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73 magazine
for radio amateurs

23 • Feature Articles • 23

CONVERSIONS: T-278 (2m), ART-13
ARC-3 (2m), ESM/1, etc.

FM HR-2 Improvements
Nicad Charger

General Class Q & A

73 magazine for radio amateurs

#138 MARCH 1972

CONTENTS

FEATURES

STAFF

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Amateur Radio

MARCH MCMLXXII Monthly Ham

HAM DOC HEALS VETS

Reprinted from The Rockland County Journal-News, Nyack, N.Y., Dec. 21, 1971.

By Gale Tollin
Associated Press Writer

Minneapolis, Minn.

(AP) – His friends call him "Doc" but Felton Jenkins is a physicist-engineer and not a physician. He does his healing in the basement of his home, using eight powerful shortwave radios and three telephone lines to deliver therapy to wounded servicemen in Vietnam.

'It's my way of saying thanks to the boys," explains Jenkins.

For the past four years Jenkins has been devoting much of his time and money to putting wounded soliders in voice contact with their families. Six days a week – with Sundays off – he is up at 6 a.m. seated among his microphones, dials and speakers. He handles 25 to 30 contacts each morning, in about three hours, and the number has run as high as 37 when conditions are favorable.

The soldier's conversations with home, Jenkins feels, have medical benefits – especially when nervousness and loneliness figure in the wounded man's condition.

Frequently Jenkins works through the Military Affiliate Radio System – MARS. Ham radio operators in Vietnam patch into a telephone which is taken to the bed of a soldier in a military hospital or on the hospital ships Sanctuary and Repose, anchored off the Vietnam coast.

Jenkins is on the U.S. end of the transmission. He calls the soldier's family by telephone and patches the conversation into his radio.

If the father is at work and the mother at home, Jenkins phones each of them on different lines and patches them into a conference call. The result is that the son in Vietnam, father on his job and mother in her home can chat in a three-way conversation.

"It's like a party line." said Jenkins. "It gives me a certain amount of pleasure to be able to do something for somebody else." he said. "I look at life as a great big mirror. You look in it and smile and it smiles back."

His hobby, he said, brings him satisfactions that can't be measured in dollars.

As an example, he recalled the case of an American solider who had lost both legs in Vietnam.

"His spirits were low, and he wasn't cooperating with the doctors." Jenkins said. "The doctors were about ready to give up on this boy, and they asked me if I couldn't arrange for him to talk with his parents.

"The parents happened to live in Mexico and it wasn't the easiest thing in the world to get them to a telephone. I had a friend in Mexico pick them up and bring them to his radio. We patched them through to their son.."

A business executive friend of Jenkins heard the conversation in Texas on his own ham radio. He broke into the conversation and asked to talk to the boy. He told him he would give him a job. Jenkins and the Texan asked another friend, who heads a string of business schools to forego tuition for the soldier and the third man agreed. The amputee was flown from Vietnam, entered the school, was graduated and went to work in a business owned by the Texan.

"He turned out to be one of the finest employees this firm has ever had." Jenkins added.

Doc Jenkins leaned back in his swivel chair, amid his radio equipment, and summed up his feelings: "You see, some of our work does have its dividends."

Boy Scouts in Radio AWARD OFFERED

Explorer Post 160 of Fairmont MN is sponsoring the Friends of Scouting award. The purpose of this award is to promote the exchange of ideas, memories, planning of future Scouting events, develop interest in the Scouts, and so on. To obtain the certificate, you must work any 25 current members in the Scouts in any country where they may be registered. Exchange QSL and GCR list (i.e., Scouting position such as Cub, Boy Scout, Explorer, Committeeman, Scoutmaster, etc.). Send these with a dollar to Explorer Post 160, c/o Twin Valley Council, Box 22, Mankato MN 56001. SWLs are also eligible for the award.

Other Scouting awards that are available from the Boys' Life Radio Club (Certificate Department, B.S.A., North Brunswick NJ 08903) are the Worked Every Region–B.S.A. This is for submission of QSLs verifying contacts with members of the Scouts in the twelve Scouting Regions. The WAS-BSA is for working Scouters in the fifty states. Only SWLs may earn the Call Area Specialist certificate for verifying stations in all 10 U.S. call areas; and the World Listener award is issued for submitting cards from 25 different countries, at least one from each of the six continents.

NEW MOBILE XCVR

Linear Systems announced recently that it would be entering the two meter FM field with its new SBE model SB-144. The new transceiver is ideally suited for the mobile installation. It has twelve channel capability, ten watts power output, back-lit channel selector dial, and combination S-RF meter. Comes complete with mike, three sets of popular crystals, and mobile mounting bracket. Write to *Linear Systems, 220 Airport Blvd., Watsonville CA 95076.*

L to R: Mr. S. E. Fellerman K3FEC, of Kensington, Maryland; Dr. Robert R. Rodman WB4JAW, of Springfield, Virginia; Mrs. Terri Simons, XYL of the late Bert Simons; K4YLP; and Mr. Wilmer G. Rogers WA4OPW, of Ashland, Virginia.

FIRST K4YLP MEMORIAL AWARD PRESENTED

At a recent meeting of the Virginia Amateur Radio Association in Richmond, Virginia, the first K4YLP Memorial Award was presented to Wilmer G. Rogers WA4OPW by Mrs. Terri Simons, XYL of the late Bert Simons K4YLP. Wilmer, an avid DXer, was selected on the basis of the kindness, consideration and courtesy shown in the field of amateur radio.

W.G., as some of his friends call him, is a past president of V.A.R.A. He has given his time unselfishly training prospective hams, helping fellow hams with antenna problems, organizing club activities such as field days and picnics, running phone patches and many other things contributing to the hobby and the Association.

This award was made possible by the Lox & Bagels Radio Club, an organization of amateur radio operators spanning the east coast. The award, an impressive certificate and a $25 savings bond, will be awarded yearly to the member of the Virginia Amateur Radio Association who most displays the qualifications exemplary of those traits displayed by the late Bert Simons.

IN PUEBLO COLORADO
REPORT ON HUNTOON TALK

John Huntoon, ARRL General Manager, recently spoke before the Pueblo (CO) Ham Club. He commented on League activities and policies, and made some interesting comments about the 200 MHz band. After saying that the CBers stand a 50-50 chance of getting part of the band, he went on to say that the League has not filed against the proposal and that the FCC has not definitely recommended it; "If it comes to be, it will hurt, but won't hurt much since the advent of two meter FM . . . If you object, please write your League and it [220] most likely could be the next repeater band."

Following is a reprint of one man's opinion of Huntoon's presentation, *courtesy of The Grid Leak*:

After Huntoon's lecture he opened the floor for questions and discussion and our local hams in my opinion really put Huntoon through the good old fashioned ringer. Some of the questions asked were as follows: Why QST didn't carry more articles pertaining to the subject of FM and FM repeaters? Why didn't ARRL print manuals concerning the FM mode of transmission and repeaters? Why is QST so difficult to read and understand? Why is the FCC calling in at this time Technician and General conditionals for re-examination? What are the chances of the CBers getting the 220 band?

Mr Huntoon stated that in the future there will be more articles concerning FM and FM repeaters. There is an ARRL manual on FM in the process of being prepared and should be ready either in the latter part of 1972 or the early part of 1973. QST will be more readable in the future. Last year he felt the chances of the CBers getting the 220 band were 10 to 1 against their getting it, but as of today he felt that they stood a better than 50-50 chance of getting this band.

His answer to the questions about the Techs and Conditionals kind of gave me a sour taste in my mouth and left me with the feeling that the ARRL as an organization is rather inept and really isn't in too much of a hurry to see the amateur ranks grow. He stated that in his opnion many conditional licenses were obtained fraudulently and if a ham is really interested in ham radio recall by the FCC should hold no fear for the operator. At this point if it hadn't been for Chuck Chambers KØYFR holding me, I might have fallen either to or through the floor.

Most of the hams at the meeting disagreed with the above mentioned answer for a number of reasons. I for one disagree with his answer and the FCC actions for the following reasons: The average Tech conditional because of the bands allotted to him has very little opportunity to use CW. The average General conditional usually uses phone as is the practice amongst most hams. And besides when an individual gets into ham radio and starts operating he usually forgets all the fine points of theory he learned when he was studying for his examination.

Most licensed professions that I am acquainted with never require their licensees to ever have to take another exam to prove their proficiency, even if the individual has been licensed under a "grandfather clause." Now I realize that ham radio is not a profession, but it is a licensed hobby and consequently I feel that the law as it applies to licensing anything should apply. And the law on that point is that it is illegal and a clear example of double jeopardy when an individual has to be subjected either to trial for the same offense or to examination in a profession or hobby for which he already has been issued a license.

In private conversation with Mr. Huntoon, I told him I felt that the ARRL doesn't seem to go too far out of its way battling for hams when various legal situations arise. He told me that to a great extent I was correct because the ARRL lacks funds to get involved in legal and other situations that may arise all over the country.

Unions defend their union members.

Professional associations defend their members.

Why shouldn't ARRL defend its ham members?

Dr. Morris Levinson WBØBSV

At Long Beach

YL'S TO MEET

Women amateur radio operators will gather at Long Beach, California during the long holiday weekend of May 26–28, 1972. The Sixth International YLRL Convention marks the 33rd year of this organization's activities. As 33 has become the traditional sign-off for QSO's between YL's, the 33rd birthday celebration is a high point in the history of this organization of women amateurs from all over the world, now numbering close to a thousand members. The convention will have headquarters, operating station, meetings, entertainment, birthday luncheon and "cruise" banquet at the Edgewater Hyatt House on Pacific Coast Highway overlooking the Long Beach Marina.

The YL's will entertain their OM's with a tour of the Swan Electronics plant in Oceanside on Saturday, May 27th, returning to the Edgewater for a luau. A visit to the Queen Mary and other harbor points of interest is planned. But the event these YL's anticipate with the greatest interest is meeting in "eyelash QSO's" the YL's they have met on the air or will look for on the air once they return to their home QTH and with whom they share their exciting hobby in friendship, public service and ever-expanding horizons. Los Angeles YL's hosting this convention encourage all who attend to come supplied with a pocket full of snapshots for "swaps" to exchange with calls and autographs. They look forward to seeing Darleen Souligny WA6FSC, who spent much of 1971 traveling and meeting DXers around the world. This year's YLRL President who will preside at the convention is Mae Hipp K7QGO of Sparks, Nevada.

WITH THE FCC

There have been some questions about FM deviation used on six and ten meters. The following reply to a letter of inquiry by W6YAN clarifies the issue:

Section 97.65(c) of the Commission's rules require that F3 emissions used between 50.1–52.5 MHz occupy the same bandwidth as a A3 signal or 6 kHz. Part 2 of the Commission's rules (§2.202) defines bandwidth of an F3 signal as equal to two times the maximum modulation frequency plus two times the quantity one half the difference between the maximum and minimum values of the instantaneous frequency. (B_n = 2M + 2D). As you can caluculate, if the audio modulation is 3 kHz, D must be zero.

FCC-Amateur Rules Section

* * *

A. Prose Walker, chief of the Amateur and CB Division of the FCC, has indicated FCC thoughts about these services. In an interview with *CB Magazine* (January, 1972) Mr. Walker answered several questions that are foremost on the minds of many hams. As far as a license without a code test, there is a possibility that such a provision will be made. When asked about this, he stated, "The International Radio Regulations of the ITU to which the United States is a signatory, contains various provisions relating to the operation of radio stations. Article 41, paragraph 3 (1) states that Administrations may waive the requirement for capability in Morse code in the case of amateur stations making use exclusively of frequencies above 144 MHz. For years we have been told that one of the reasons why more licensees in Citizens Radio do not progress to Amateur Radio is because of the requirement for the code. Even though the code requirement for the Novice and Technician license is only 5 words per minute, indications are that it is still a hindrance. We believe that 5 words per

HOT GEAR

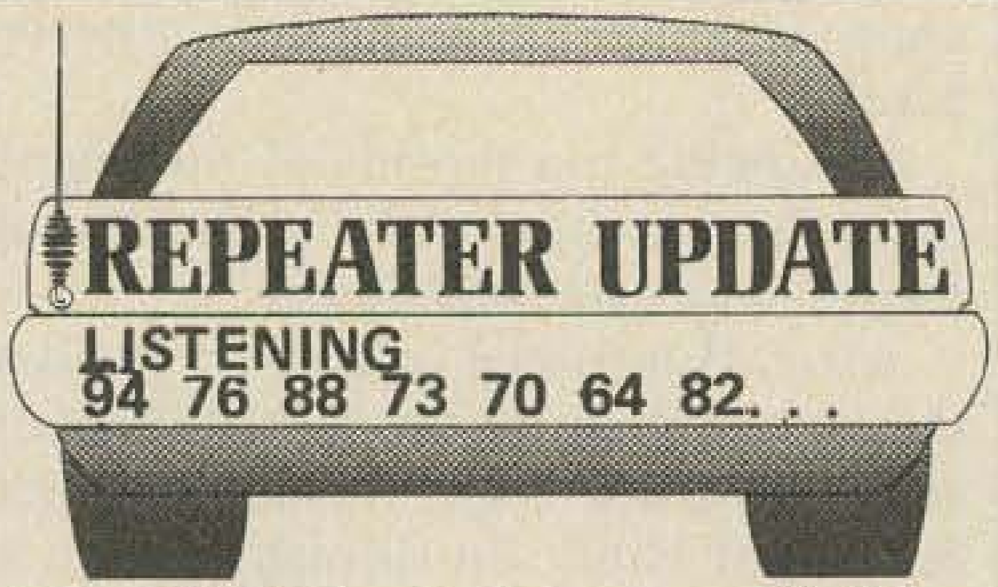
HR2A, S/N 04-6208, stolen from car in New Orleans LA. E. A. Shaw, P.O. Box 1346, Pascagoula MS 39567. W5FXX/5.

Heath SB102, S/N 132-128107, Warren Singer, 13721 Lynn St., Apt. 8, Woodbridge VA 22191 (703-491-2257).

List from Past Issues:

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
Simp. Mod-A, #35457	W2PWG	1/72
SBE SB-33 #103906.	WA5JGU	2/72
Heath HW22A #907-18375	W1BDX	2/72
National HR050 #280019	WA5DQF	2/72
Hallicrafters SR160 #416000-108039	K9YVA	2/72
Drake TR3 #3858	WA9EYL	2/72
Collins KWM2A #13815	ARRL HQ M. Godwin	2/72
Collins 312B4 #59920		
Col 30L1 #40084		
Col MPI #44507		
Col MM1 (mob. mike)		
Misco minispkr.	Sgt.Hopkins Wilm. DE Police	2/72
Swan SW174 #426-5	WØAXT	2/72
Reg. HR2A #04-05896	K4GBL	2/72

PLEASE INCLUDE YOUR ZIP CODE WHEN YOU WRITE 73.



