turn it on. When the receiver is warmed up, close the transmitter key and tune the signal on your receiver. You are now ready for some real code practice. The short antenna on your receiver may give you some background QRM. This is good, as you will have it when you are operating as a Novice.

If you are practicing with a friend and each of you has a transmitter, use crystals of the same frequency so you don't have to keep retuning the receiver. If you have only one transmitter, connect the keys in parallel. Connect a two-conductor wire from the two terminals on one key to the two terminals on the other key.

I think you will enjoy this method of code practice. It is as real as you can get without a license. You will find the little transmitter convenient for additional practice after you get your license, too. You may want to add the International Crystal PAX-1 transistor rf power amplifier module and have a QRP transmitter for on-the-air use.

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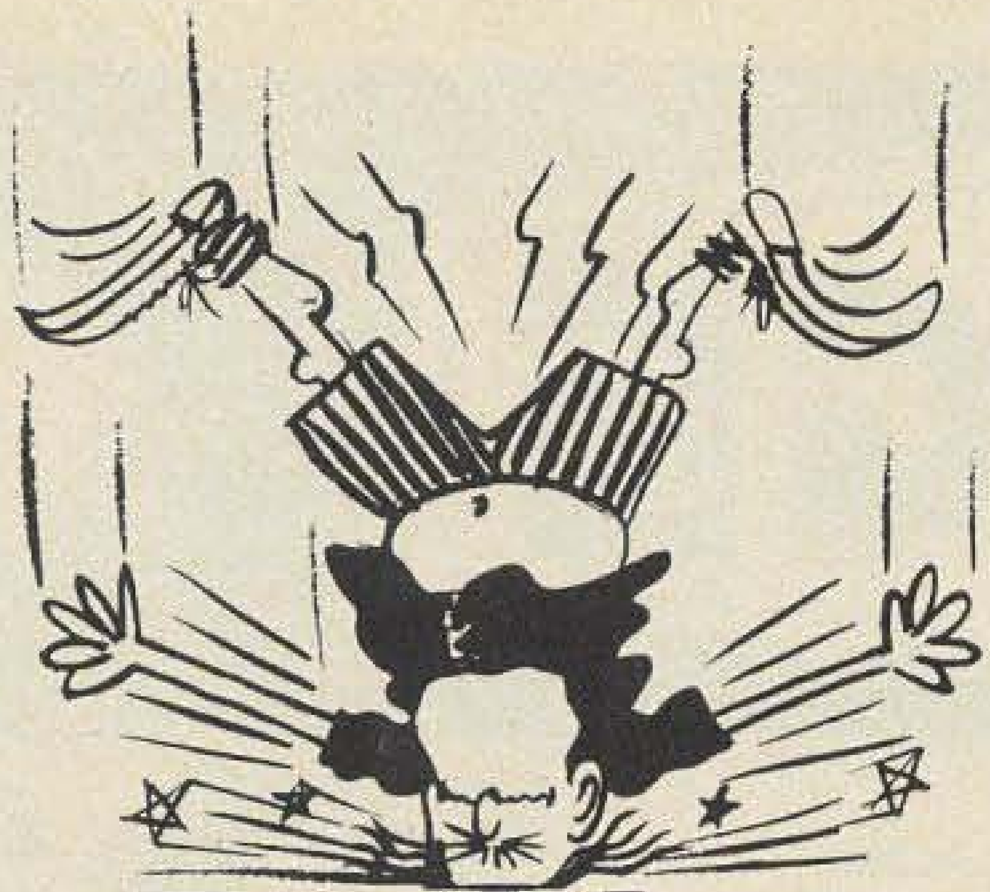

The Problem of Inversions

The designation of any SSB signal as either "upper" or "lower" is simply an indication of the *position* it holds, frequency-wise, with respect to its reference frequency, which is that which the carrier would occupy if it weren't suppressed. This position, due to the nature of sidebands themselves, determines the characteristics which an individual sideband will possess.

The term "inversion," however, denotes a *change* of the sideband signal from its original to the *opposite* position, which change necessarily results in the signal's acquiring opposite characteristics as well. Accordingly, where no such change in the sideband signal has taken place, the signal, whether it be upper or lower sideband, cannot properly be considered as representing an inversion.

To get along, then, into this problem of inversions, let's go directly to the area where this problem arises: the mixer stage of our SSB rig. While the intended function of this stage is simply to convert the *frequency* of either the USB or LSB signal generated in an earlier stage to a desired output frequency, this stage sometimes does a bit more! The "more" bit is the alteration or change of position and characteristics of the SSB signal – an LSB signal becomes USB, or a USB signal becomes LSB.

Since an inversion occurs in some cases, and in others it doesn't, the question naturally arises as to whether the occurrence or nonoccurrence in a given situation can be predicted reliably. It can.

Let's suppose that we're introducing to the mixer a 9 MHz USB signal and injection frequencies from the output of a 5.0 to 5.5 MHz vfo, from which mixture we obviously obtain output in the 20m band by utilizing the *sum* frequencies, and output in the 80/75-meter band by utilizing the *difference* frequencies. On either of these two bands, our output will be USB, the same as our input sideband signal, as no inversion will result when any sum frequency is utilized, and no inversion will result *in this situation* when any difference frequency is utilized. If, in this example, we used an LSB input signal instead, our output on either band would be LSB for the same reasons.

Before presenting an example of a situation in which an inversion *will* occur, however, it should be pointed out, even though it's pretty apparent that to obtain outputs in bands other than 20 and 80m, we will require injection frequencies additional to those supplied by the vfo alone. Premixed injection frequencies for this purpose can be obtained simply by employing an auxiliary oscillator along with our vfo.

Now, let's suppose we're interested in working, say, the 15m band using the same 9 MHz USB signal. Using a premixed range of injection frequencies from 12.0 to 12.5 MHz, we could obtain outputs from 21.0 to 21.5 MHz by using the sum frequencies, and our output would be USB, the same as our input sideband signal, since no inversion would take place. However, using a premixed range of injection frequencies from 30.0 to 30.5 MHz instead, outputs in the same range (21.0 to 21.5 MHz) could be obtained by using the difference frequencies, but here an inversion *would* take place and our output would be LSB. To obtain a USB output, using the 30.0 to 30.5 MHz injection frequencies, our 9 MHz input signal would have to be LSB.

We've offered two examples here involving utilization of *difference* frequencies, in one of which examples we've claimed that an inversion *will* take place, and in the other we've claimed that it *won't*. Since both examples involved difference frequencies, there must obviously be some difference in their differences. The difference in the difference frequencies, to keep things simple, could be labeled as *positive* and *negative* differences, with the appropriate label being established simply by subtracting the injection frequency from the input sideband signal frequency, but *never* the other way around!

In any case where the injection frequency is *lower* than the input sideband signal frequency (as when, to obtain 80m output, we mixed the output of a 5.0 MHz vfo with a 9 MHz sideband signal), a

Table I. Sideband Inversion Logic

GIVEN	Frequency A (USB) Frequency C (Inj Freq)	Frequency B (LSB) A or B
APPLICATION	Frequency A (USB) minus Freq C Mixer Output 1 (USB)	Frequency B (LSB) minus Freq C Mixer Output 2 (LSB)
GIVEN	Frequency D (Inj Freq)	A or B
APPLICATION	Frequency A (USB) minus Freq D Mixer Output 3 (LSB)	Frequency B (LSB) minus Freq D Mixer Output 4 (USB)

positive difference will result. Subtracting 5.0 from 9.0 gives a *positive* difference of 4.0. Likewise, in any case where the injection frequency is *higher* than the input sideband signal frequency, as was the case when, to obtain 15m output, we mixed frequencies from 30.0 to 30.5 MHz with our 9 MHz sideband signal, a *negative* difference will result. Subtracting 30.0 from 9.0 gives us −21, since we're subtracting larger figures from a smaller one, which differences are clearly *negative* differences.

Proof covering the claims made in this article as to when an inversion will occur and when it won't is available in two forms, either of which should suffice to dispel any doubts concerning the reliability of these claims. One involves the examination of an actual rig utilizing frequencies identical to those used in our examples, and the other involves recourse to "sideband inversion" logic.

The popular combination of a 9 MHz sideband signal and a 5 MHz vfo, which was used in our examples, along with an auxiliary oscillator, when needed, is utilized in the Hallicrafters HT-46 transmitter, which makes it one of a number which could serve to illustrate the occurrence or nonoccurrence of inversions in the manner claimed. On the band selector of the HT-46, we find the 80 and 20m bands marked in *red*, and all other bands marked in *white*. Encountering this situation cold, it would be natural to suppose that something happens on 80 and 20 that doesn't happen on any of the other bands. But, having already read the information offered earlier in this article, you will have guessed correctly that exactly the opposite is the case here. The red markings indicate the bands on which inversions do *not* occur, and the white markings indicate those bands on which they *do*, even though no mention of inversions, as such, is made anywhere in the operating manual on this rig. Output in the 20 and 80m bands is obtained by utilizing *sum* frequencies for 20, and *positive* differences for 80, in both of which situations we claimed that no inversion will result, which claim is supported by both of these bands being marked in red. Output in all of the other bands (40, 15, and 10) is obtained by utilizing *negative* differences, in which situations we claimed inversions will always occur, which claim is supported by the white markings for each band obtained in that manner.

Our alternative proof is in sideband inversion logic, as offered in Table I. If frequency A represents the upper sideband of any pair of sidebands and frequency B the lower, then, by the definition of sidebands themselves, A must be higher than B. Frequency C in our chart represents any injection frequency lower than A or B, and frequency D represents any injection frequency higher than A or B. The substitution of any actual frequencies for the letters in the table will establish that, without exception, inversions will occur only with *negative* differences.

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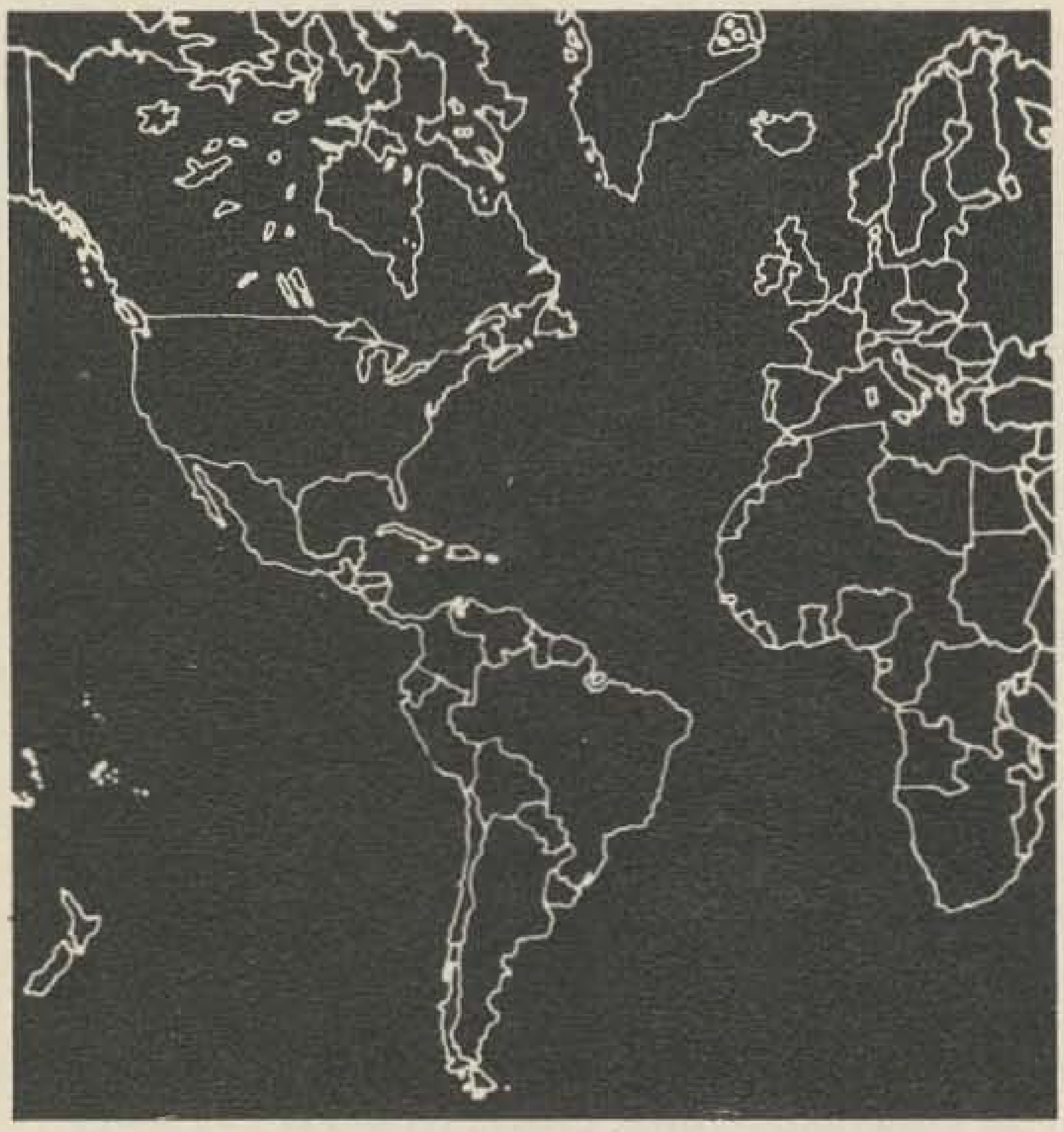

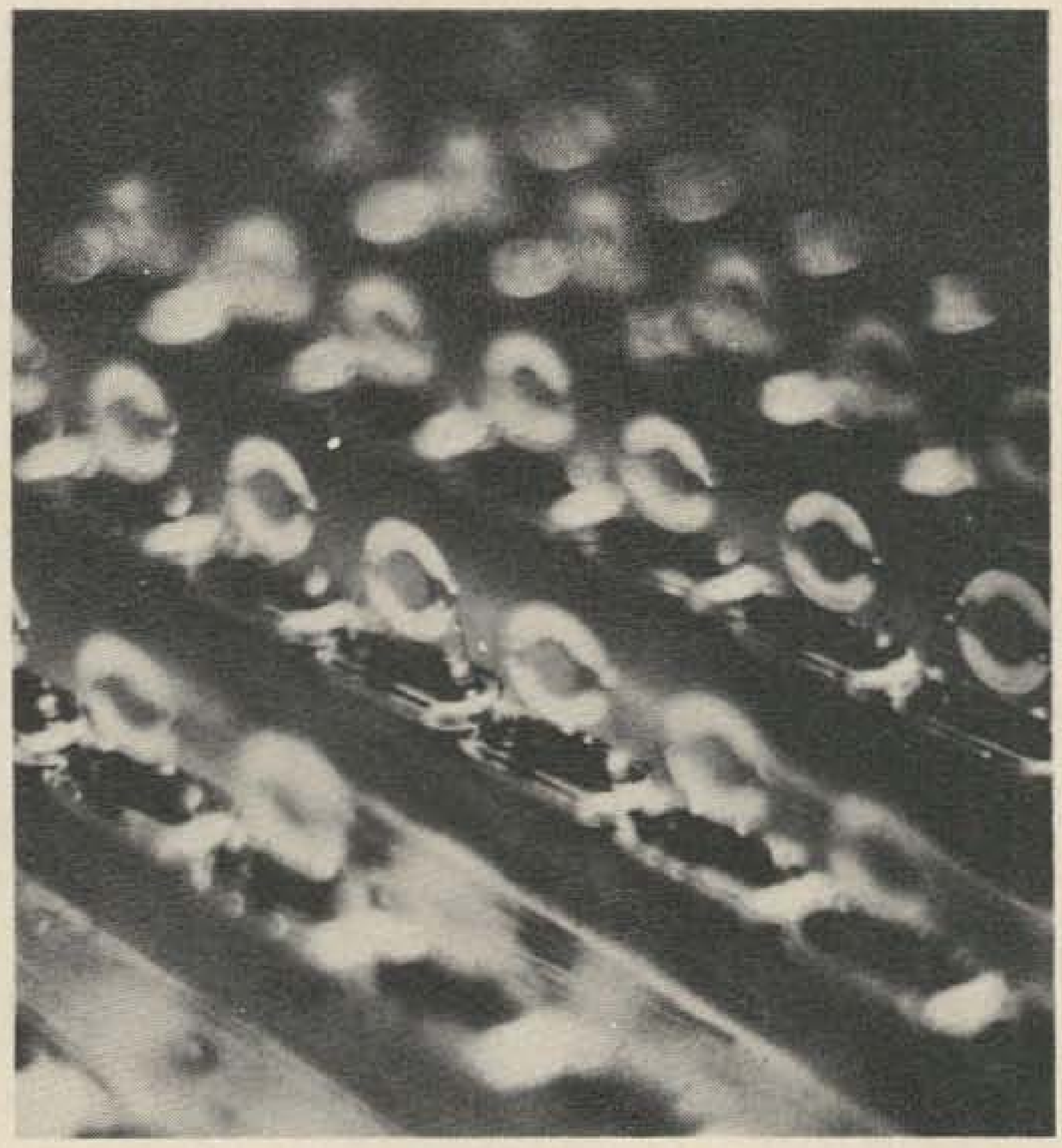

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A MEDIUM FREQUENCY CONVERTER FOR HIGH FREQUENCY RECEIVERS

When today's "oldtimers" were learning the code in the '20s and '30s, they copied a lot of it on the "medium-frequency shipping band." Today's communication receivers seldom cover the broadcast band, let alone frequencies below 530 kHz. There are many interesting signals to be heard on 500 kHz; passenger liners, cargo ships, coastal stations, commercial traffic, ship position reports and weather bulletins. The MCW signals on these frequencies pack a distinctive punch; fellow ex-marine radio operators will know what I mean; and recently I decided to settle an urge to hear them again. Almost every ham I know has one or more old BC radio sets in his junkbox, and this seldom-used junk is just what you will need for this simple medium-frequency converter. Component values are not critical, and the unit gives excellent results.

My station receiver is a Drake 2B and tunes from 3.5 MHz to 4.1 MHz on its lowest frequency band. With this converter, I can tune from 400 kHz to 1000 kHz, using the 2B on 80m. I used a 3100 kHz crystal with a trimmer capacitor across the socket to adjust the crystal frequency to exactly 3100 kHz, and get accurate frequency readout from the 2B dial. Any similar crystal will do if you make suitable allowances; e.g., 3200 kHz will give a tuning range of 300 to 900 kHz. If you have a 3500 kHz crystal and are not interested in the lower part of the broadcast band, you can use that instead. In theory, this will give you a tuning range to 600 kHz. I tried a 3500 kHz crystal, and found that I could hear signals as low as 200 kHz, despite the fact that the converter input will only peak to just below 400 kHz with the component values given. From 200 to 400 kHz you will hear a variety of radio navigation beacons, and from 400 kHz upwards, you will tune the shipping band.

The tuning capacitor is an old two-section variable with both sections in parallel, and a 100 pF mica added to give a total capacity of about 1000 pF. If your junkbox offers you a three-gang type, by all means use it. The coil is a standard broadcast band antenna coil, from a set that used a wire antenna rather than a loop or ferrite rod. If in doubt as to which winding is which on the coil, the commonly used connections are shown on the circuits of Figs. 1 and 2. If you have an unmarked coil, you have an excellent chance of wiring it right first time if you measure the dc resistance of the windings with an ohmmeter; the tuned winding normally has the lower resistance of the two. As well as the coil and capacitor, the old radio that I stripped had a triode hexode converter tube (6K8). Having used