CO KØPHF Pueblo 28–88
FL WB4QEL Orlando 16,34–76
IL W9MJL Danville 22–82
MD K3BEQ is now WA3KWG
OR W7DXX Mt. Scott 34–94
T2.5 52.525
T2.88 29.68

CANADA
Ontario
VE3KCR Chatham 34–94
(projected37–76)
VE3KER Kingston 34–706
VE3LAC London 46–706

Thanks to W4FZX, WB9FOP, VE3CSK, VE3RL.

Amateur Radio, August 1971. New Zealand has been working on a 2 meter band plan for the country. In the draft plan we received, they have made provision for all modes of operation. There are FM simplex channels every 50 kHz from 145.8 to 146.2 MHz, with 145.85, 146.0 and 146.15 MHz, as the prime channels. 146.0 MHz to be first. On the FM repeater side they have allocated four channels on 700 kHz spacing. A pity, as it does not make them compatible to Australia. Inputs on 146.3, .35, .4 and .45 with the outputs on 145.6, .65, .7 and .75. The three-channel AM repeater systems have inputs on 144.6, .65 and .7 with the outputs on 145.725, .775 and .825. 144.8 MHz, is set aside as an RTTY net frequency. The beacons are on the "hundred" equal to the call area, e.g. ZL1 on 145.1, ZL2 on 145.2, ZL3 on 145.3, and ZL4 on 145.4 MHz. The segment 144.0 to 144.1 MHz is set aside as DX and experimental working. 144.1 to 144.5 MHz is a general working segment.

Federal Repeater Secretariat.

minute is a bare minimum, and is not difficult to achieve with proper application of effort. Nevertheless, we are actively considering amending portions of Part 97 of the Rules and Regulations for the Amateur Service which would permit operation above 144 MHz without the code requirement included in the examination. In all likelihood, there will be two classes of no-code license. One will be roughly equivalent to the General Class but for VHF and UHF operation; and the other equivalent to the Advanced or Extra Class covering only above 144 MHz. The examination will be completely new and will cover VHF and UHF related technical matters. Another aspect we are also considering is to possibly require the licensee of an Amateur Repeater station to hold the higher class of license."

The EIA proposal that would eliminate several megahertz of the amateur 220 MHz band and change them into a Class D Citizens Band was another topic for discussion. Mr. Walker had this to say about RM-1747: "We have given it considerable attention over the past months since it was filed with the Commission. The decision has not yet been taken whether to issue a Notice of Proposed Rule Making. There are various factors involved such as the priority of use of the 220 MHz area of the spectrum; the possibilities of other needed uses if a change in the existing allocation were to be considered; what would happen to 27 MHz if the band for CB were changed; whether the same type of operation as now exists on 27 MHz would also prevail on 220 MHz and what would be the ramifications of that; whether the CB user actually wants or needs such a drastic change in the spectrum allocation for the Service or whether the proposed plan is primarily for the benefit of the manufacturer in opening up a new market. Details of all these and other considerations would take up a great deal of time. Let me assure you again that we are giving most serious consideration to RM-1747, but we are not on the verge of a decision as to exactly what is the best course to follow. You know that we are charged with the administration of the CB Service and therefore we must give full consideration to the maximum benefits to be derived by the licensees from whatever course is followed. Obviously, no one would desire opening up a new area of the spectrum without the assurance that the operation to be expected would be an improvement over that now obtained on 27 MHz. You also know that the band 220–225 MHz is currently allocated to the Amateur Service on a second priority basis to Government. No doubt the Amateurs would like to be heard whenever the moment is propitious, such as the possible issuance of a Notice of Proposed Rule Making. I repeat, we have not yet reached a conclusion as to the manner in which we shall dispose of RM-1747."

As for the current abuses of the Citizens Band on 27 MHz, Mr. Walker mentioned that working skip is not the main problem; "Actually, there are many others of a more serious nature which have nothing whatsoever to do with long distance transmission; failure to identify, use of pseudonyms in lieu of call signs, foul and obscene language, threats of bodily harm to others, use of high-power linear amplifiers, operation on frequencies not allocated to the Service, intentional interference, and many others which reduce the potential usefulness of the Service for those who wish to use it for the purposes intended." He mentioned that these violations are being taken into consideration. He further indicated that a very large amount of self-regulation must prevail if the Citizens Service is to perform its intended function. "One of the most useful procedures would be to emulate the degree of self-regulation that has prevailed in the Amateur Service for the past 50 years."

■BULLETIN■

HAM INJURED IN ATTACK BY 'QST'

by WA1NQJ (Special from The Squelch Tale)

K1RGQ was viciously attacked by QST Magazine recently. However, showing true heroism and amateur spirit, he rescued his Swan and Regency, sustaining an injury to his arm in the fray. John assured us that he is now fully recuperated.

While tuning in on K1FFK – 6 meters – and eagerly peaking his wattmeter, John saw that his homemade bookshelf containing many, many years of back issues of QST Magazine was beginning to topple. If things had fallen in the direction they were headed, all of his gear would have been knocked off his operating table to oblivion. John, anticipating damage to his gear, threw himself over it; the magazines and bookshelf fell, throwing John to the floor and pinning him there. Alone in the house, it took John approximately an hour to extricate himself. He is happy to report that his arm is fine now and that none of his gear was damaged.

SEMICONDUCTOR NEWS

D. Thorpe

RCA says goodbye to germanium and silicon small-signal transistors.

RCA's Solid State Division has decided to phase out over one hundred types of small-signal transistors. Included in the cutback is the whole line of small-signal silicon transistors. The devices discontinued are as follows:
Silicon: 2N2475, 2N3241, 2N3261, 2N3512, 2N3932, 2N3933, 2N4068, 2N4069, 2N4074, 2N4259, 2N4390, 2N5180, 2N5183, 2N5184, 2N5185, 2N5186, 2N5187, 2N5188.
Germanium: 2N388, 2N398, 2N404, 2N1302, 2N1303, 2N1304, 2N1305, 2N1306, 2N1307, 2N1308, 2N1309.
40,000 Series: 40231, 40232, 30233, 40234, 40235, 40236, 40237, 40238, 40239, 40240, 40242, 40243, 40244, 40245, 40246, 40354, 40355, 40397, 40398, 40399, 40400, 40405, 40413, 40458, 40519.

GE Discontinues IC Manufacturing

GE has quit making their popular line of audio IC's such as the PA234, PA237, PA246, PA263. Most of these are already in short supply – for example there are no more PA237 devices to be had. Best bet for audio IC's include the Motorola MFC9020, MC1316P, RCA CA3020, CA3020A and Plessey SL403D.

The RCA devices are already hard to find, for example the popular 2N5188 and many of the 40,000 series are in short supply. In most cases, a suitable replacement device can be used so the situation isn't as bad as it first may appear. If you need help in locating replacement devices for RCA transistors or GE integrated circuits contact *Circuit Specialists Co. Box 3047, Scottsdale AZ 85257.*

SSTV SCENE

Among the notes of special interest this month is the addition of XW8AX to the SSTV ranks. Since Asia has the lowest amount of SSTV activity, I'm sure he will be quite busy handing out those 'Eyeball QSO's and instant QSL's." This, at last, makes worked all continents on SSTV a reality for us all . . . provided you can catch him. Try listening around 1200–1300 GMT Saturdays and Sundays on 14.230 kHz. You SSB DXers take note here . . . you can work anybody in Asia for an Asian QSO. We have to work a specific station and swap not only signal reports, but pictures as well. DXing Supreme, eh?

(continued on page 13)

EDITORIAL BY WAYNE GREEN

GOING THROUGH CHANNELS

One of the biggest features of FM communications is the concept of channelizing. What a difference this makes! One wonders what might happen to low band communications if we could introduce this novel concept there.

With two kHz channels in the 20 meter phone band we could have 75 sideband channels in that 150 kHz wide band. Would we have better communications this way or worse? We might have essentially 75 going roundtables during the more active hours, but the less time that each operator could talk would make it a lot easier for everyone. Or would it develop that we would have 75 channels all sounding like the CB channels? Would we have multi-kilowatts and giant beams blasting through on each of the channels, ignoring the lower powered peasants? It has worked well on two meters, perhaps it might on 20. We could try.

If we were to start with one channel on twenty meters and then gradually expand this to two, three . . . etc., perhaps we could see how we might go with channels. An FM-sideband interface which would permit a two meter repeater to work cross-band to twenty on a national channel could be a starter. Perhaps something like 14,250 kHz? This isn't a bad spot. It is a bit below the SSTV group and above most of the serious DXing. It is below the General Class band and the intensive QRM of the nets and frustrated rag chewers who operate there. Channel two could be 14,248 . . . etc.

Think of the benefits to everyone. It would, first of all, make a lot more fun for the two meter FMer, expanding his horizon to the world. It would bring FM to the attention of the low banders, whetting their interest and perhaps speeding up the swing to FM of more old timers. It would encourage more repeaters to handle the traffic and rag chewing which would develop. And if channelization helps on twenty meters, that would be the best benefit of all!

The legal problems of Techs using 20 meters by proxy have been covered in depth elsewhere.

CONTROL

The key to the question of legality of Techs being repeated out of the Tech bands lies in the matter of control. If the FCC decides that the carrier coming from a Tech station is controlling the transmitter of the repeater, then the Tech would be in control of the output carrier and would be required to be sure it was within a band his license called for.

But is the Tech carrier really in control? Let's look at that situation more carefully. Let's think a little more deeply about the word "control." Our problem here is one of a lack of definition . . . one where Techs might have one definition and the Commission another.

Perhaps we can clear things a bit by drawing a parallel. Let's take the case of an Advanced Class station on 20 meters. Sideband, of course. As normally operated this station used VOX (voice on transmit), a gadget which turns the transmitter on when someone speaks into the mike. When a visitor speaks over this station his voice turns on the transmitter, even though he has no amateur license at all. This is quite legal as long as the licensed amateur is present and is "in control" of the station . . . which means in essence that he can turn off the station if something goes wrong. Control then is the ability to turn a transmitter on or off in an emergency and not the routine turning on and off of the transmitter.

This is exactly the situation we have with repeaters. While the carrier from a Tech does indeed actuate the repeater transmitter, this does not interfere with overall control by the licensee of the repeater. Control of a repeater may be via 450 MHz link, by phone line, or other accepted means, but this is the control and the FCC will have to make sweeping changes in their interpretations of the rules before they can prevent repeaters from relaying Techs into the General parts of the two meter band . . . or even into the Extra parts of 75 meters!

WHAT IS AM?

Those readers who are theory minded may be able to commiserate with me on the problem of amplitude modulation. I've read a lot about it down through the years and felt there must be something basically dense about me since none of the explanations made sense. Why, if we are varying the amplitude of a transmitted carrier, does the carrier not vary in amplitude? And those sidebands, what are they and where did they come from?

Pity a chap named Robinson out in Michigan who has managed to come up with a real amplitude modulated carrier and has found that he has patent problems because everyone, including the Patent Office thought that "amplitude modulation" resulted in the carrier varying in amplitude.

The process that we have always considered as amplitude modulation was actually a high level mixing of audio and radio frequencies, resulting, as always, in mixers, in the sum and difference of the two mixed frequencies plus the two original frequencies.

I don't suppose you really want to be bothered with an attack of theory like that, but the concept hit me and I thought I would pass it along.

NORTHEASTERN REPEATER MEETING

Representatives of several of the repeaters in the New York and New Jersey areas got together in early January to hash out problems of repeater interference and, to the pleasure of all, came to agreements. This is certainly a very welcome step ahead.

The basic agreement was for repeaters to shift to 600 kHz spacing and thus bring about the orderly growth of repeater use on two meters. A full report on the meeting will eventually filter through, but the word is that WA2SUR in New York will shift from 19–73 to 13–73, that WA2UWR in Paramus will change from 28–79 to 19–79, WA2YYQ on Staten Island will go from 25–88 to 28–88, WA1KGK in Trumbull will change from 22–76 to 16–76, WA1KGD in New Haven from 11–61 to 01–61, and so on. It is possible that K1MNS in Derry NH will go from 25–76 to 25–85, but this leaves a question about WA1KFX which was 31–88 and was apparently being set up on 25–85 as soon as power was restored on Mt. Snow . . . it would clobber MNS. WA1JTB in Greenwich is still in doubt too, but may go 31–91.

This rash of agreements will undoubtedly bring about even more with K1FFK expected to shift to 04–64, WA1KGS (Waltham) to 01–61, WA1KHA to 25–85 in Torrington, WA1KGQ to 19–79, etc.

The move toward a national transceive channel got a boost too, with an agreement to go 146.52 transceive throughout the New York–New Jersey areas. The next step is to encourage manufacturers and distributors to see that all newly sold transceivers come out with this pair in them instead of the old 146.94 pair which has muddied the waters so badly in several major areas such as New York City and Chicago.

* * *

The FM scene changeth fast and it is difficult to try and keep up with events in a monthly magazine.

Saroc came and went in early January. There were more exhibitors and visitors than ever and, despite a lack of planning as far as the speaking program went, everyone had a good time. FM was the watchword, with hand units everywhere and the regular channels filled around the clock, often sounding more like CB than amateur after the frequent cocktail parties.

The Pallisades Amateur Radio Club group turned up in force and brought with them their own instant repeater (right out of the October 73, by the way) so everyone could use their weird Los Angeles crystals while visiting Las Vegas (146.61 in, 147.33 out!). This enabled all of the club members to use their mobile and hand units during their stay without changing them over to the 34–94 Nevada repeater channels.

With the idea of promoting some organization of the FM growth in the northeast, we started the Repeater Bulletin back in January. This publication is being sent free to everyone using the New England repeaters and the reaction to the first 24-page issue was universally enthusiastic. The second issue, a 32-page bulletin, is now out and the publication seems to be achieving its objective of providing a forum for discussion of development of FM in the New England area.

In line with the idea of helping New England repeater groups to coordinate, an FM Symposium was planned for February 12th. Apparently this threw some of the vested interests into panic and a swift behind the scenes effort was made to set up an FM organization which would pull the rug out from under the symposium. Rather than being dismayed at this, I think it is a good move. The objective is to set up a system of self-government and the agreements made so far are quite in line with this. There is still more to be done, obviously, and 73 will do whatever it can to help this along.

To those who are afraid that 73 or Wayne Green are going to try and take "power" away from them, I say that I seek only the power of reason. I do not want to run anything or dictate, but I do want to be heard and I want to help anyone else with ideas to be heard . . . I ask no more than that. Power all too often means running roughshod over people with ideas that differ from yours and it is this power that I dislike.