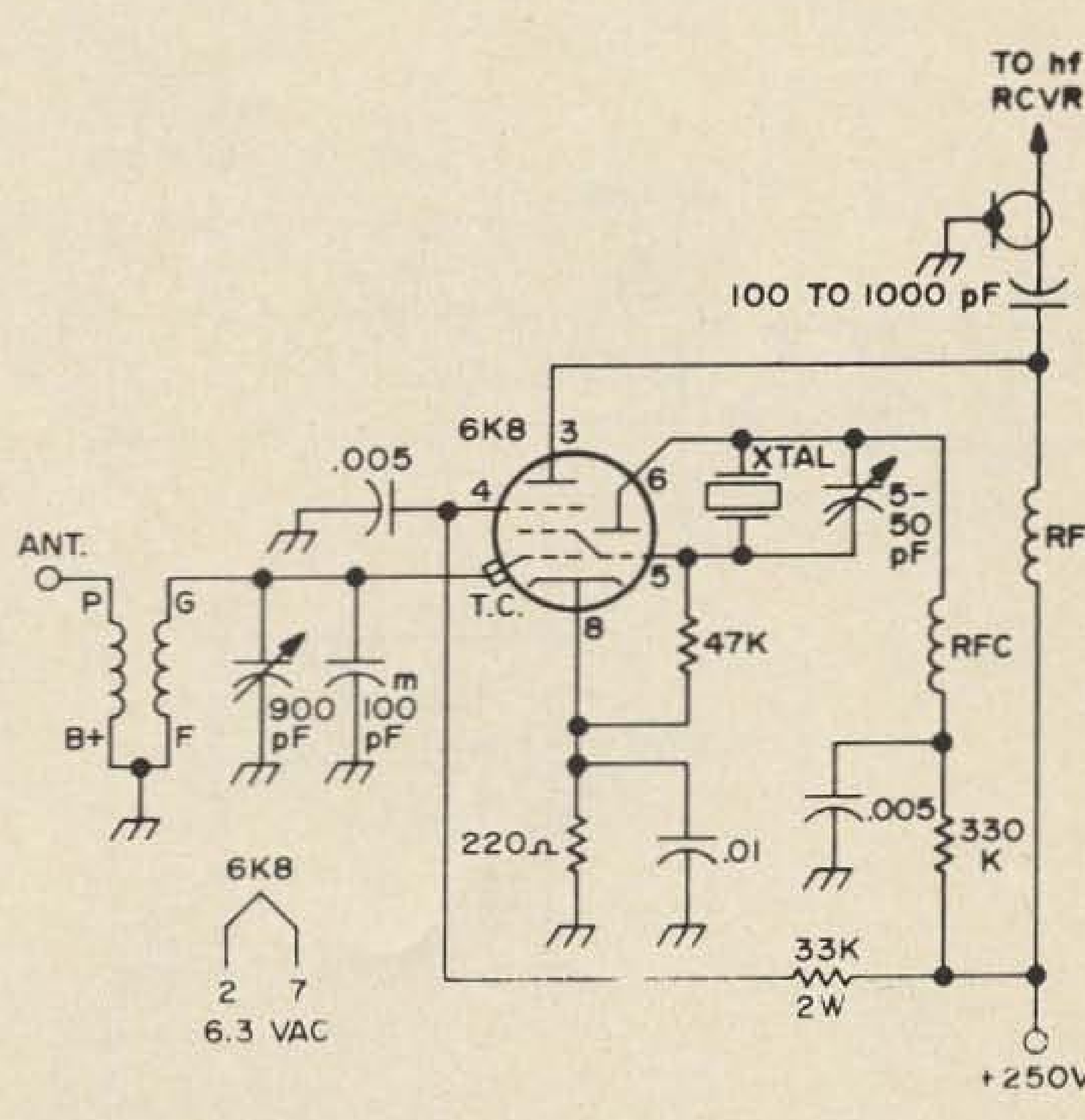

Fig. 1. A medium-frequency converter for high frequency receivers using a 6K8.

the coil and capacitor, I used the tube, too. Pentagrid tubes such as the 6SA7 and 6BE6 are not suitable for this circuit due to their internal construction; however, an excellent modern tube for this converter is the 6U8 triode pentode. Circuits for both tube types are given.

Use as low a voltage as possible on the oscillator section plate, consistent with reliable starting of the crystal. This minimizes spurious mixing and breakthrough of unwanted signals. If your B+ supply differs greatly from my 250V, it may be necessary to alter the values of the B+ line resistors, but they should be near enough for voltages from 220 to 280V. If you use a 6U8, you may have to experiment with the oscillator plate resistor to find just what value is best; I suggest you use a 500 kΩ pot at first, and adjust it to a setting that gives good results; then replace it with a fixed resistor of the same value. The bypass and coupling capacitors in both circuits are not critical in value; in Australia, a very convenient source of .005 μF disk ceramic capacitors is discarded starter units for fluorescent lights. Each starter contains a glass-enclosed switch and a bypass capacitor. The rf chokes can be any that you have on hand; if one is better than the other, use the best one in the mixer plate.

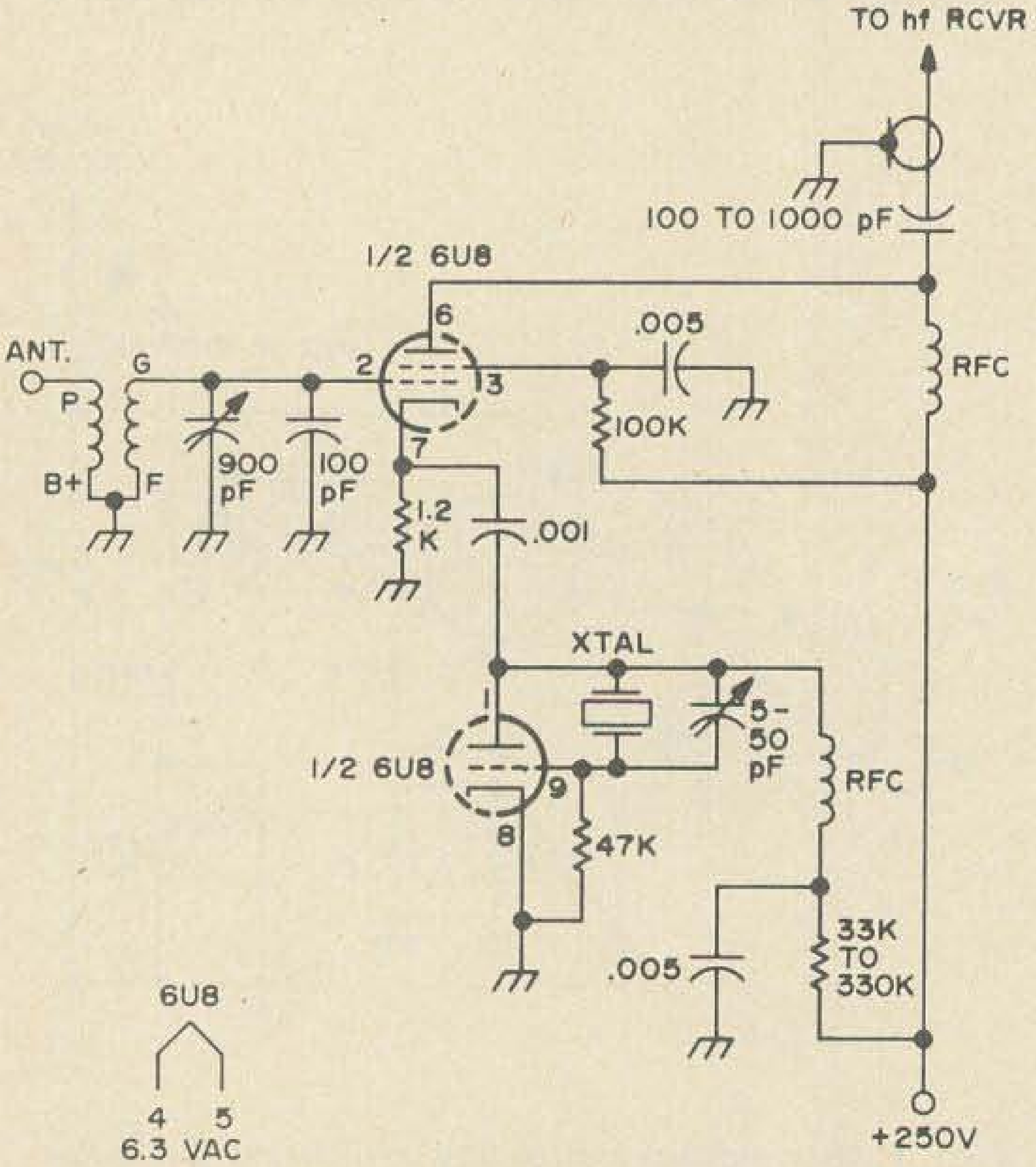

Fig. 2. Converter circuit built with 6U8.

The cable from the converter to the receiver antenna input should be coax of course; anything in the 50–75Ω range is ideal.

The power requirements could probably be met from most receivers, but I take my power from the lightly loaded supply that feeds my vfo. The converter was built on a small chassis of 9 by 3 by 2 in., which suits the space I had available on the radio desk.

In use, I select the required frequency on the Drake dial, peak the preselector tuning, and then peak the required medium-frequency signal with the converter tuning capacitor. My station antenna is only a 67 ft long, Windom-fed, inverted vee, 25 ft high at the center, but seems adequate for 500 kHz reception, as I have heard signals over 2000 miles away at night, and up to 500 miles by day.

The coastal radio stations call on 500 kHz, and use one working frequency, generally between 414 and 492 kHz, though one or two frequencies have been allocated between 514 and 520 kHz; the power is around 2 kW. Ships call on 500 kHz and have 410, 425, 448, 454, 468, 480, and 512 kHz for working frequencies. Most cargo ships run 500–900W, and passenger ships run up to 2 kW. All stations observe two "silent" periods each hour; two 3-minute periods beginning at 15 past and 45 minutes past the hour.

Hams who are boating enthusiasts will find the local coast stations' weather bulletins of interest, and with code speeds varying from 15 wpm to over 25 wpm, there is plenty of practice available. The quality of code varies, too; from the roughest imaginable, to the perfection of machine type Morse.

This converter can be used with any receiver that covers 3.5–4.1 MHz or higher; build it yourself and see how interesting the lower frequencies can be.

My grateful thanks are due Gil Moody (VK3ZR) for suggesting that the mixer plate load be an rf choke. Without this advice, I would certainly have used tuned output, and run into no end of trouble with tracking problems and receiver overload.

. . .VK3IQ■

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Longdon Heath
Upton on Severn
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EASY END FEED Z-MATCH

If we look for the quickest, easiest, cheapest way to put out a signal on any band from 80 to 10, we see that the answer is an end-fed wire. This has extremely variable characteristics in terms of radiation, depending on length, band, direction, etc. On any particular band it is generally about as good as a dipole, if similar in length to a dipole for that band. On lower frequencies it may be a quarter wavelength or less, while on higher frequencies it would be two half-waves, or more.

The beauty of the end-fed wire is that in practice it can be *any* length. This means it is strung between the two best available supports, with one end (adequately insulated) descending into the shack. It may be vertical, sloping, horizontal, or a mixture of these, and is probably longer than about 20 ft, though it is unlikely to be over about 125–150 ft unless you are lucky with space.

Its feed impedance will be a variable thing, according to frequency, length, and other factors. The usual transmitter or transceiver pi output tank is mostly intended to work into a load of about 50 to 75Ω. So inevitably, this and the end-fed wire will be incompatible on some bands.

Z Match

An impedance or Z-matching device between transmitter and end-fed wire corrects matters so that all but extremely short wires will load the transmitter. Figure 1 is a simple but practical circuit. L is a robust tapped coil, and the variable capacitor is about 150 pF, wide spaced for other than low power. This was found satisfactory for any wire from 10 to 150 ft. With shorter wires arcing occurred. The longer wires naturally radiate better.

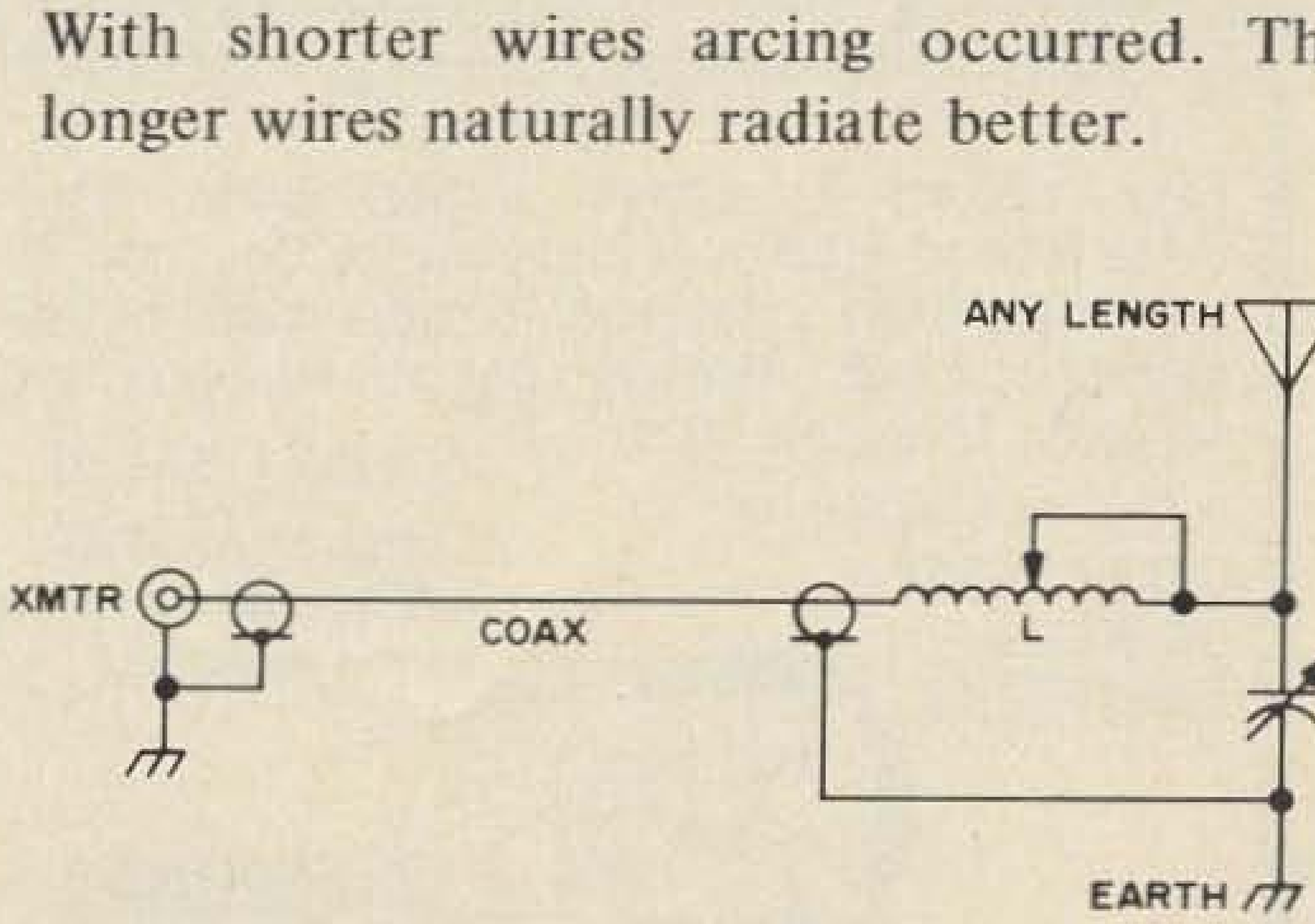

Fig. 1. Circuit of the type used.

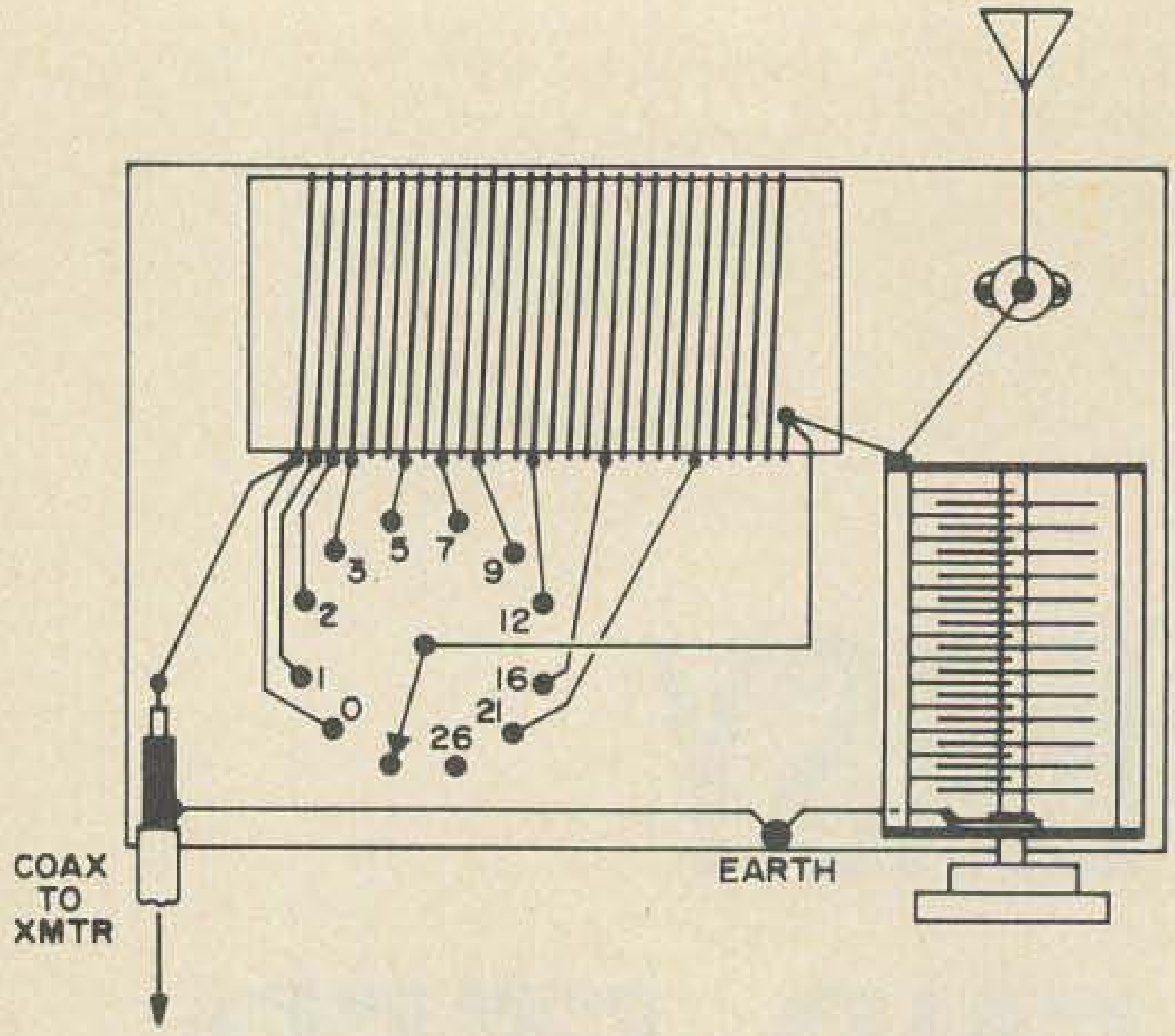

Fig. 2. Coil and other details.

This is a good opportunity to use a surplus inductor. The one actually used was wound for the job, however. It had 26 turns of 16-gage wire on a 2½ in. diameter ceramic form, the winding taking up 3½ in. Stout leads soldered on go to the tabs of a 12-way rotary switch (Fig. 2). The switch selects the following numbers of turns – 0 (coil shorted), 1, 2, 3, 5, 7, 9, 12, 16, 21, and 26 (whole coil).

An swr indicator may be put in the coax from the transmitter to Z match. A good earth ground is helpful. Remember, there may be considerable rf on the antenna connection.

The receiver or transceiver S-meter should give a guide to tuning. Begin with the capacitor at minimum, and no turns in circuit. Rotate the switch to bring up signals. When the best point is passed (too many turns) rotate the switch back one position, and peak the variable capacitor for best reception.

Adjustments are somewhat similar for transmitting. If the TX pi output capacitor is at about a setting which would work into around 50–75Ω, rotating the capacitor with the correct number of turns in circuit will show a point where the system draws power and can load the transmitter.

It was found that with quite long wires, the variable needs little or no adjustment over a fair section of a band. But with short wires, it has to be retuned with other than small changes in frequency.

. . .G3OGR■

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Albuquerque NM 87105

Coat Hangar Antenna for 2 Meters *REVISITED*

When I saw the coat hanger antenna for 2 meters in the June 1969 73, I knew it was just what I was looking for, so I made one. It works nicely, but a few changes can make it even better. Since I use one 10 ft length of coax to connect transmitter to dummy load and transmitter to SWR, I wanted to use the same piece of coax on the antenna, but the original article had it soldered to the antenna directly. I made two modifications on this antenna, and now the coax is removable and it is now impossible to put an eye out with it. The grounding plane section of the antenna is dismantled and put together as follows:

1. Put two connectors, No. SO-239 back to back and solder them together with about ½ in. space between them (see diagram).
2. Cut a piece of plexiglas 3/8 in. thick, the size of the connectors (about 1 x 1), and cut out the area indicated on the drawing, then put it back together. Now you can screw the cable on and off when packing the antenna or storing it.