The symposium should be interesting. It will be reported in the next issue of 73. The first session of the symposium will tackle frequency synthesis and will feature a panel discussion with Ed Clegg and Andre (Vanguard Labs). Gil Boelke may also be present, if the new Bara synthesizer is completed in time.

The second session will tackle needed FCC regulation and this will be reported in full to the FCC. I think we amateurs want to be self-policing and to have a strong say over our own rules. Sessions such as this should help us in this.

The third session will attempt to get the representatives of the New England repeater groups to set up a frequency board which will help new repeaters to find channels and assist present repeater groups in working toward a minimum of interference.

Following the third session will be the banquet with Jean Shepherd K2ORS as the speaker. Jean, one of hamdom's best known writers and humorists, is heard nightly over WOR, WGBH and other stations, has a book on the current best seller list, and has a television series (Jean Shepherd's America) which has been highly acclaimed. Few of us have missed the hilarious stories he has had published in Playboy, which have won him their coveted humor award for several years running.

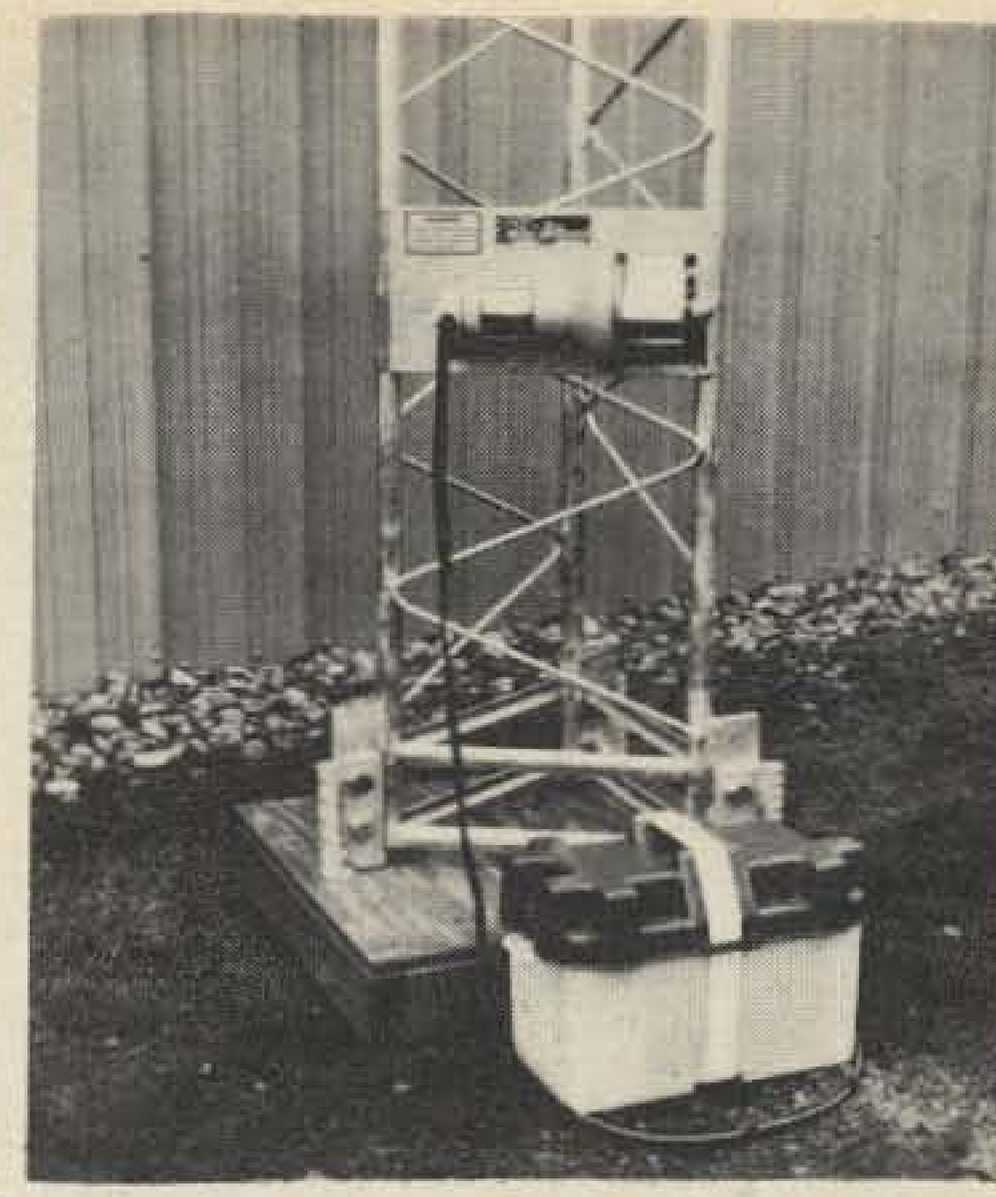
After the banquet there will be one last technical session tackling the pros and cons of changing the current 600 kHz spacing to 1 MHz channel spacing. The arguments are formidable for 1 MHz, so it is entirely possible that the repeater representatives might opt for that on the spot. We shall see next month.

. . . W2NSD

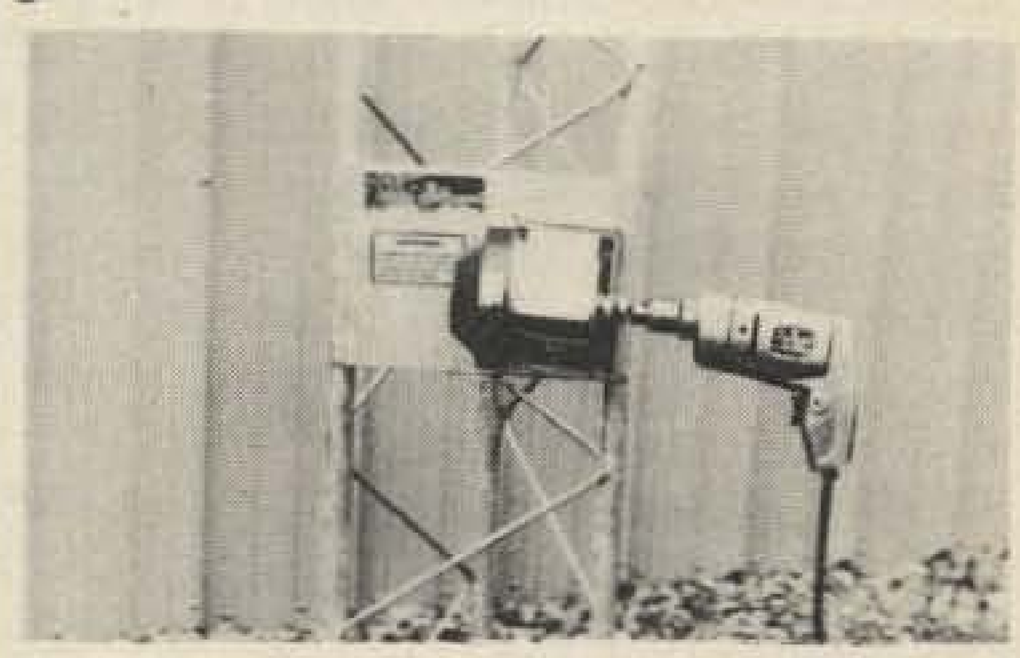
NEW PRODUCTS

NEW WINCHES MODERNIZE TOWERS

Tri-Ex Tower Corporation of Visalia, California, has announced the release of two new electric winches for crank-up towers. The 12 volt electric reversible winch is sold with power cables; the battery in weather tight case and 110V AC battery charger are optional. It has forward and reverse speeds for raising and lowering



the tower, and a level wind assembly to keep the cable from stacking. Braking is immediate, without coasting or creeping. The electric winch adds a safety feature in eliminating spinning handles, slipping clutches or exposed gears.



The TDD-100 Winch is driven by the average 3/8 in. drill. Two drive bits are furnished with the winch to be inserted into the gear train for raising and lowering. If the drill is not reversible, the short drive bit can be inserted in the opposite end of the winch to lower the load. Braking is automatic and the TDD-100, stopped at any point, will hold a load indefinitely.

Both winches are easily installed and bolt directly onto the existing tower winch mounting frame. For complete information on the new Electric Winches, write *Tri-Ex Tower Corporation, 7182 Rasmussen Ave., Visalia CA 93277.*

HAND-HELD SSB

If you do not want to go FM, here's a hand unit for the low band enthusiast, single sideband at that. The Mini-Mitter II is a crystal controlled rig that runs four watts PEP output into a fifty to seventy-two ohm load. The beauty of this unit is that a short whip antenna is available as an accessory and the unit is instantly portable for field day, emergency, or camping, or just having fun sitting under the sun in your back yard. The power level is adequate for medium range QSOs when the kilowatts are not on top of you, but that's the fun of QRP opera-

(cont. on page 8.)

More New Products

(continued from page 7)

tion. The Mini-Mitter is available as a kit for $150. Popular frequencies of 3995, 7215, or 7255 are available, and the rig can be changed according to instructions in the manual. For complete information, write to *American States Electronics, 1074 Wentworth St., Mountain View CA 94040.*

MINIATURE BUZZER

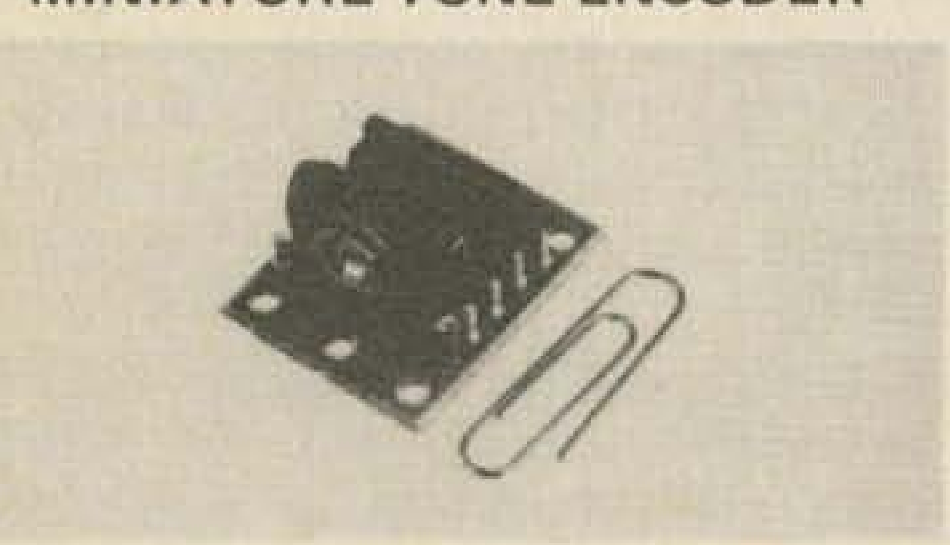
Miniature is the word, too . . . 7/8" long, 5/8" wide, and 3/8" thick is small. The output is good and loud, though, despite its small size to permit it to be used for code practice for a good sized room full of people. The buzzer is available in 1.5 and 12 volt dc models, with the 12-volt unit drawing only 15 mA, quite low enough to be operated by a transistor gate for paging or warning applications. The quarter ounce unit is small and light enough for uses in hand transceivers.

The Model GA-100 buzzer is solid state and has no moving contacts, therefore there is no arcing and no electrical or rf noise generated as with most buzzer units which act as miniature spark transmitters.

The output tone runs around 400 Hz, about right for code practice or paging uses.

The buzzer is being marketed by *Projects Unlimited, Box 1426 Northridge, Dayton OH 45414,* and sells for $5.95 through parts distributors.

MINIATURE TONE ENCODER



Alpha Electronic Services Inc. has announced its new hybrid tone encoder Model ST-85J which is designed for use in all two-way radio communication equipment including portable and hand held units. This compact, easily installed unit provides an economical method of controlling base stations, repeater stations or special functions. Current requirement is less than 4 mA at 12.6V. Composed of two thick film chips, one containing the encoder circuitry and one containing the frequency determining network, the ST-85J is available with several installation kits and simple step-by-step instructions to assure easy installation in any make or model of radio, especially where space is a premium. For additional information, write *Alpha Electronic Services, Inc., 8431 Monroe Avenue, Stanton CA 90680.*

SSB TRANSCEIVER

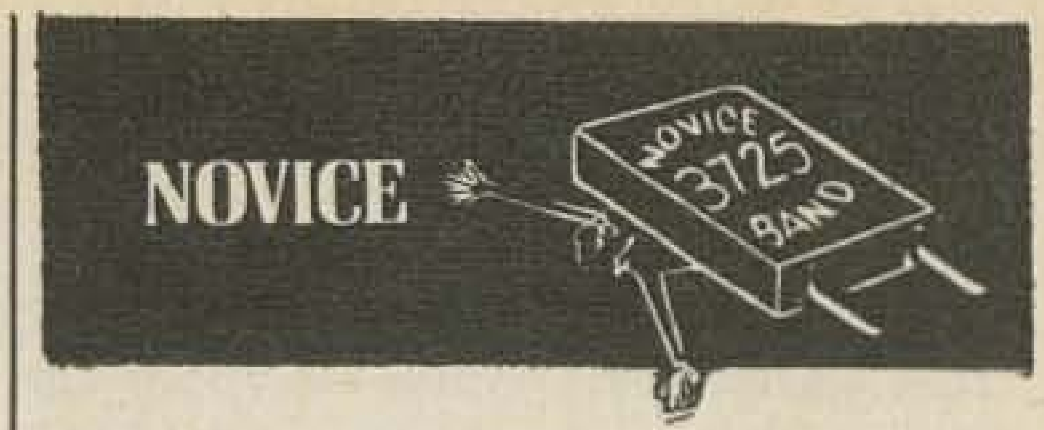
You can be top man on any band with Sideband Engineers' SSB transceiver. This rig offers six digit frequency readout on all bands eighty through ten; that's 100 Hz direct reading, and the vfo skirt is calibrated so you can reset your rig to precisely the same frequency time after time. But that's not all. The 500 watt PEP input is sufficient for barefoot operation, and for those who want to run the full legal limit, a two kilowatt linear amplifier will soon be available. The SB-36 has a built in VOX, semi break-in CW, and separate crystal lattice filters for upper and lower sideband. These filters allow the rig to produce clean and crisp SSB audio without frequency shift when changing sidebands. (Ever try to work someone on LSB on forty in the evening? Try USB for a pleasant surprise.) Accessories include an external vfo for split frequency operation and a CW receiving filter to help you pick out the rare ones from the QRM. For more information on this amazing rig, write to *Linear Systems Inc., 220 Airport Boulevard, Watsonville CA 95076.*

SUBMINIATURE TOOL SET

Tiny multi-purpose instrument tools in a 22-piece set are now available for use on very small fasteners. Suitable for use by instrument repairmen and hobbyists the tools are designed for instrument repair and light assembly work involving very small nuts, set screws, and machine screws.