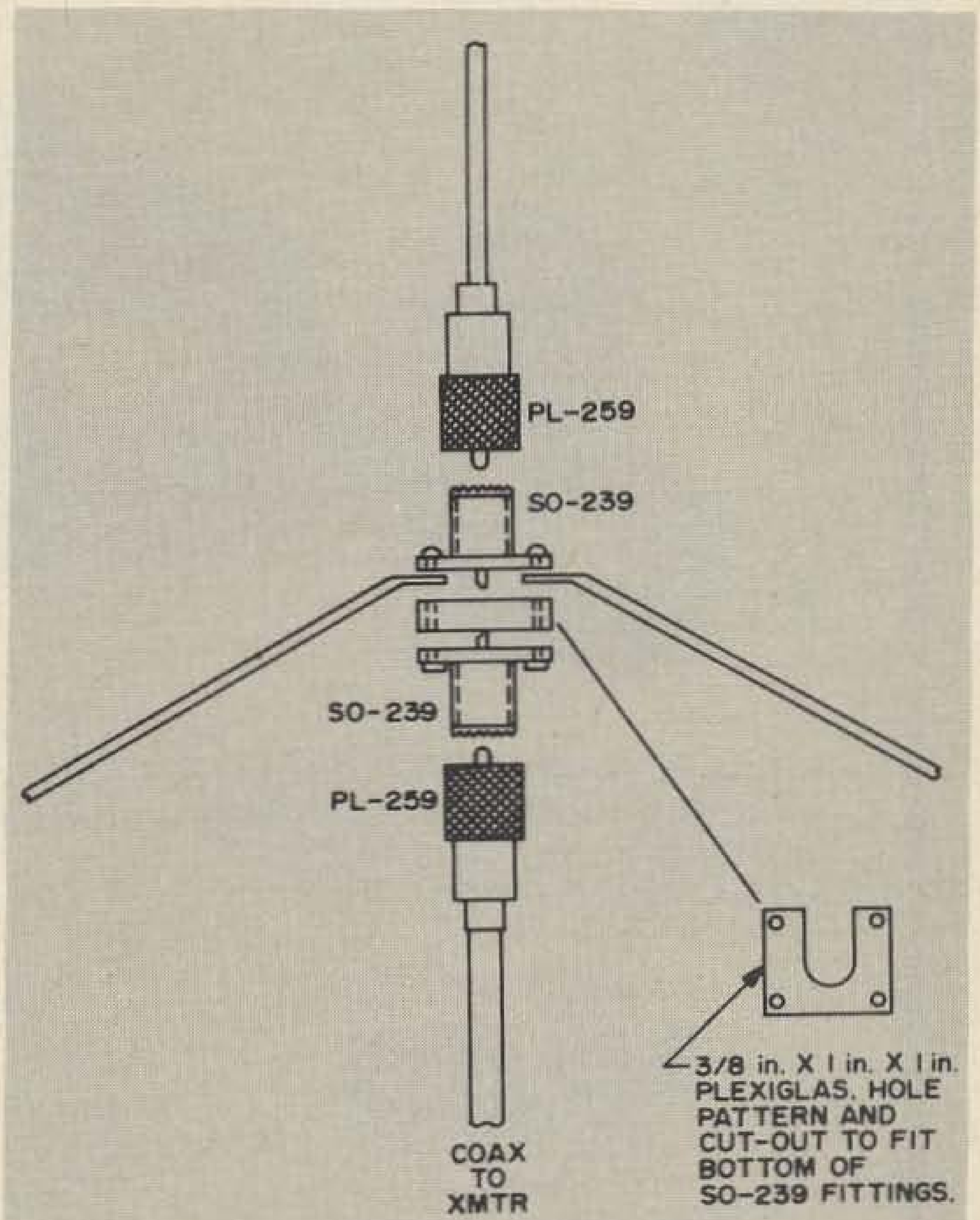


Fig. 1. Construction details of the improved groundplane.

If you are afraid someone might get poked in the eye with the grounding section of the antenna, put four foam balls on the ends of the elements and paint them a bright color. I painted mine a bright orange and it really stands out. If you like your homebrew equipment to have your call letters, paint them in black on the colored balls. It really stands out. Good luck.

. . .Gelsinger■

73 Uses the Simpson Model A FM Transceiver

This is an amateur model of the very well known Simpson Model T marine transceiver, a four channel 150 MHz FM transceiver. The amateur who is looking for an American built unit of exceptional quality would do well to take a close look at the Model A.

Some of the features which make this transceiver so interesting to the FMer are its uncompromising construction, with nothing left out for economy. There are four transmit channels and four receive channels, and any may be paired with any other if you live in a mixed-up repeater area with machines on, say, 22-76, 22-82, 16-76, 25-76, 25-88, 28-88, 31-88, etc. Independent switching of the receive and transmit channels just may

be the way things are heading.

By tilting the oval loudspeaker back and building in a small air coupling section in front of the speaker, the Model A is capable of putting out a remarkably good sound. If your car has much more noise than a Rolls you may just need all the loudspeaker you can get to hear what is coming out of your receiver and you may find the usual 2 in. speaker a whisper in a windstorm when you rev up through the gears.

Separate boards are used for the receiver and transmitter functions, a fact which has alerted some of the more devious technicians in our midst to the possibilities of using the Model A for a repeater. All it takes are a few wiring changes and a carrier operated relay to make the basic change. To my knowledge there are well over a dozen active repeaters around the country today using the Model A boards.

The transmitter puts out a minimum of 6 watts and uses the popular 6 MHz crystals (the same as the Regency transceivers). That power level is quite adequate for most repeater operation and represents a good compromise for your car battery longevity. You can always put in an external booster amplifier for boondocks work.

The receiver has a ceramic filter with 6 dB skirts at 13 kHz and 60 dB at 36 kHz, which means that a strong signal on 91 will not wipe out both 88 and 94 for you as it will in some other popular receivers. One good strong 91 machine can raise Ned for a hundred miles on three channels unless everyone has good selecting receivers. Sure, you can always buy a $15 filter and put it in yourself, but that means drilling holes and work which could be avoided if you chose a receiver with narrower bandwidth.

The oscillators all use diodes for switching, which means that you can actually switch channels from any distance you wish. This system is ideal for use with remote base installations where you might have the transceiver up on the top of a mountain and remotely operated by 450 MHz link or phone wires. You may not be able to live on top of a mountain or a tall building, but you might be able to stick a remote rig up there, which is the next best thing.

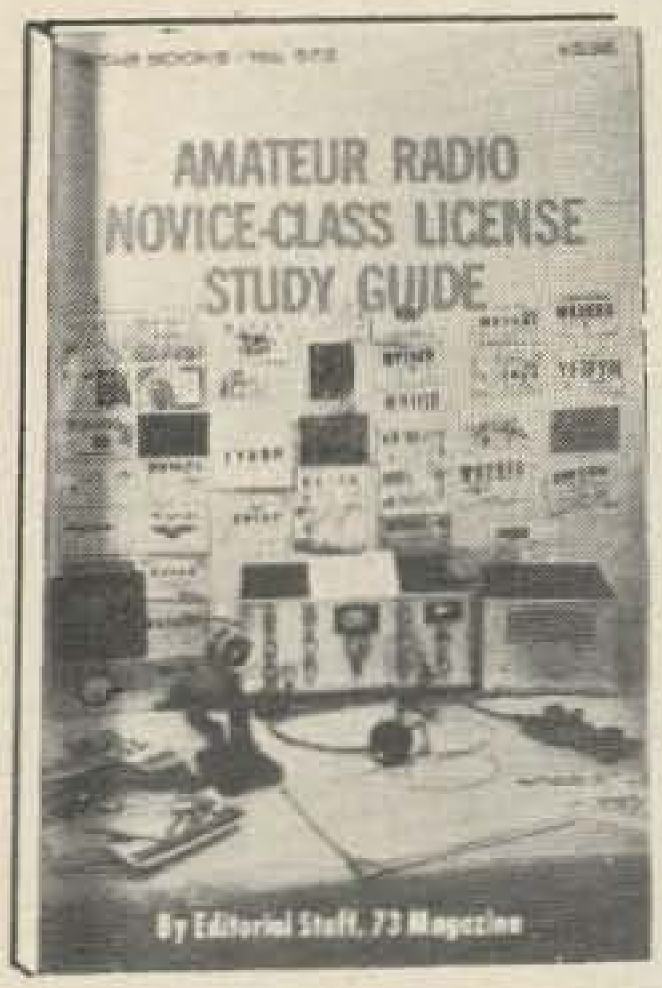
The oscillators are padded enough so you can buy inexpensive low tolerance crystals and zero them in. The pads are right out there where you can tune them too, rather than requiring a deformed midget with a lot of patience to get your crystals on channel.

The Model A is in a flat pack that will fit under the dash of most cars and still leave plenty of leg room. The box is made of extruded aluminum side rails with vinyl covered aluminum top and bottom covers and a front panel of injection-molded Cycolac. The circuit boards are glass expoxy and the parts are machine-wave soldered to them. In all, it is an extremely professional and commercial quality job of construction.

It also works.

...W2NSD/1

Free Free Free Free Fr



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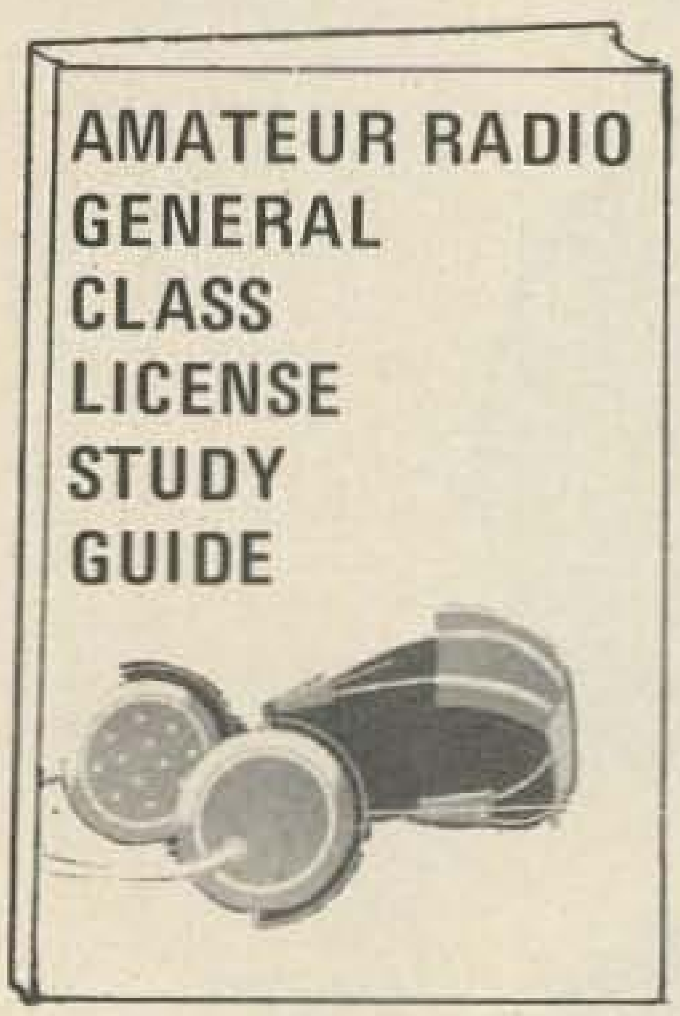

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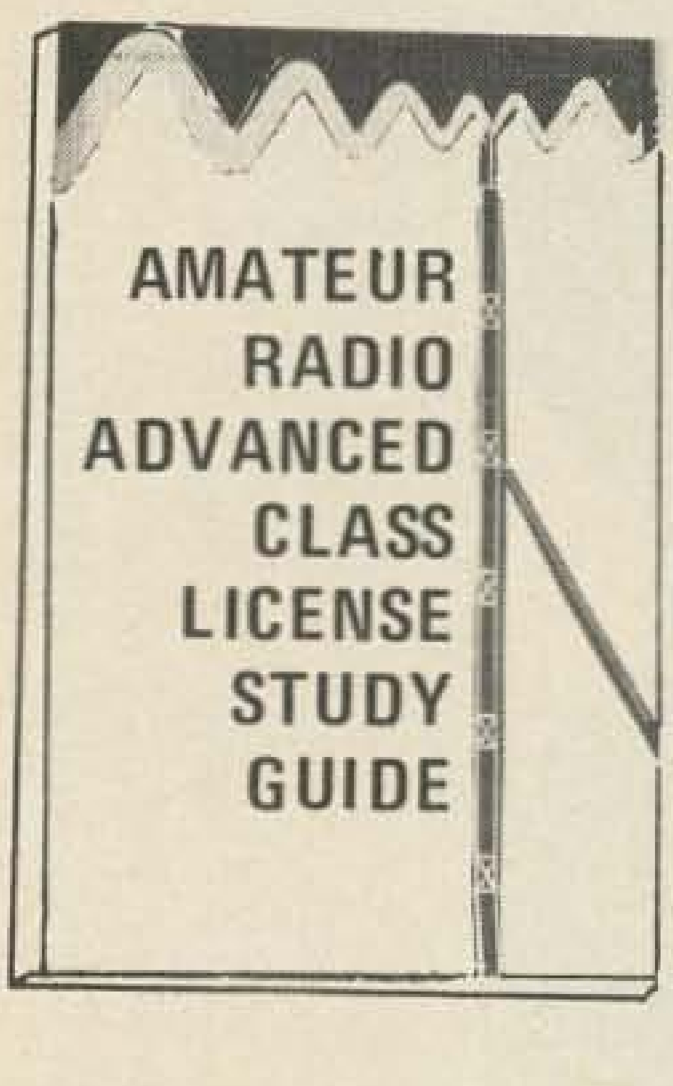