The tool set, Mini Kit No. 54, contains six jeweler's type screwdrivers, two cross-recessed Phillips-type drivers, five open-end wrenches, three Allen-hex type wrenches, five socket wrenches, a marking scribe, and a knurled, chuck-type handle for positive gripping. The blades are interchangeable, and all are made of hardened, tempered nickel-plated tool steel. The complete set is packaged in a clear plastic box for easy use and convenient storage. It is priced at $14.50, postage paid.

For further information, contact *Jensen Tools and Alloys, 4117 N. 44th St., Phoenix AZ 85018.*



Dear Sirs:

I have been trying to receive DX stations and stations on the West Coast. However, I have not had very much luck. Please tell me the times during which I can work these stations, and the bands where they usually are found. I would appreciate it very much.

Sincerely,
Roger W. Miller WN1OGZ
Bantam CT

Dear Roger,

Well, I guess you have found that it really takes a lot of digging to get the DX. Although I am not as much a DXer as some, let me share some hints I have worked out and a few of those from people more successful than I.

First, listen a lot. There's an old adage that says God gave us one mouth and two ears to be used in that ratio. It's good advice. Very few DX stations will come back to long CQs, and the rare ones usually do not come back to me then I call CQ DX. That is what I have found. Listen a lot in the General portions of the bands to get an idea about what frequencies are most active and open. Use a good receiver with a good antenna; a ten foot long-wire just will not make it for consistently good results. A set of earphones is a good investment, especially if you intend to do any late night listening, and even more important if your shack is in your bedroom.

Second, choose your frequency carefully. Fifteen seems to be going out and forty and eighty are coming in due to the changing sunspot cycle. Now that the sun is sending out less radiation that ionizes our atmosphere, higher frequency signals (e.g., fifteen meters) are not being reflected to distant locations. The last time the sunspots changed around like they are doing now (they work in eleven year cycles), I found that winter months meant forty was *my* best band. A friend of mine consistently worked Russians on eighty. A second friend used to listen intently on ten meters for the freak band opening and he worked Africans. It is only fair to tell you that all of this was in the early morning, around six or seven. Others I know preferred the late, late night, after the TV stations closed down. Their results were similar. By the way, my best direction was South America.

At night, you have probably found that it is extremely hard to pick out another ham on the forty meter band. It seems that foreign broadcast sta-

SOCIAL EVENTS and CONTESTS

VERMONT QSO PARTY

All amateurs are invited to participate in the Vermont QSO Party sponsored by the Central Vermont Amateur Radio Club. Vermonters are urged to work as many out-of-state stations as possible so that those interested can earn credit toward WAS, WANE, W-VT and USA-CA Awards.

1. TIME: Saturday, Feb. 26, 2300 GMT (6 P.M. EST) to Monday, Feb. 28, 0300 GMT (10 P.M. Sunday)

2. SCORING:

Vermont stations 1 point per contact and multiply by the number of ARRL sections and foreign countries worked.

Outside stations 3 points per Vermont station worked and multiply total by the number of Vermont counties worked on each band.

QSO credit with the same station on different bands and/or modes will be given.

3. AWARDS:

(A) Certificates will be awarded to the highest scoring stations in each ARRL section.

(B) To the highest scoring station outside of Vermont, a trophy will be awarded.

(C) To the highest scoring station in Vermont, a trophy will be awarded.

(D) To the 2nd, 3rd, and 4th highest scoring stations in Vermont a special certificate will be awarded.

(E) The W-VT (Worked Vermont) Certificate will be awarded to stations working 13 out of Vermont's 14 counties, provided the station has not previously been issued this award.

(F) Special certificate for multi-operator stations.

4. EXCHANGE: Vermont stations send number of QSO, RS(T), and county. Others send QSO number, RS(T) and ARRL section.

5. GENERAL CALL: For non-Vermont stations: "CQ VT" or "CQ VT QSO Party". For Vermont stations "DE VT" or "Vermont Calling".

6. LOGS (or facsimiles): Postmarked *no later than March 31* should be sent to CVARC care Ansel R. Carnahan, P.O. Box 3, Montpelier VT 05602.

7. Stations sending a S.A.S.E. will receive a copy of the results.

Vermont stations are urged to be active and to promptly QSL all stations worked.

* * *

The Fifth Annual OOTC QSO Party will be held from Tuesday, March 14 through Thursday, March 16, starting and ending times both 2300 GMT. Scoring for Canadian and U.S. amateurs is one point per contact per band. Contacts with stations outside of U.S. and Canada count three points per contact per band (KH6 and KL7 count as DX). Foreign stations earn one point per contact per band for QSOs within their own country. Five points are earned for contacts outside of their own country. All modes are allowed, but only one contact per station per band may be scored. Multipliers: Count each state, province, or country as one multiplier per band (DC is counted as a state). Logs must be in GMT, and sent to G. MacConomy, W6BUK, Space 45, 36770 Florida Ave., Hemet CA 92343 no later than April 20.

* * *

On March 5, the Tri-County ARC will hold its Mid-Winter SwapFest at the National Guard Armory in Whitewater WI. The all-day affair will be held indoors and there will be lots of free parking. Tickets are one dollar in advance or one-fifty at the door (an extra buck reserves a display table). Talk-in will be on 3985 kHz. Contact WB9DWG for tickets and info. His address is RR #4, Box 235, Fort Atkinson WI 53538. Snow-date is March 12.

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tions clutter up the whole place. It is true that much of this is illegal operation on the part of other nations, but the spread of 7.0 MHz to 7.3 MHz is not exclusively ham throughout the world. Some countries are broadcasting legally in that range because it is legal for them to do so in their part of the world. They too are supposed to abide by the rule that they should cause no interference to other services. But that doesn't help us very much at all. I'm going to guess and say you go to school. If so, get up an hour earlier (that means going to bed earlier; don't I sound like your parents?). Get up and listen on forty or eight to hear what is on. It's often different from the night. Try three in the morning for more variety. Get the picture? The fewer people there are to crowd the band, the easier it will be to work the few who are there.

What I'm getting at is to listen around the bands and find what is best for you; time, frequency, direction the antenna works best, the weather.

As to transmitting, they'll rarely hear you if you are in the middle of the band. It seems like every Novice has crystals for the middle of the band and uses them all the time. Get closer to the band edges. The closer you can get to the station you want, the more likely he is to hear you. This is a good case for owning many crystals. "Impossible", you say. "Even if the price were halved." MicroComm makes a variable crystal oscillator that is like a VFO; it allows you to swoosh right on top of the station you want to call. Of course all swooshing is done with the transmitter in standby. They advertise in 73, and they only ask forty dollars for the device. That's the price of about ten crystals and this unit works on eighty and forty. A worthwhile investment, I'd say.

As you listen and work around, you'll notice that the bands can change right out from under you. Learn what times the west coast comes in. What time does South America roll in? Does the band change its direction in a clockwise or counterclockwise rotation? Make graphs or notes in your log so you will be able to tell just what the bands were like when you look through your log thirty years from now.

The key is keen listening. If you can't hear them, you can't work them.

73,
Eric

DX FOOTNOTES

(From the West Coast DX Bulletin)

If construction of a weather station on the island of Bouvet proceeds as hoped, the call prefix 3YØ may be heard. A ZS1 is being mentioned as the one who will be the operator there. The Spratley Island expedition was not carried through due to unfavorable landing conditions. It appears that the ITU never authorized the use of the call 1S1A and prefers that it not be appropriated. It has been indicated that in such instances where there is no proper call sign that just the call of the operator with the geographical location as a suffix should be given. In this instance, the call might have been WA5VTU/Spratley.

From the Pacific area, the Fijis may change their VR2 prefix for a 3D2, and it seems there is a 3D2 being heard on 20. From Nauru, the C2Ø prefix may only be used on holidays, such as January first. Does anybody know when holidays occur on Nauru? JD6 will be the prefix for Okinawa to replace the KR8 issued by the vacating authorities. KJ6BZ, on most days at 21,285 at 2200Z, has been looking

(continued on page 10)

DX FOOTNOTES

(continued from page 9)

for the Midwest and East Coast. He will return to Johnston on March 2. VR5FX is still very active from Tonga, usually found on 20 CW in the 14,235 to 14,250 kHz range.

Watch for Karl, VE8RA, as he plans to operate from Wallis (FW8) from March 14–22, and New Caledonia (FK8) from March 22–27, possibly until April 3 depending on activity. All bands will be used from each location. When calling, indicate whether you are transceive. Karl will also listen in the General portions of the bands and QSLs will be handled by VE7BWG.

From a remote plantation in Haiti, HH9DL has been heard at 14,220 kHz around 2250Z. Don, the only true HH9 in residence, is also reported as showing up regularly on forty at 7250 kHz at 1230–1300Z. His QTH is at Fort Liberte, thirty miles west of Cap Haitien.

SU1IM and his daughter Dr. Moona, SU1MI, are the only Egyptians currently active. Ibrahim has been trying to get through to the West Coast around 1500Z and after, usually operating in the 14,040–14,060 slot. K6KA has an eyeball sked with SU1IM in Cairo this April. Hopefully they'll make it.

And from the Far East, A5A to A5Z has been assigned to Bhutan. Yontan's SSB signal was last reported as not too strong. He may try the 1600–1700 time period on CW looking for the 6's and 7's. Look for him around 14,045, but he was recently heard at 14,301 at 1200Z.

An ARRL Directors' Letter informs us that a third party agreement has been signed between Trinidad and Tobago and the United States. Since this is the first instance of "British" willingness to allow its amateurs to handle third party traffic, hopefully it is a portent of similar things to come.

DX NEWS

If a direct QSL address is not otherwise available, QSL's for K and W/TF amateurs operating in Iceland should be sent to Keflavik Amateur Radio Organization, Box 44, FPO New York NY 09571.

Box 1058 Reykjavik is appropriate for QSL'ing to Icelandic nationals (TF––) only.

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LETTERS

I insist that you print ev

I have been very pleased with the good service in changing my address and getting me my 73 magazines. I subscribe to two other electronic magazines, and yours is the only one I have been receiving since I came to N.Z. four months ago.

Ham radio over here is a little different. These guys are homebrew artists! They are known as "Make-do" artists and it is certainly true! I feel conspicuous with all my factory-built gear, and will have to start building again. There is a spirit among the hams and at radio club meetings that I remember in the states back in the 30's . . . friendliness and "shirt off my back" attitudes, etc. They have certainly been most helpful to me. I obtained my reciprocal call with a minimum of red tape and now have K4IF/ZL1BME for a call. I will sit the regular exam and then will have just a ZL call. (This because I have immigrated permanently.)

H. D. Woertendyke
Blenheim NZ

I have my end of the ten meter link in operation and tied into my remote on Harness Mountain. As it now stands, 94 signals heard on my mountain are retransmitted on 29.680 and incoming signals are retransmitted out on 34. Subject, of course, to my control. Anyone listening on 29.680 will hear the Pacific Northwest repeaters along with the "auto-ID." This auto ID consists of a female sexy voice who every 3 minutes says: "This is the W7DXX DX repeater on Harness Mountain in southern Oregon." When the repeater (the 10 meter end) is activated from another 10 meter signal the auto ID sends a CW ID (de W7DXX/DX RPT).

Until you get your end going or someone who reads your comments in this month's 73 gets his going on 29.680 there will be no DX. However, anyone with receive capabilities should hear the Pacific Northwest when 10 is open.

If you wish, give me a call on SSB on 10 and we can coordinate. You pick the frequency and time.

Take a listen to 29.680 for the link and let me know when you are ready to go.

Keith E. Lamonica W7DXX
Springfield OR

Keith's repeater expands the range of the two meter enthusiast many hundreds of times. Can you envision coast-to-coast contacts with a little hand-held unit with a nineteen-inch whip? Think of it.

Having tried many times to learn the code and get a ticket I read with interest WB6JNI article that each letter should be sent at about 20 wpm. W3KBM also made a similar editorial Nov. 1970. Once I had such a code instructor and it helped but he was only substituting.

Could you tell me if any code "tapes" are available that are "skip" recorded? If none are available maybe a reader would be able to make me a "skip" tape of K9AAU "A New System for Learning Morse Code" Apr. 1969.

Ramer W. Streed
3004 So. West Avenue
Sioux Falls SD 57105

Off-hand, we don't know of any such tapes. Perhaps one of our readers can help out here. –E.

I would like to apply for your Real Rag Chewers Award. I have completed the requirements set forth in your Sept. '71 issue.

The calls of the stations involved, WB9EMV (me) and WB9CKG The operators' names are WB9EMV Mark Miller, and WB9CKG Richard Leiterman. The times were from 2300 GMT, December 21st, to 0500 GMT, December 22. We used the 40 meter band with the modes of CW, SSB, AM.

I have been a subscriber to 73 ever since I was a beginning Novice (my only ham mag.). I enjoy it very much and am glad you came out with these fine awards for us without big beams or kilowatts.

Mark Miller
Wauwatosa WI

Other awards available are the WAZP (Worked All Zones Promised). This is a pledge to do just that – a promise to work all 40 zones. The Certificate Haters Club is a solemn oath to hate this and any other certificates that might ever be earned. Less tongue-in-cheek awards that recognize real operating accomplishments include the WAAS, Worked Almost All States. Everyone knows that the fiftieth state is the hardest to work, and this award recognizes the achievement of 98% of the intended goal. And an easy chore for the DXer might be to work ten countries, but the Novice (and some Generals too) has to really work hard to get that many. The DX Decade Club is a large group of DXers who do not make DXing their chief aim. Endorsements are available too. To receive the CHC or WAZP, send a signed statement *swearing to abide by the appropriate conditions. For RRCC, send the calls of the stations involved, names of the ops, and times (GMT) beginning and ending the QSO. For DXDC and WAAS, send the QSLs (package them carefully and include return postage sufficient for first class mail) so we can send them back to you. Naturally, all awards cost one dollar and you can send for them in care of the Novice Editor, 73 Magazine, Peterborough NH 03458.*

Well you finally found a type size so small that it cannot be read. I refer to the lack of an index for the year of 1971. Only you would print the December issue without the yearly index.

W. C. Warman W1KVK
S. Burlington VT

The yearly index was postponed because we are planning a complete index from October 1960 to December 1971. All in due time.

Eric

Here's my $6 for another year. I think 73 is the best by far of all the ham magazines. I enjoy it very much and really look forward to the next issue each month.

Another note is on the ads in 73. I really enjoy reading the ads and I like them spread throughout the magazine. Your ads just seem to be more attractive than in the other magazines and I make a point to read all of them. I really like the color ads and especially liked the Regency ad in October.

So keep up the good work and when all the other magazines are gone 73 will still be on top in my book.

Larry Standlee WA5NTF

Our faces are blushing.

I just got my Dec. issue of 73 (my 3 year renewal was just sent in). Like you, I was disappointed in the Dec. issue. I sure hope you get ads to build up 73, also more good articles.

More power from 6146 was a disappointment to me. It's like taking a stock car designed for average 60–65 mph and driving it 95–100 way past design. I like to run things with reserve.

On the subject of interesting QSOs I hardly even run into anyone I wish to sign with quickly. Most of them I look forward to talking to again, I just don't get on as much as I would like.

Orville Gulseth W5PGG
Clarksdale MS

Several months back I bought a copy of your "Amateur Radio Extra-Class License Study Guide." After which time I practically lived with it until taking the Extra examination November 16. Upon completion of it I was told I "almost" passed it, meaning I didn't. Back to the drawing board and the study guide and a return bout on December 14 which proved an overwhelming success, and believe me, I owe 95% of it to you and your genius (genii?) minds for compiling and publishing such a helpful Study Guide. It is most comprehensive in scope and information obtained from it enabled me to understand subject matter that had hitherto been way over my head.

My first try at the examination, and failure, was by no means the fault of the Study Guide. I just had not had enough practical experience with a lot of the subject matter to envision the answers they wanted. The examination showed me where I had spent a lot of time studying subjects that they weren't interested in and by the same token showed me what to expect the second time around.

In general, this is to write my appreciation for making this book available to Hamdon, which has been sorely in need of something like this. It will surely remain a valuable item in my library and I hope other hams feel the same. Without reservation, the genius who put this Guide together has no equal, "par excellence!"

Ross E. Hicks, Jr. W5LPF
Arlington TX 76010

You're welcome, you're welcome. This letter is typical of those we receive in reference to our Study Guides – Novice, General, Advanced, and Extra.

I have received about 100 letters from readers on the "Plug-in Solid-State Vibrator Eliminator" which you have reprinted in the Jan. 72 issue. Most of them ask for additional information and errors if any. Here are the most common questions and answers.

The original circuit shows resistors R1 and R2 and being 44 and 4.4Ω. (A) This was a printing error and should read 4.4Ω each. However the value required may be between 3.3 to 5Ω.

What type transistors did you use? (A) I used Two type 2N443 stud style transistors.

Is there an American replacement for the toroid? (A) To my knowledge there is no American replacement. The Hammond Model 511E is manufactured in Canada by the Hammond Manufacturing Company, Guelph, Ontario. However it cannot be purchased direct but through most of the electronic jobbers here.

Do you recommend any other changes? (A) I would install a choke and filter in the 12 volt line to prevent the 200 Hz from getting out on 12 volt line.

Since there are probably many more readers who might be interested, I have sent this info which should be helpful.

Vern Epp VE7ABK
Nelson BC

I echo your plea for an article on a synthesizer. I am amazed that some of the leaders in solid state devices and accessories haven't seen the need that exists. How about a nice kit? Also how about an article on adding a limiter/discriminator/squelch to AM receivers? Take your old communications receiver, hang an FM receiving adapter on it next to a converter, wire a meter in the discriminator and maybe even a deviation meter, and you have a highly useful instrument that can do quadruple duty.

I'm not smart enough to design these things, but I sure can see a need for them.

Re your suggestion on a repeater contest. Sometimes you have good ideas. This time you didn't. A contest would not be in keeping with the type of operation most repeater users desire. I love contest work, but not the screaming and backstabbing that would go on for the inputs of the machines.

Frank J. Derfler Jr. K9KIC/1

I have been a licensed amateur for 13 years, an ARRL member for the last six consecutive years (I had to join because I could not longer buy the QST over the counter). I have been an IEEE member going on my third year. So you see I do know something about both organizations.

I agree with Mr. Chapin in his Guest Editorial in Jan. 1972 issue of 73. I too feel there is a need to reorganize the organizational structure of the ARRL and update the by-laws and constitution using the IEEE as a pattern.

In Mr. Chapin's editorial only four classes of membership in the IEEE were listed, but there are five grades of membership. The associate member grade was not listed. The grades of membership in the IEEE are (1) Fellow – (2) Senior Member – (3) Member – (4) Associate and (5) Student.

Frederick R. Washburn WA6FJJ
Los Angeles CA

About two months ago I bought a Tempo One w/ac supply from Henry Radio in L.A. In the order I pointed out that my decision was based solely on an ad in 73 Mag.

I like this rig. I had not planned a purchase of this size this year, but the family has grown and left home so funds are available.

This is my first SSB transceiver. So with limited background and experience in this area, I still like it. Using dipoles, if I can hear them, I can work them.

The other night at 7.251 MHz there was a fellow in Ecuador working a U.S. station. Guess what happened? One of our friendly, courteous hams loads up right on freq; 1st the xmttr, then the linear. He wiped out everything. Why can't these people load up a few kHz away and then come on freq?

R. W. Yerbury
Dugway UT

For ten dollars, a person can obtain a dummy load and use it. This would end the headaches of thousands of hams who listen and complain of QRM. It would also keep them from being headaches.

E.

(continued on page 12)

LETTERS CONT.

Tnx for making the DXDC award available; now I have something to shoot for. The following list shows what DX I've worked, and in what order: VE, KL7, JR, LU, OH, TI, KC4, XE, KH6, KZ5, KV4, ZL, VK, KG6, PJ9, and UKØ. The last 4 were in the DX contest (CW, of course). Please don't lose these cards, because I already feel sick about giving them to the post office, hi!

Larry Des Jardin WB6KMW
San Andreas CA

The P.O. got them here all right. They are pretty dependable. The DXDC award is available to all who send proof of two-way QSO's with ten or more foreign countries (and a buck and return postage). Novices, especially might be interested in this award.

My recent QSO with W2NSD Mobile 146.94 direct on 1/3/72 has led me to look into 73 magazine. I discovered a magazine I thoroughly enjoy, just as much as talking to Wayne.

Donn Watson WA2REH/1
Boston MA

You would be interested to know how other Ham publications are rated in this country. I have recently acquired a set of CQ for 1970 and could not find a single useful article. The RTTY column, which used to be one of their regular features, is gone, and there is little else of interest to us in India. The U.S. Library here donated to our club a set of QST for 1970. This bunch had a few articles of interest, but nothing comparable to the articles you run. You might like to know that while no one at Madras subscribes to CQ or QST, my copy of 73 is read by no less than 4 ham families, three of which contain two ticket-holders, in effect a readership of seven.

Let me wish you a bright and prosperous 1972.

M. V. Chauhan
Madras, India

Just had an idea for a ten-minute timer when my daughter's alarm clock broke and I was asked to repair it. Being a ham I noticed the SNOOZE ALARM lasted ten minutes. After five years of thinking, actually about three seconds, it occurred to me that this would make a perfect ten minute alarm for the ham to announce his call and how can you beat that for $2.98.

All that has to be done is disable the regular 12-hour alarm (simple upon examination) and whenever you want the ten-minute timer to work, just pull out the alarm set lever and push down the Snooze button. Ten minutes later the thing can blow up Boulder Dam, turn on your tape recorder, announcing a station break and your call letters. If you don't hit the Snooze button pretty soon it will start the first bars of "Dixie" and end up with "Who Got My Roller Skates." At least it will go off every ten minutes every time you hit the Snooze button.

You can buy a lot of beer or even a vari-coupler and a 201A for the money you save while making the FCC happy.

Clyde A. Welch WA4VKB
Anderson SC

Amateur radio allows a wide variety of operating methods and activities, but there is one type of operation I would like to engage in but cannot – I would like to talk to my wife while I am driving around in the car. Since the chances of her ever getting a license are pretty slim, the best solution seems to be either CB or a repeater with autopatch.

However, after reading the section of your editorial in the January issue about the advantages of using duplex on 220 MHz, another possibility has occurred to me. Why not remotely control the home station with the mobile transmitter? Then the xyl could talk through the home station.

This could be accomplished very easily if duplex were used. A low frequency remote control signal could be transmitted from the mobile along with the voice transmission to simultaneously turn on the home transmitter, activate the station identification circuits and signal the xyl. Each user of the system would have a different remote control signal.

The xyl would operate a microphone switch that would control the modulation of the carrier. This would comply with the rules since they require that only the carrier be turned on and off by a licensed operator. The station would be identified automatically in a manner similar to that used by repeaters.

Full duplex is not required. The repeater would have two separate receivers, but the combined receiver outputs could modulate only one transmitter. This would reduce the complexity and expense of the system and still allow one person to break the other. Most of the time, only one person will be talking at a time anyway. Another advantage is that calling will be simplified since everyone will be listening to the same frequency.

I don't see anything illegal about remotely controlling the home transmitter and operating it in this manner. The main FCC problem would seem to be in obtaining permission to remotely control the home station from the mobile.

I wonder if other readers think this type of operation is legal, possible and practical.

Roy E. Gould W5PAG
4748 DeBeers Drive
El Paso TX 79924

Note in the latest Callbook that New Hampshire is dropping in ham population as is the general count. Hmmm.

Missed the Revoked License box in the last issue. Watch the FCC releases for a bunch from the west coast. Some of them have been jamming WCARS and other communications on 40 and 80, and who knows what all else. One of them said he'd be on the air (just far enough away to splatter on the freq) until someone came by and took his ticket off the wall. Looks like somebody did! They nabbed a kid in Vegas who threatened to fight the president of the net if he showed up in town; as well as the goon who sounded like a pig.

Paul Schuett WA6CPP
Lodi CA

Hallelujah! Congratulations to those who helped rid the air of some inconsiderate ones. Every day we get letters about noise, QRM, and intentional jamming. It may seem like the Golden Rule is outdated and we need force to accomplish the same goals.

But for each bad news letter, we get ten like the following:

Fer the skinny blonde wat sends them 'elp notes from the dunjun. Don't wurry Luv, 'elp is on the way. I just give yore boss sum munny fer that pitchur mikin' book so I can git mi camera going like 'arry Bloggs. 'E blots out chanel 24 and 14 an I wont sum too so pik we out a good wun and if there's any left over send me some of them Mat Dillons an Festuses u got in the cellar. Tell yore boss 'es got a gud thing goin fur us 'ams wot can reed an rite an make things. So don't sen enymore of them 'elp notes. My old lady don't like it and sets the dorg to bitin' me w'ere I use most fer oporatin' my geer w'en it's in vox. An my cher don't 'ave no cushin. An tell Big Ears 'e ort to go fer ARL direktur an git us sum sence out of Charlie wots givin' away our bands. Don't fergit to send mi TV book kwik.

WA8QXU

Any activity on 10 meters FM? What does FCC think of 2 meters to 10 meter repeaters (or vice versa?) Anyone trying it successfully?

Barry Foote K1BTF
Framingham MA

Yes, there is quite a bit of activity on 29.6 MHz, particularly with low power rigs. On 29.68 MHz there are a growing number of repeater links to two meters. W7DXX seems to be pioneering this, though other repeater groups are reported getting into the action. Look for WA1KGS in Waltham to be linked to 29.68 soon . . . and others. It won't be long before two meter groups will be in contact with each other via 29.68 links . . . and, as W7DXX asks, how long will it be before someone driving in San Diego is talking with someone in Munich? Not long! DXX has already been pioneering some 20m links and recently the two meter gang had a chance to work UAØZAR via the repeater.

Due to my future husband, WA4GPJ, I have become an avid fan of 73 and amateur radio. I really enjoy 73 and although I don't understand all the technical articles, some of them are actually sinking in!

I have copies of every 73 from August 1970 through September 1971 in which you published a series of articles on the General Class License. Unfortunately I don't have a copy of July 1970 which contains the beginning article. Is there any possibility of getting a copy of General Class License Part I? The articles are well done and the progress is logical *and* simple. So many of the License Guides assume that one knows a lot of technical knowledge.

It would also be great if you could print articles for XYL's who could enjoy their husbands hobby instead of being a "Ham widow." I am delighted that Jerry is urging me to get my ham license. In fact, for Christmas he gave me a code key and a code oscillator, all rigged up and ready for me to operate. What more unusual Christmas gift could a future XYL get? By the way, I found the code very easy, considering the fear I had before getting started on it. Could you compare it to going to the dentist – "The I-know-it-is-going-to-hurt bit?"

Again, I really enjoy 73 and especially your editorials and humor that appears in the oddest places. You might say I think that 73 is terrific.

Ann Largent
Richmond VA

Ann, all the best to you and Jerry. Your missing copy is on the way with our blessings. The number of YL and XYL articles we print is about proportionate to the number we receive; maybe you will share with us your experiences after the big day. By the way, I read of another ham who gave his fiancee a code practice oscillator in kit form and made her build it in front of him. In comparison, Jerry sounds like a pretty good guy.

I reread your December editorial for the second time after letting it sink in for a couple of weeks or so.

I guess you could consider me a DX'er of sorts, or a rag chewer of sorts, or one who really cares about the chap on the other end, thousands of miles away. I have confirmations for DXCC at 241 and I don't really feel it is all that important to get 242 unless it comes easily.

I have operated from "CT1" and I also hold G5AUP in U.K. When I'm in this country I like to work the boys in Europe and around the world. When in Europe I like to work back this way. It's nice to work Father Moran (9N1MN) from NJ, but it's fun shaking him up from my London location, too. Why? Because he is concerned; he remembers about you, your friends, etc. Something personal, you see, is the key.

You won't get rid of the phonepatch gentlemen in the rare DX part of the band until you educate them as well as respect them on their part of the band. Sort of a gentleman's agreement you might way.

Now let's get down to the real biz of making a meaningful QSO.

It is important to really listen to what the other fellow or lass has to say. Don't be afraid to comment and above all have something to say, not just rst, QTH & name. Find out if he makes wine for a hobby or watches mini skirts. Judging by his accent you might ask if he is possibly from a different part of the world. What can you find in common with the other op? Follow this up if it was a good chat and make a file card on him. Next time ask him how his wife and kids are. What a surprise for him that you not only knew his name, but you knew his family, too. It takes hard work to acquire this type of feel for things. It will pay off tenfold, I assure you.

I keep track of over 3,000 people outside of the USA and I assure you it doesn't take me more than ten seconds to know my man or woman at the other end of the DX band on either CW or SSB, 10m or 16m.