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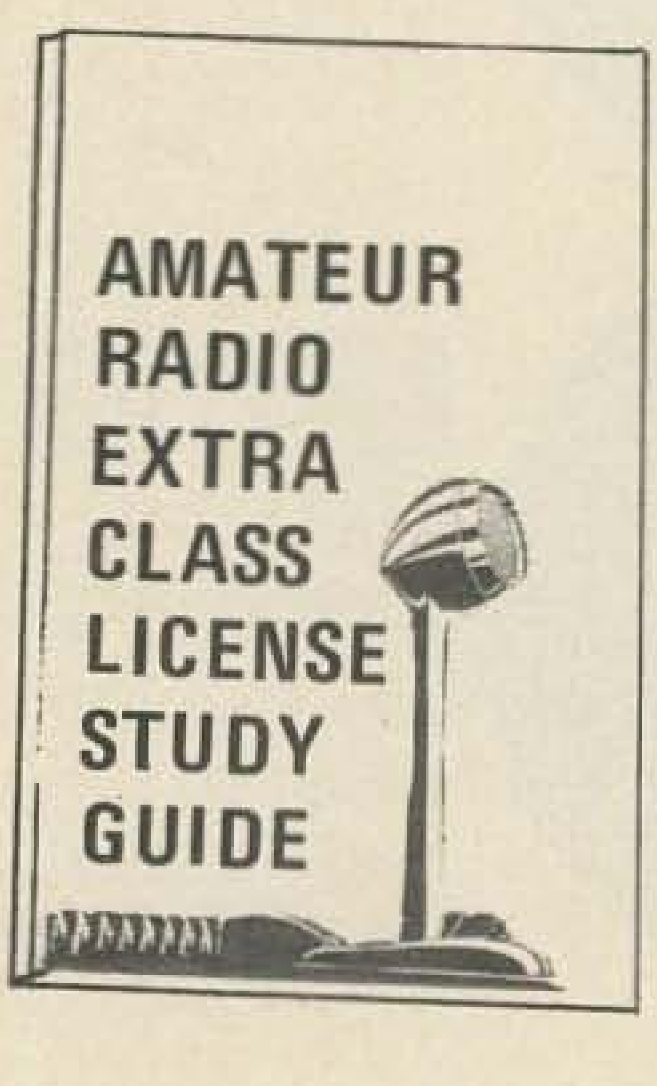

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Repeater users in New England and Eastern New York (including Lo Island) may be interested in a subscription to a Repeater Bulletin whi is available free to qualified amateurs in that area. This bulletin w attempt to provide communications between the 40 or so repeater grou now using 2m FM in the Northeast. The Bulletin will provide not on news of activities, plans and items of interest on each of the 40+ repeat but will also attempt to keep up with the news of new equipment, n circuits, and provide a forum for discussing repeater problems. We ho to reprint some of the more interesting FM articles from past issues 73, plus excerpts from past, present and future FM books. It should provocative and interesting.
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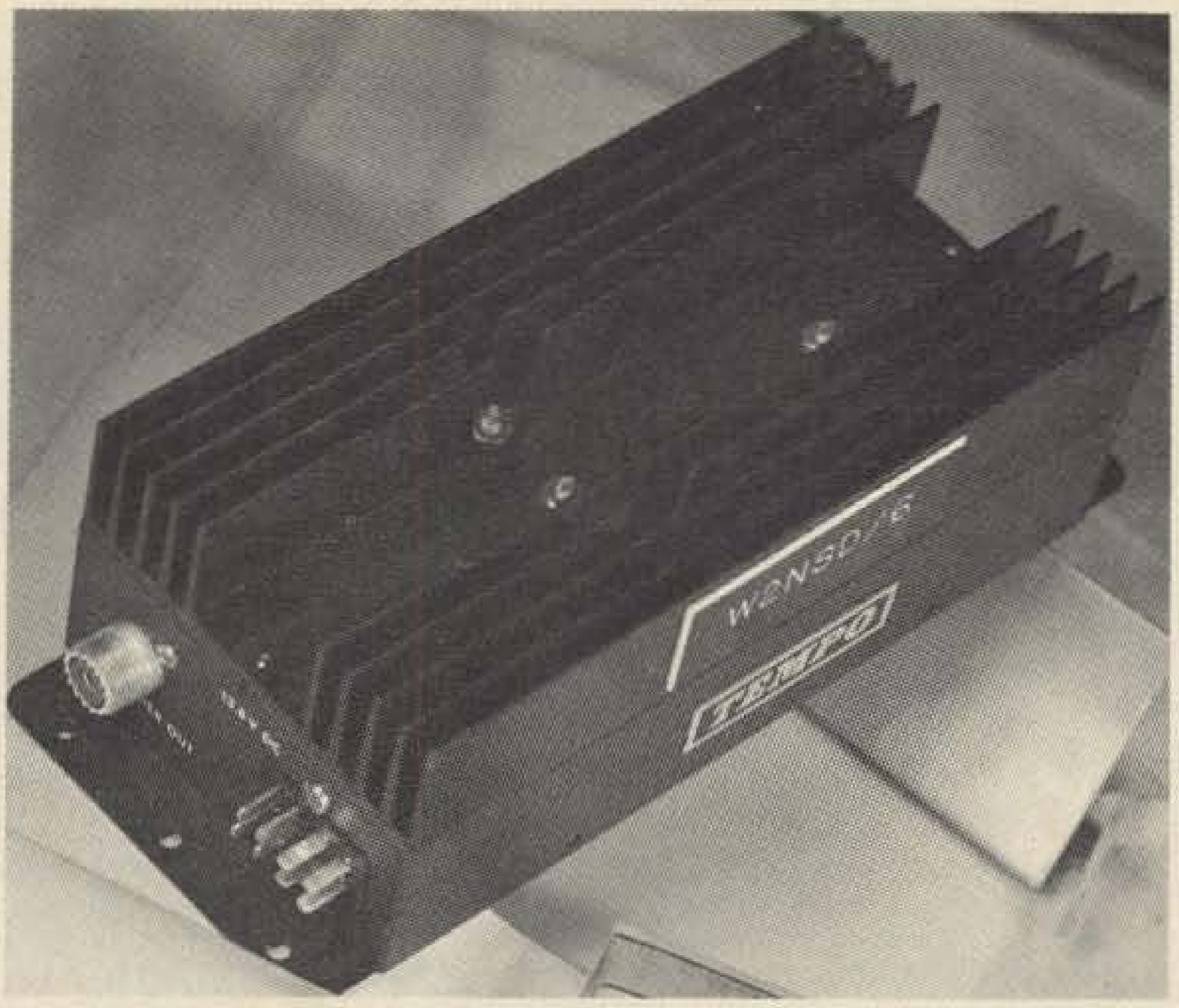
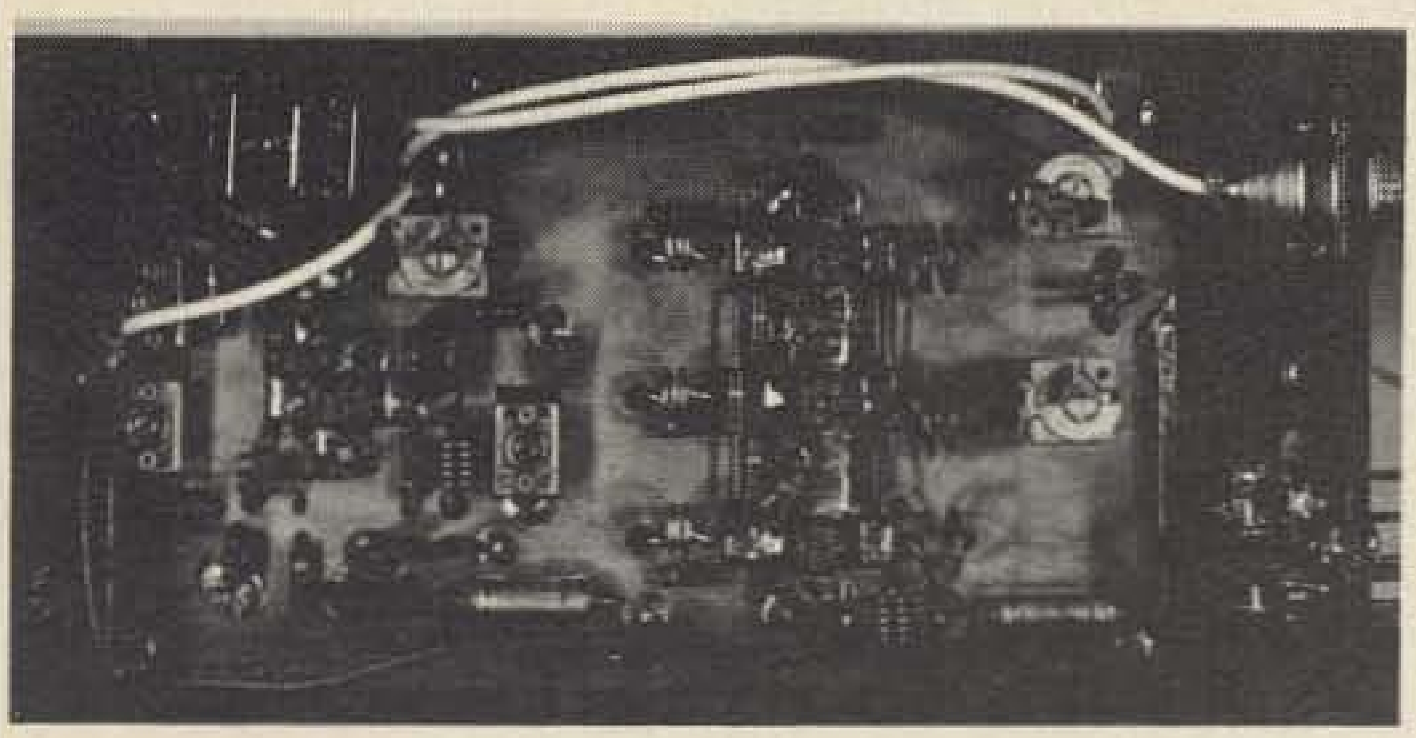


73 Reviews

The CT POWER Amplifiers

Knock that repeater right off the mountain!