I don't think I have anything special going for me except I don't make it a practice of asking for a QSL with my first over – Hi.

The other day I had a 1 hour QSO with a 7Q7 on 14.255 MHz. It must have been more than a report and how's the WX. It must be frustrating for a chap who needs 7Q7 and could care less about our chatter. But for those who were kind enough to stand by and not lose their heads, it paid off, for this 7Q7 was in a good mood then.

Chances are I will be talking to him again soon and by past experience he will know where to look for me and will probably call me.

Many amateurs don't know that for each working op there may be ten listening to your QSO. Some of my new-found friends are really old friends in a way as some tell me, "I listened to you for over two years before I got my ticket" or "We like what we hear and feel we really know you."

Try to work in and around the same frequency from time to time. Get to know the people well. Check that freq. at least twice before making that "CQ Europe." They size you up quickly and they can cut you down just as fast. Try to understand what makes people tick. Do the unusual. Talk about things not related to radio. Ask him about his country and what a loaf of bread costs. How many hours of work to buy a certain item, and so on. In other words, get involved. Above all, be sincere, be helpful, speak slowly to a chap who has trouble with English. Use small words. Be patient.

I assure anyone it works. I have skeds with Europe and Africa on a regular basis, and I have had visitors from Greenland, Denmark, England,

(continued on page 14)

(SSTV Scene cont. from p. 5.)

Well, if you are still looking for African QSO's listen for ZS3B on either 14.230 or 21.340 around 1900–2100 GMT. ZS6PP also frequents 21.340, often around 1630 GMT, EL2BC should be getting his Robot gear by now also. Watch for him also on 21.340. Generally, the Europeans and Africans are leaning toward 21.340 activity with 14.230 as a secondary choice. Much activity, also, from down under (VK5 and ZL5) but this'll call for the midnight oil. They generally show around 0800–0900 GMT on 14.230 (twenty is starting back its "Late Night Re-Openings" a little early this year).

We've been "looking in" lately on the Canadian SSTV net, which meets on Sundays and 2200 GMT on 14.180 kHz. Very good pictures – some real candid shots – and a lot of info exchanged. Look in some Sunday, I think you'll like it.

The year 1972 promises to be an outstanding year. The advent of 50¢ integrated circuits, $5 phase-locked loop IC's and availability of 12–16 inch P7 phosphor cathode ray tubes, should be a real boon to SSTV. WØLMD has proven his all integrated circuit, magnetically deflected monitor for over a year now. So it should be appearing in print soon.

If you can't wait, and Sid can't furnish you with a diagram, send me an SASE and I'll drop you a copy. The monitor has bandpass filters and a tunable SYNC detector circuit, which really proves itself on marginal signals. Also, this year, watch for more information on the larger screen monitors, slow scanned cameras and new ideas on flying spot scanners. And watch for Heath to come out with a nice monitor for under $250 – maybe an SB205.

The Dayton Hamvention is coming up again in late April and, as usual, much slow scan activity is planned. Many of the new ideas on SSTV were first presented at the Dayton convention, and I'm sure this year will be no exception. Everyone will bring diagrams of their "brainchild" to the SSTV booth, and many of the top SSTV'ers are usually around.

Possibly Don Miller W9NTP, will unveil his SSTV handbook there this year.

The second W.W. SSTV contest should be over by the time this appears in print, so why not drop a postcard to me giving your results and score. Results will be tabulated, and I'll report the new "Big Guns" in this column. Send along pix or tapes of interest also. I'll photograph an interesting picture or so for possible publication in this column later.

. . .K4TWJ

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.

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STANDARD SRC-145, Japanese equivalent to the SRC-146 hand-held unit for 2m FM. With simplex crystals for low end of band. First certified check for $200 to Box N, 73 Magazine.

BALUN – 2KW, 1:1, with coax fitting and dipole insulator, Teflon insulated wire, epoxy encapsulated, $8.95. Plate Choke 2A., 5KV, $6.45. Dual 30A. shielded filament choke $6.95. ppd. U.S.A. GREGORY KORDES, Box 1279, Tustin, California 92680.

(continued from page 13)

Portugal and others. I have also done the same myself. I assure you that when you visit a foreign land and you meet your friends they will show you and your family things no regular American would usually see.

What amateur in a foreign land would put up a 60 ft crankdown, tilt-over tower with beam at his country place with wall-to-wall American gear for my use during my stay? You say, he's kidding. Not so – I will show doubters color pictures.

Would you believe a very important man in his country took time off from his important duties to be a guide for my wife and me?

Could you imagine that a gentleman in one country who said he would meet us at the airport sent two dozen red roses to our hotel because he was called away to HB9 land, but another amateur and his wife drove 50 miles during the night to be there waiting with my QSL card in his hand so I would know someone cared.

This has only been a small sample of what can happen if you let yourself be involved.

Amateur radio can do more for international good will than our State Department has over the years.

Think of it in another way. What can I do for amateur radio? How can I get involved? Is that QSL all that important? (It will come in time, anyway.)

Paul T. Atkins WB2OZW
Park Ridge NJ

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

HOOSIER ELECTRONICS Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Authorized dealers for Drake, Hy-Gain, Regency, Ten-Tec, Galaxy, Electro-Voice, and Shure. All equipment new and fully guaranteed. Write today for our low quote and try our personal, friendly Hoosier service. Hoosier Electronics, Dept. D., R.R. 25, Box 403, Terre Haute, Indiana 47802.

73's – Vol I No I to date. Some bound – Some with minor cover damage. Best offer within 30 days. W3CJY, 6281 Akron St., Temple Hills, Md. 20031.

B RAND NEW coax connectors P1-259 (male) or UG-260D (BNC male) 7 for $2.00; nice low impedance headphones reconditioned $5.00 each; New carbon paper black typewriter ribbons for IBM Executive models A, B, C $1.50 dozen. All plus postage. Bill Hayward WØPEM, 1307 NE 57th Terr., Gladstone, Missouri 64118.

FCC "TESTS-ANSWERS" . . . Original exam manual for First and Second Class License. – plus – "Self-Study Ability Test." Proven! $9.95. Satisfaction Guaranteed. Command, Box 26348-S, San Francisco 94126.

7289 (3CX100A5) ceramic sub for 2C39. Surplus. Pre-checked at 449 MHz & guaranteed. $3. ea.; $30 doz., plus postage. Ed Howell, Folly Beach, S.C. 29439.

SELL: Copper clad, both sides, epoxy board 3x24x1/16 $1.25, 3x21x1/16 $1.00, 3x18x3/32 $1.00 post paid. Vernon Fitzpatrick, WA8OIK, McLain Park, M-203, Hancock, Mich. 49930.

2 MTR. POWER SUPPLIES
Solid state, Regulated, overload protected 117V AC in/13.5V DC @ 3 Amp. out. Only $22.95 & $1.00 POSTAGE. Limited Quantity. Low, Low Prices on Japanese 2 mtr Gear, Free Catalogue. GLENWOOD TRADING CO., Box 1009, Blaine, Wa., 98230.

TELETYPE: Model 14 typing reperf, $28; CV-278/GRC late model FSK converter, $105; 40 rolls 11/16" perforator tape, $8. Jim Cooper, POB 73-M, Paramus, NJ 07652.

DRAKE 2C, Xtal Calb., with 2 CQ and Drake 2NT Xmtr. $300.00. Like new. Bart Burne, WN3QXU, 1725 Wyoming Ave., Scranton, PA. 18509.

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

GREATER BALTIMORE HAMBOREE. Sunday April 9 at 10 A.M. Calvert Hall College, Goucher Blvd. and LaSalle Road, Towson, Maryland 21204 (1 mile south of Exit 28 Beltway-Interstate 695), Food Service, Prizes, Flea Market, $1.50 Admission, NO TABLE CHARGE OR PERCENTAGE.

EVANSVILLE, Indiana HAMFEST 4H Grounds (Highway 41 North 3 miles) Sunday, May 7, 1972; air conditioned, auction, overnight camping, ladies' bingo, reserved flea market booths. Advance Registration. For flyer, contact Morton Silverman W9GJ, 1121 Bonnie View Drive, Evansville, Ind. 47715.

WANT CLEAN COLLINS 51J-4, also Drake C-4; with manuals and original shipping containers. No junk! First letter give each serial number, condition, price; also price for both, if have both. Watson, 700 West Willow Street, Long Beach, CA 90806.

MOULTRIE Amateur Radio Klub, 11th annual Hamfest, Wyman Park, Sullivan, Illinois, – April 30, 1972, Indoor-outdoor market. Ticket donation $1.00 in advance – $1.50 at the gate. Open 8:30 A.M. W9BIL – 146.94 MHz. M.A.R.K. Inc., P.O. Box 327, Mattoon, Illinois 61938.

ROBERTS 50 watt AM/FM Stereo Receiver $100 PPD. – Picture. Past issues radio magazines wanted! Thomas King, 340 Water, Platteville, Wisconsin.

FOR SALE: 2 meter FM remote base with 450 control, includes tranmit and receive on 34, 76, 94, with KW and 450 repeat, with auto patch and yagi beam for 2 meters and various other remote and repeater goodies. Contact Keith W7DXX (503) 747-1685.

2-METER FM INOUE IC-20, Brand New, 1 & 10 watts, solid state, 12 channel, w/Xtals, w/accessories, $235.00, Bob Brunkow 206-747-8421, 15112 S.E. 44th Bellevue, Washington 98006.

21ST ANNUAL DAYTON Hamvention will be held on April 22,1972, at Wamplers Dayton Hara Arena. Technical sessions, Exhibits, Hidden Transmitter hunt, Flea market and special program for the XYL. For information write Dayton Hamvention, Dept. S, Box 44, Dayton, Ohio 45401.

SURPLUS BONANZA
NAVY VHF TRANSCEIVER. MAY-1 200-400 MHz. Complete with coil sets, discone antenna, manual, foot locker. $65.00
ARMY TELETYPEWRITER SWITCHBOARD. BD-100, new, 10 channels with regen relays, patching fields, cords, test meter, manual. Also, spares in chest. $30.00
Other items, send stamp. F. L. Hajdu, 41 Ledge Lane, Stamford, Conn 06905.

Sam Kelly W6JTT
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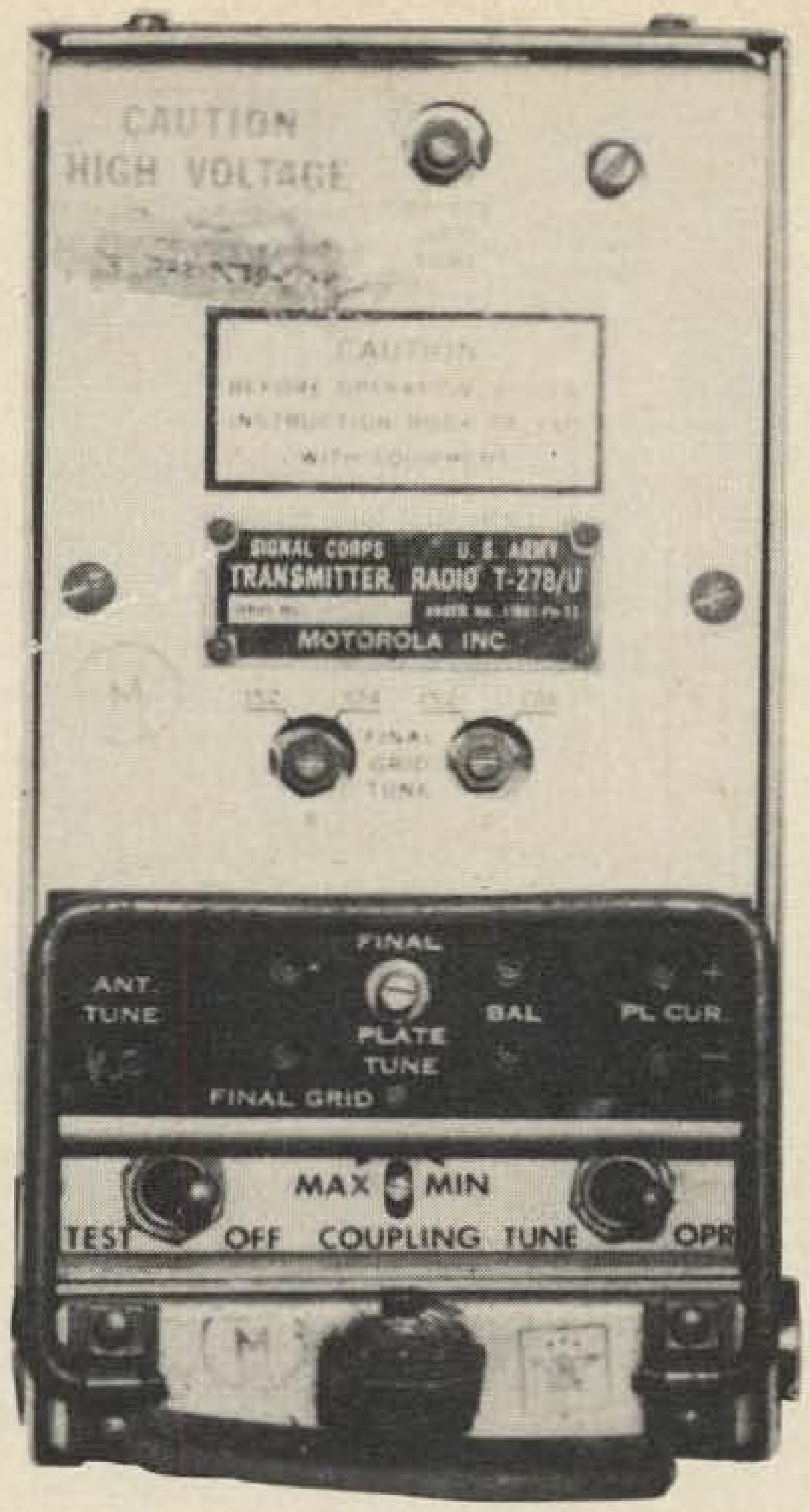
Garden Grove CA 92641



Converting The T-278 TRANSMITTER For Two Meters

The T-278/U transmitter is a two channel crystal controlled FM transmitter. As issued, it covers 152–174 MHz with a power output of 25W. It is most commonly encountered as part of the AN/VRC-19 mobile transmitter-receiver, but is used in a wide variety of other configurations. The transmitter requires a separate power supply and controls. Normally a DY 93-G power supply is used, but there is an ac supply, PP-804/U, which is used for base station configurations.

Conversion consists of building a power supply, control circuits and a slight modification to the final amplifier tuning capacitor. Figure 1 is a schematic diagram of the power supply and control unit. The connections between the power supply and control unit and the transmitter are simplified if you remove the existing connector and use a terminal strip for the power leads. A small butch plate can then be installed to mount two BNC connectors for the antenna and receiver antenna connections.

After you complete and check out the power supply and *before* you connect it to the transmitter set the filament control so that the wiper is on the maximum resistance side. Then connect the power supply to the transmitter. Turn it on and adjust the filament control for 1.25 volts as measured at the test point.

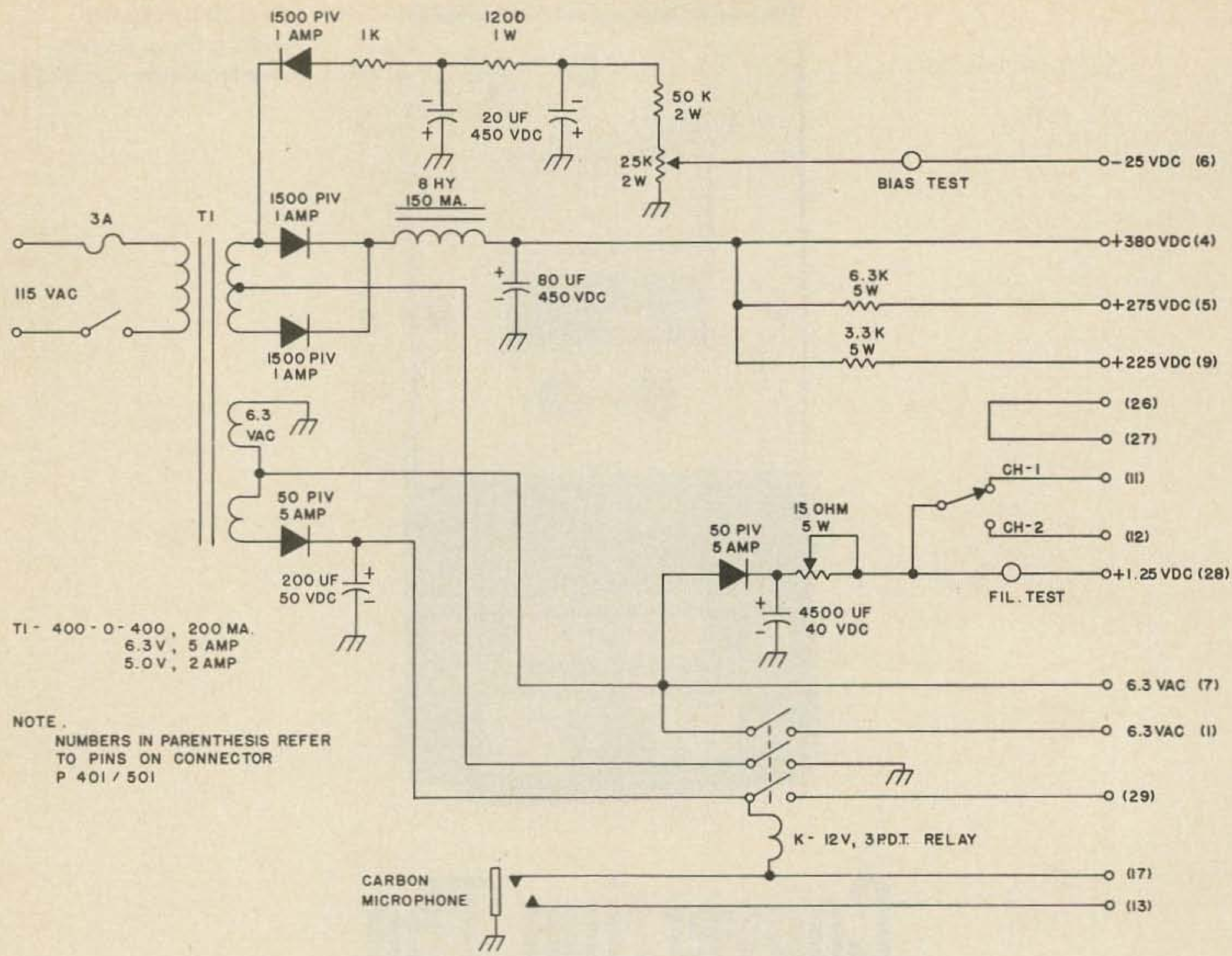


Fig. 1. Power supply and control T-278/U transmitter.

The crystal frequency is calculated by dividing the desired operating frequency by 32. Crystals should be ordered as CR-27/U type for use in an oven. Install the crystals in the oven and set capacitors C-403 and C-404 to their midpoints. For two frequency operation it will be necessary to install a second 1AD4 in the socket labeled V-402. The second frequency cannot differ by more than ±1 MHz from the main frequency.

Allow the set to warm up for at least 15 minutes before proceeding with the following alignment. This time is required for the crystal oven to stabilize. Check to insure that the crystal oven is rated at 6V.

Alignment

1. Modification of the final tank circuit. This modification is not necessary if you are going to operate above 147.5 MHz. For coverage of the entire band it is necessary to solder two 1 in. diameter thin copper disks to the existing disk capacitor. Satisfactory disks can be made from a scrap of copper or brass sheeting, or the disks found in between 88 mH loading coils can be used.

Check the operation of the sliding shorting bar. It can become erratic due to corrosion. In any event the fine pitch tuning screw is difficult to tune. The shorting bar is easily removed. Tuning is then entirely accomplished using the disk capacitor.

2. Place the test switch in the test position and the tune-operate switch in the tune position.

3. Connect the common lead of a VTVM to the chassis and plug the probe into jack J-401. Adjust Z-401 for maximum negative voltage. Detune to 90% of maximum. Move probe successively to J-402, 403 and 404 adjusting Z-402, 403 and 404 successively for maximum negative voltage. Nominal voltage at J-404 will be about 70V.

4. With the probe in J-405 (driver grid), adjust Z-405 and C-429 (driver grid tuning capacitor). There is an interaction between

these controls so repeat the procedure several times. Nominal voltage at J-405 is −55V. If a peak cannot be reached it may be necessary to solder a 5 pF padding capacitor across C-429.

5. With the probe in the final grid jack (J-406) adjust the final grid tuning capacitors and the driver plate capacitor for a maximum negative voltage.

6. Connect the VTVM across the plate current jacks. Watch out! The jacks are at plate potential. The meter reads 100 mA for each volt.

7. Connect the antenna. Adjust capacitor C-448 for minimum current. Adjust the loading capacitor and the antenna coupling for maximum current while retuning C-448 for a dip. Place the tune–operate switch in the operate position and readjust capacitor C-448 for a dip. Adjust the coupling link to limit the plate current to 150 mA (1.5V dc).

8. Disconnect the VTVM from the plate current jacks and reconnect it across the balance jacks. If the final tubes are balanced the reading will be zero. If they aren't balanced it will be necessary to adjust the final grid tuning capacitors to establish balance.

9. Place the test switch in the off position and the tune operate switch in the operate position. The set is now ready for use.

If no modulation is noted, check for a 2V dc voltage on the microphone jack. If no voltage is present, you have an early set that hasn't been modified. To modify unsolder pin one of the microphone input transformer T-401 from ground, and reconnect it to the wire going to pin 15 of the connector. This will provide dc for the carbon microphone.

In practice, the transmitter has been used for both voice and AFSK RATT. The 600Ω audio input (pin 14) is used for teletype.

Precise frequency adjustment is provided by adjusting capacitors C-403 (frequency 1) and C-404 (frequency 2). The best bet is to have the net control station talk you on frequency as you adjust these controls.

I was worried about the reliability of the 1.25V filament tubes. This turned out to be groundless as the set has been in use for over a year without a single tube failure.

W6JTT

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Statuettes — Silver — Tinware House Furnishings — Granite Ironware

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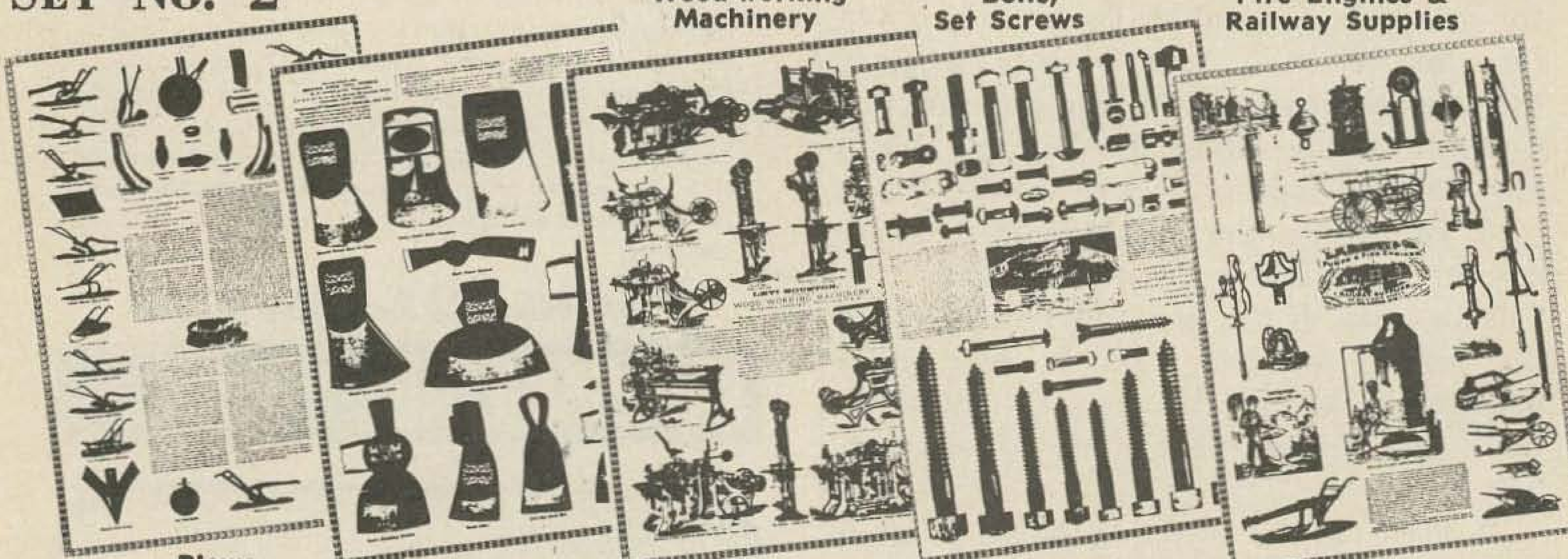

Plows, Cultivators — Axe & Hatchet Blades Adzes

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Allen W. Porterfield, Jr. W2ISL
41 Winnebago Road
Yonkers NY 10710

Easier Conversion of Surplus Transmitter AN/ART-13

120V ac Power Supply

Earlier conversions of the ART-13 transmitter used the 24V dc relays from the separate dynamotor. In Fig. 1, I used no power supply relays because, like most buyers of this rig, I received no dynamotor. Two ac power supplies are controlled by primary 120V SPST switches.

The VFO supply is fixed with a voltage between 400 and 450V filtered dc. The 813 power supply is 0–3500V. A 20Ω 1W resistor added to the negative lead of the

Front view of rig shows tuning knob of C3, dynamic mike, speaker for sidetone, and tuning chart.

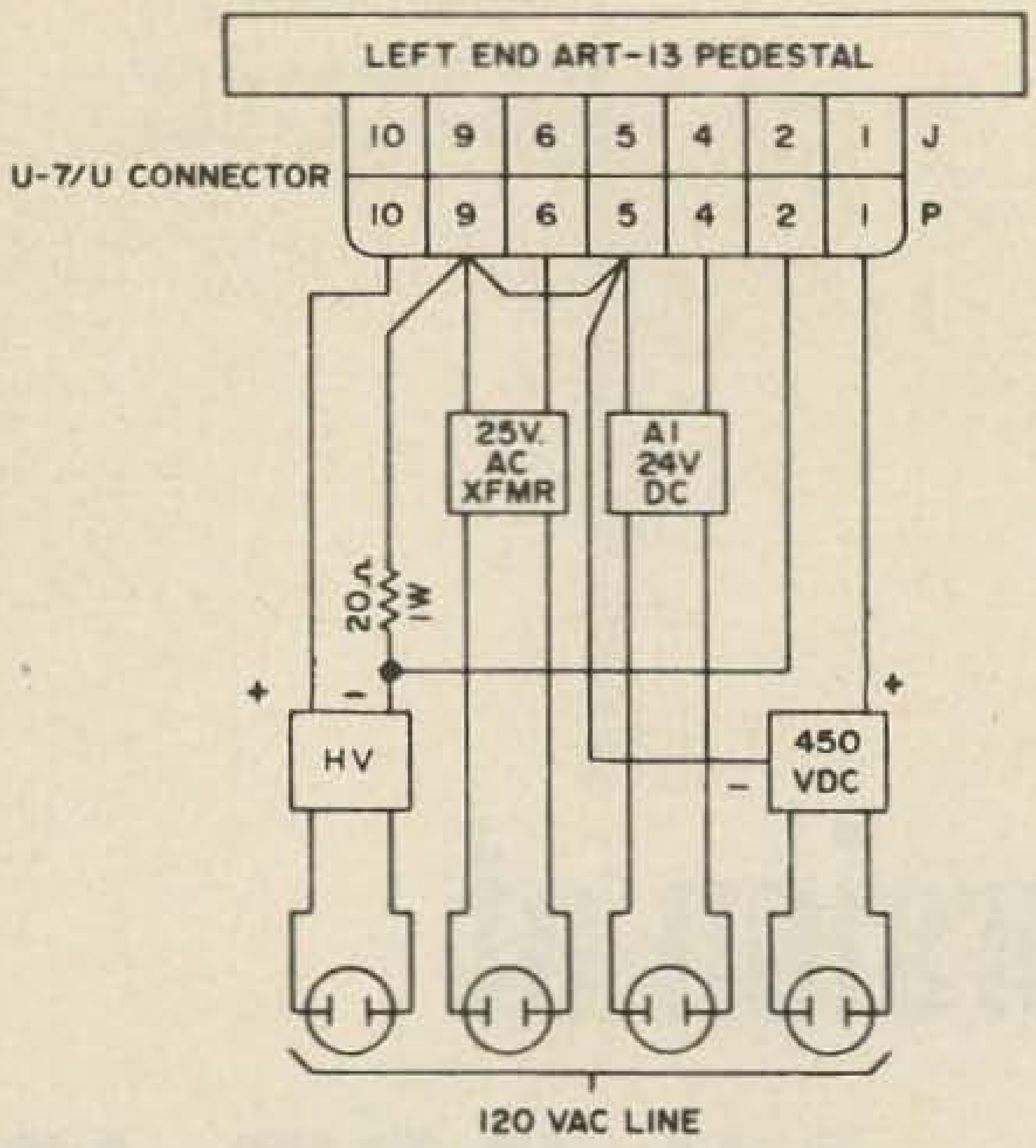


Fig. 1. Power supply arrangement. Parts are: 25V transformer: 100W Lionel Corp. (or 2 12.6V, 4A); 24V dc: Two 10A 12V dc battery chargers; 450V dc PS: 225 mA minimum, 300 mA max. (see text); HV PS: 1200V to 3000V, 200 mA (4 866 rectifiers); Resistor: 20Ω (20.1Ω) 1 to 10W (on left end).