One of the neatest, most professional wiring jobs we've ever seen!

This new concern in Hawthorne, California, is producing a line of eight two meter power amplifiers which are being marketed by Henry Radio as part of their Tempo line. The 45 and 60 watt output amplifiers are available for driving powers of one, five or ten watts, while the 100 watt output models can be driven with five or ten watts.

While the ten watt output of most of the FM transceivers is quite adequate in the primary coverage area of repeaters, what amateur has not fretted when he was far enough out to copy the repeater solid, but could not trigger it? A hundred watt amplifier will give you quite a few more miles of good solid repeater usage, you may be sure.

But fellows, be fair, put in a switch to cut out the amplifier when you are close enough in so it isn't needed. No one is going to love you if your signal comes crashing in on top of all the other mobiles. Use these power amplifiers as a force for good, not as a means for getting on every shoot list within repeater range.

One hundred watts from your mobile rig will stomp everything in town, including most of the home rigs. At 13 amperes it will deflate your battery unless your car is set up for this type of demand. An alternator system has a lot to recommend it when you are asking this from the car. Perhaps the 45 watt unit is more practical for your system with its 5A demand. 45 watts is still a lot of soup and should easily double your range into the repeaters.

Are these amplifiers difficult to install? No. Being small, 3" x 4" x 8½" for the 100 watt model, they will mount just about anywhere. My own preference is on the firewall under the front hood where the battery cable can be relatively short and deliver the 13.8 volts in good shape to the unit. A coax cable from the amplifier runs through the wall to the back of the transceiver, while the antenna connects to the other end of the amplifier.

When you turn on your transmitter a bit of the rf is rectified as it enters the amplifier and this actuates a send-receive relay, switching the antenna to the output of the amplifier. A 2N2222 transistor is used for the switching function, and TRW PT-8710s are used for the amplifier, with one as a driver and three in parallel in the final. As soon as the ten watts of rf stops coming through the hose from the transceiver the relay reconnects the antenna to the transceiver, cutting the amplifier out of the circuit.

If you are having trouble getting into a repeater you might consider going the power amplifier route.

In Action!

Using the Tempo 100 watt amplifier I have yet to find one repeater that I can hear well that I can't get into. With the amplifier off, my signals are frequently either marginal or else just don't make it at all when I get on the other side of a mountain, even though I can hear the repeater enough to copy it.

If you can get into every repeater you can hear, then you have nothing to gain from adding an amplifier. If your signals fade out before the repeater, perhaps this is your answer as it was mine.

...W2NSD/1

John J. Schultz W2EEY
1829 Cornelia St.
Brooklyn NY 11227

OPTIMAL VERTICAL ANTENNA LOADING TECHNIQUES

The author discusses the various techniques used to load vertical antennas. From the viewpoint of reasonable performance, ease of construction and bandswitching, a combination of top and base loading is favored. The construction of a pratical antenna is illustrated.

Many amateurs are faced with antenna placement situations which do not allow the erection of full-sized antennas. A loaded type of vertical antenna is often the only antenna possibility. Often, even a trap-type vertical cannot be used on the lower frequency bands because of the size of such an antenna and its support requirements. The only choice then is to use as long a vertical antenna as possible with as much loading inductance as necessary to resonate the antenna on a desired band. The physical length of such an antenna may be 1/6 or less of the electrical length it represents through inductive loading.

The subject of how to produce efficient, extremely short-loaded antennas has been the subject of numerous studies by commercial and military organizations. The purpose of this discussion is not to delve into the more advanced techniques which have been developed since such techniques often require special construction and special equipment for a relatively small gain in antenna efficiency. This approach may be necessary in some situations where the capacity of the power supply for a portable transmitter is limited and the only possibility to improve the radiated signal is through increased antenna efficiency. In the amateur case, and particularly for the newcomer who starts with a low-power transmitter, it is often easier and more economical to first try increasing the transmitter output level (via an inexpensive linear amplifier, for instance) rather than getting involved with complicated antenna construction projects. Therefore we will discuss only the simple forms of antenna loading which have been well proved and which are easy to build. The material is particularly oriented toward the newcomer who would like to construct a simple loaded type of vertical antenna that will give reasonable results on one or more high-frequency bands.

Loading Variations

A full-length quarter-wave antenna will have the current distribution shown in Fig. 1A. If the physical length of the antenna is made shorter than the required electrical length, a loading inductor can be used to establish the correct electrical length. When this is done, the current distribution may appear different than in Fig. 1A, depending upon where the loading inductor is placed. If the loading inductor could be distributed over the entire length available for the antenna (helical loading) the current distribution would look the same (Fig. 1B). Placing the loading inductor either at the extreme top or bottom of the antenna will

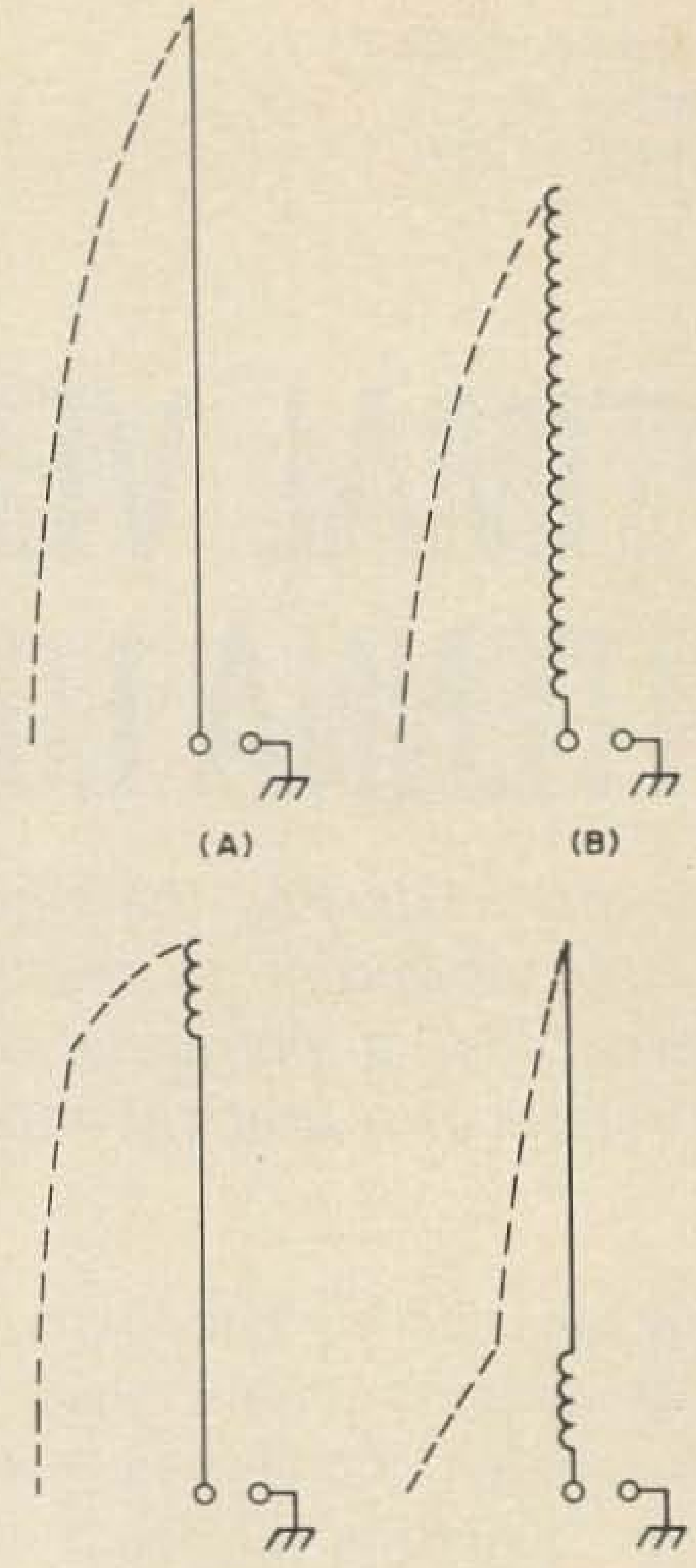


Fig. 1. The dotted lines show the current distribution on a full length ¼λ vertical antenna (A) and various forms of physically shorter, inductively loaded antennas.

produce the current distributions shown in Figs. 1C and 1D. Various points can be advanced for either top or bottom loading. Top loading has the advantage that the greatest current flow will take place in the metal rod section of the antenna and, therefore, less I^2R losses will take place in the loading inductor on top. Bottom loading has the advantage that the loading inductor can easily be bandswitched. Also, if the loading inductor is constructed of heavy enough wire, the losses can be held to a tolerable level.

Aside from placing the loading inductance either at the extreme top or bottom of the antenna, one could also place the loading inductance at the center of the antenna or place a portion of the inductance at the top and a portion at the bottom of the antenna. The current generation of mobile antennas generally uses center loading because of a

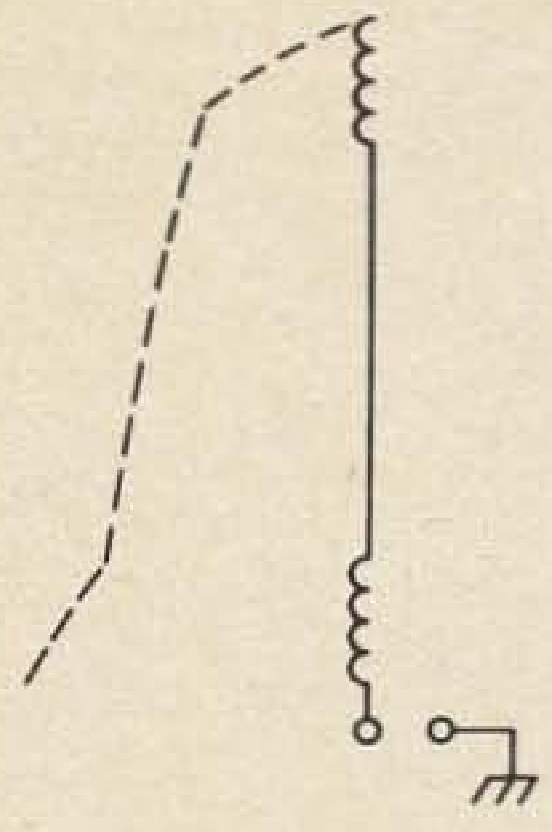


Fig. 2. Splitting the inductive loading to both ends of the antenna produces the current distribution shown.

combination of electrical and mechanical factors. The loading inductor need not be as heavy as a base-loading inductor to keep losses to a reasonable level, and the physical placement of the inductor allows a flexible upper section for the antenna, as well as access to the inductor for bandswitching by changing inductors. However, for home-station usage, the proper placement of part of the loading inductance at the top and bottom of the antenna, as shown in Fig. 2, has a better combination of electrical and mechanical advantages. The placement of part of the loading inductance at the base does not optimize the situation where the highest current flow is through the metal rod of the antenna, but it is also true in a practical situation that the most severe ground losses would still take place at the base of the antenna. So the actual increased loss that results as compared to solely top loading the antenna is a small price to pay for the convenience factors involved in bandswitching and impedance matching the antenna to a transmission line. The top loading that is used insures that a good portion of the highest current flow will take place in the metal rod.

Finally, the splitting of the loading inductance between the base and the top of the antenna greatly simplifies construction of the antenna for home station usage where a single long aluminum or steel piece of tubing is used as the main element of the antenna.

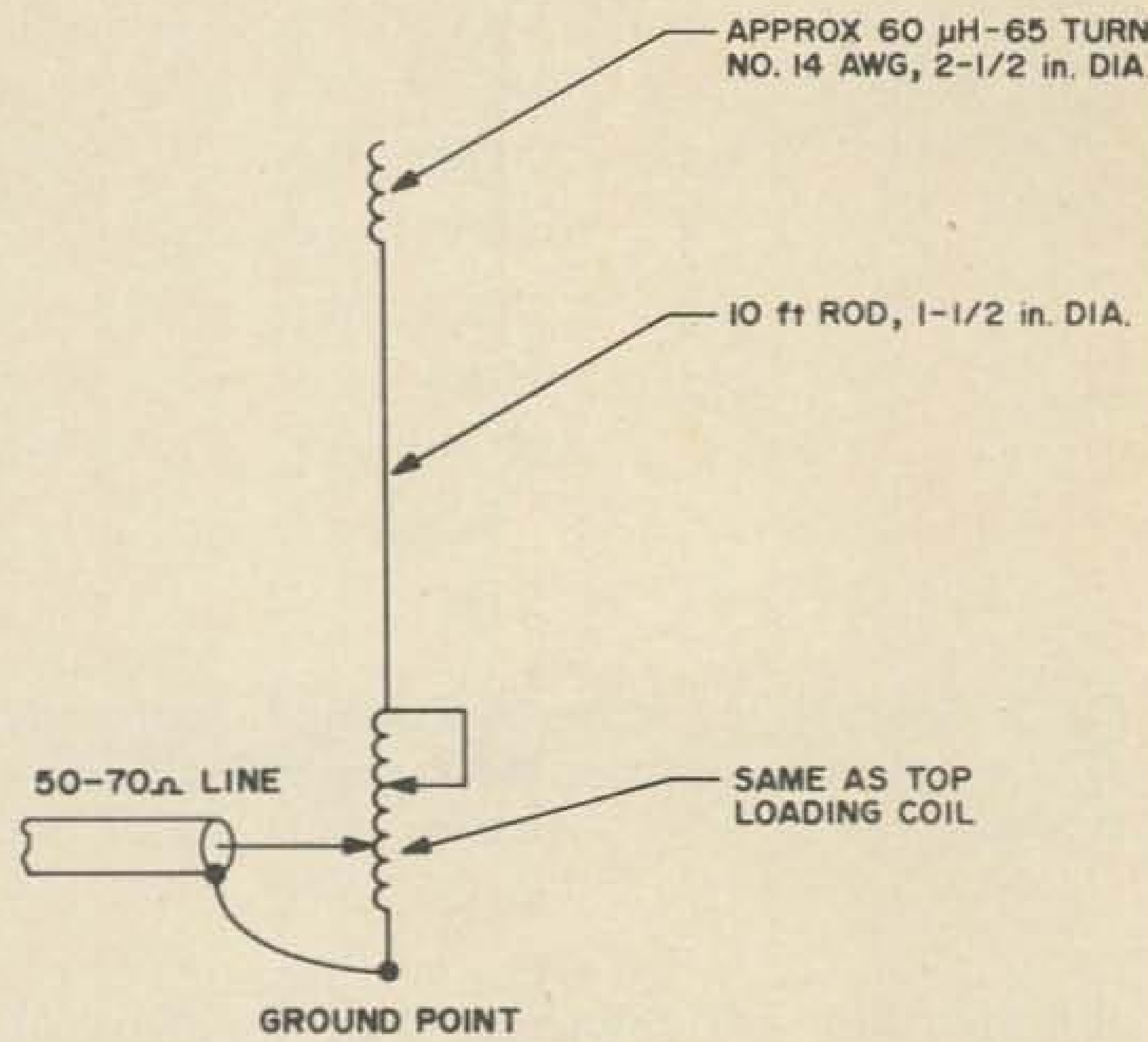


Fig. 3. Dimensions and coil sizes for 80/40m antenna.

Practical Example

Figure 3 shows a simple antenna using a 10 ft aluminum rod and top and base loading which I constructed for use on 80 and 40m. The maximum amount of top loading was utilized that would still permit enough base loading to be present on 40m so a coaxial transmission line could be tapped on the base-loading inductance for a proper impedance match. For the 10 ft rod, this meant a maximum top-loading inductance of about 60 μH. Since the top loading is fixed, this meant that the base-loading inductance has to be increased as necessary on 80m to resonate the antenna. Again, about 60 μH is necessary. The coil dimensions shown in Fig. 2 are those for which B&W or Air Dux coil stock is available. If possible, it would be desirable to increase the diameter-to-length ratio of one or both coils (maintaining the same inductance) so that the diameter is about half the coil length. This would raise the Q and improve the overall antenna efficiency. Such construction would make it more difficult to tap the transmission line on the base-loading coil but it should be easy to implement for the top-loading coil. The top-loading coil used is a salvaged coil from a commercial trap-type vertical antenna. The necessary loading inductances for other bands or with other lengths of tubing can either be calculated from handbook data or it can be easily experimentally determined. In the latter case, the maximum amount of top-loading inductance is used on the highest frequency band that still allows a sufficient amount of base-loading to permit matching the transmission line. The base loading is then increased as necessary to resonate the antenna on the lower frequency band.

An swr meter is the only instrument necessary to adjust the antenna. Starting on the highest frequency band, the minimum amount of inductance is used in the base coil that permits the transmission line to be tapped on with a 1:1 swr. On the lower frequency band, the base coil tap is first changed to bring the swr down and then the transmission line tap readjusted to finally lower the swr. It may be possible to find a compromise tap point for the transmission so its position does not have to be changed when changing bands. The actual changing of the coil or transmission line taps can be done with relays or manually with clips, as desired.

Summary

No simple, short-loaded antenna will be extremely efficient on the lower frequency bands. However, the antenna described will work reasonably well for its size and it is a practical solution for a simple to construct and inexpensive antenna where space is limited. One point that should be carefully observed in installing the antenna is to provide a good ground connection either in the form of radials or connection to some large metal structure. If no ground connection possibility exists where it is desired to install the antenna and no room exists for radials, two antennas with similar loading coil arrangements can be combined to form a vertical dipole, or they can even be mounted at right angles to each other in the form of an L.

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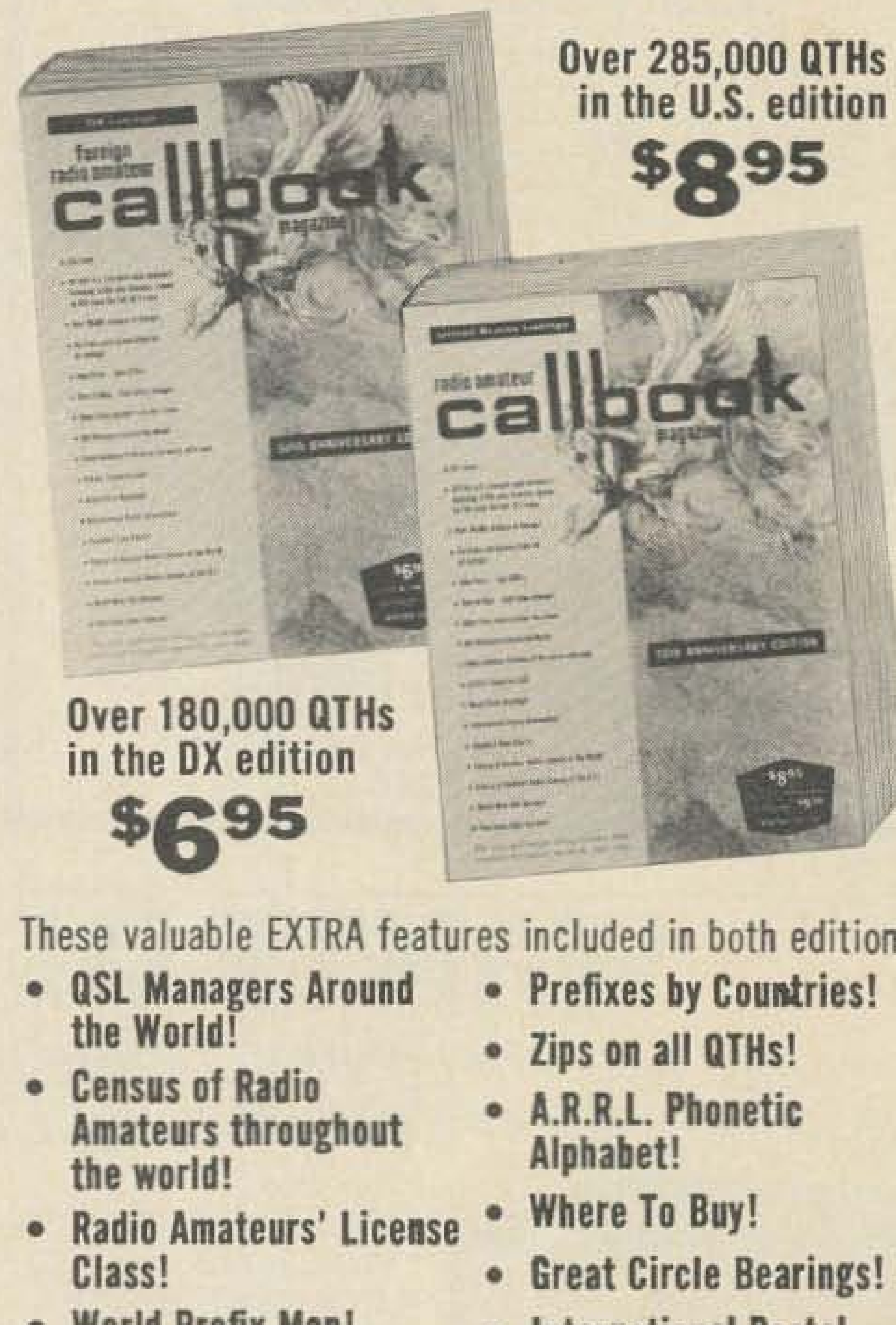

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