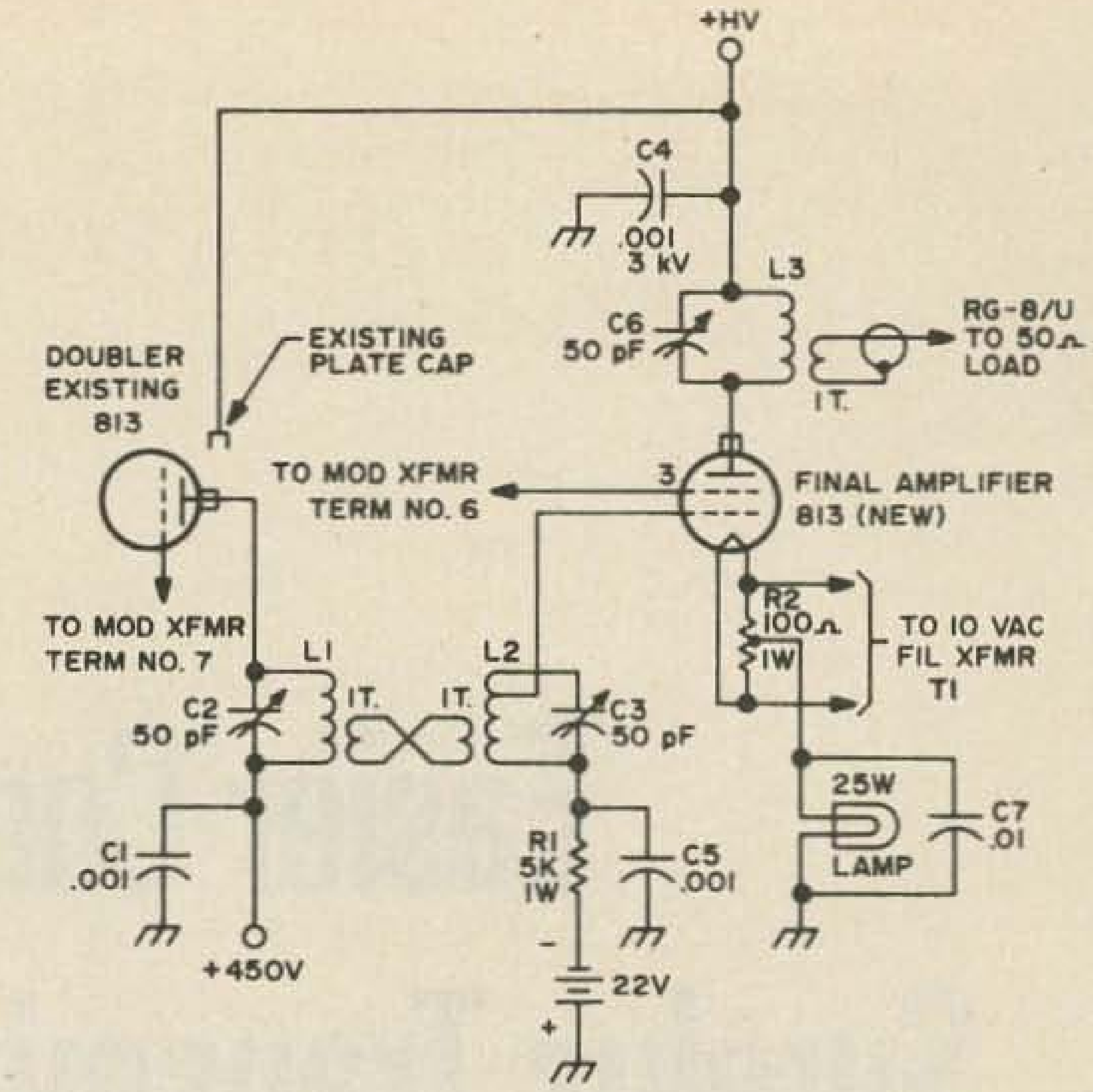


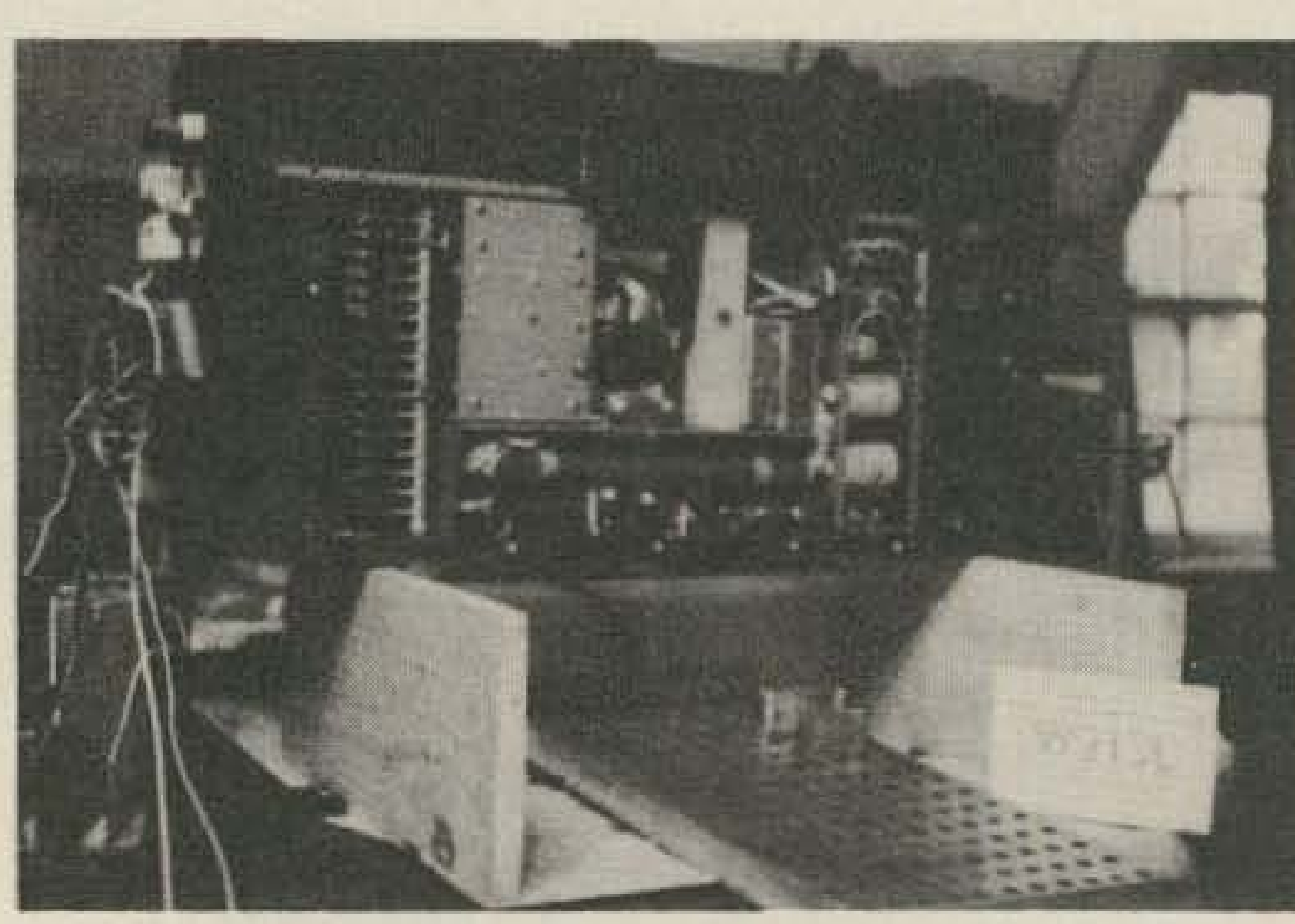
Fig. 2. Ten meter diagram. Parts include: Medium base porcelain 25W lamp holder; L2 – 4 turns No. 18 on 1¼ in. form-tap third turn; L3 – 3½ turns No. 14 on 1½ in. Hammarlund ribbed 4 pin plug-in form; T1 – transformer 10V, 4A, Zenith 7.5V and 2.5V series to add.

larger supply gives instrumentation like the original. The existing panel meter reads 0–200 mA of 813 plate current in the CW position of the emission switch. Plate volts may go to 3000 on CW. in the VOICE position, plate volts should not exceed 1250 because the plates of the 811As go pink and the percentage of modulation is lowered. The OFF position of the emission switch is not used. Neither is the cover interlock used (only 7 of the 10 pins in the U-7/U connector are used). Two 12V automotive battery chargers at 2 amps continuous duty operate the auto tune motor, etc., without filter or hum.

10 and 15 Meter Output

There are no soldering changes nor drilling of the basic Collins rig. The 813 tube becomes a doubler. Figure 2 shows the change of the plate circuit by changing the plate cap. Existing antenna terminal, RF ammeter and C, D, and E front panel controls are not used on 10, or 15 meters. The 813 doubler operates from the 450V power supply drawing 80 mA at resonance raising the 450V power supply current requirement to 300 mA. In the space left by removal of the LOW FREQ Oscillator, the 10 meter final is installed using a second 813. The plate current in this tube is read by the existing meter. Doubler resonance is found when the final plate current is peaked. A grid drive of 3 mA (external meter for initial tuneup) is sufficient to produce normal plate current on the 813 final. The PA GRID meter switch setting continues to read the input to the 813 doubler.

The aluminum bottom of the rig must be removed to peak the 1625 multipliers



Bottom view shows plywood block used in place of metal bracket.

for 10.5 MHz and 14.2 MHz putting the pointer into the acceptable center scale range – 8.5 mA of grid current. A single turn loop around the 29 MHz coil couples the RG-8/U coax to a 1 kW amplifier at W2ISL.

The RECEIVER terminal should be connected to the receiver antenna terminal with coax (shield goes to ground connections). The microphone used has a switch to control the entire transmitter without hash in the receiver when not transmitting. A dynamic microphone is used from a surplus MARK II 19 set (new 3 conductor shielded cable) with a PJ068 plug. Ventilation holes in the sides of the rig suit RG-8/U coax. The final tuning capacitor is mounted on ¼ in. plywood (as insulation) in the vicinity of the coil L3. The grid tuning capacitor also used plywood as insulation with an insulated flexible coupling to a 2 in. long ¼ in. shaft that passes through a *new* hole in the MX-128 panel (described in *Surplus Schematics* by Cowan Publishing Co.).

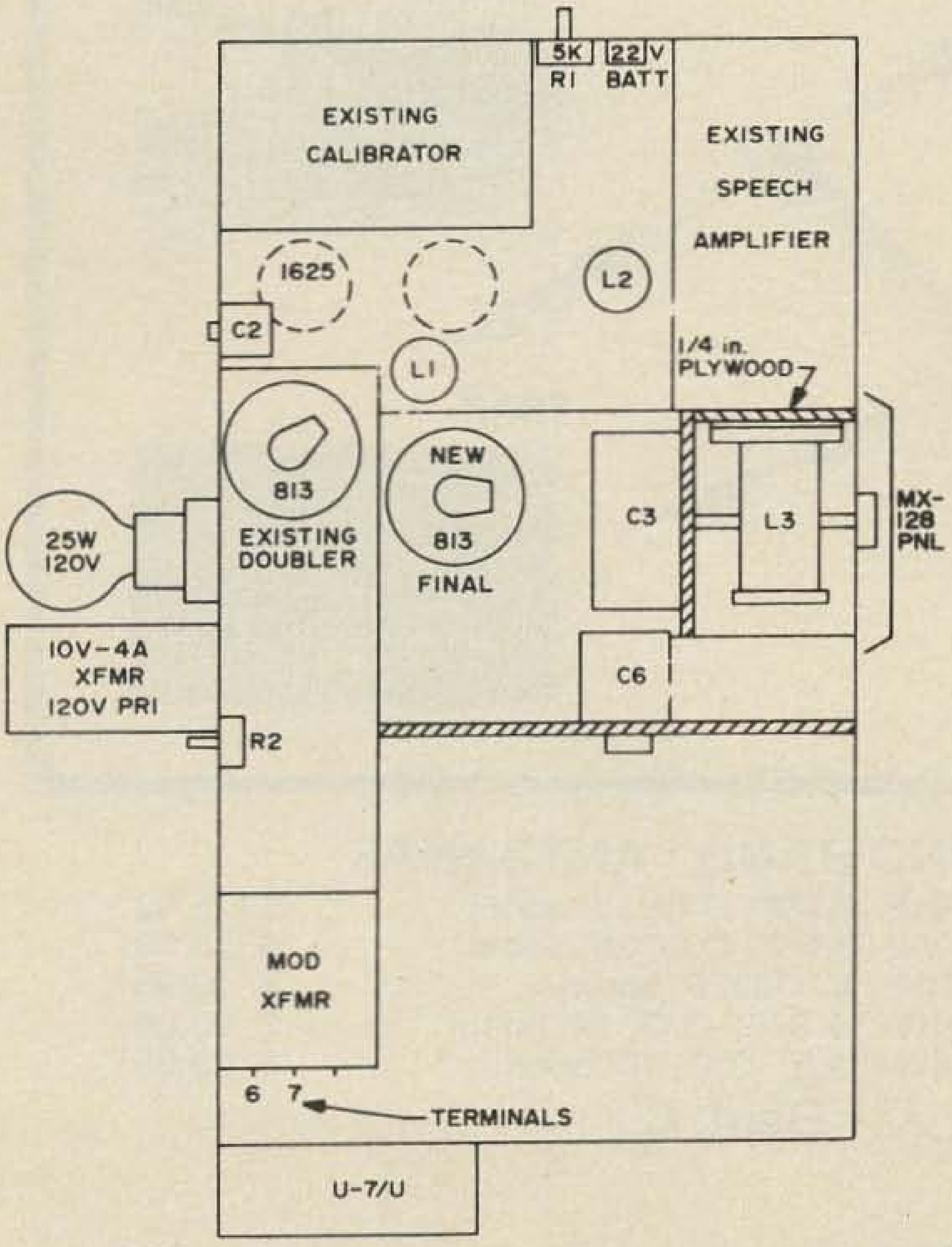
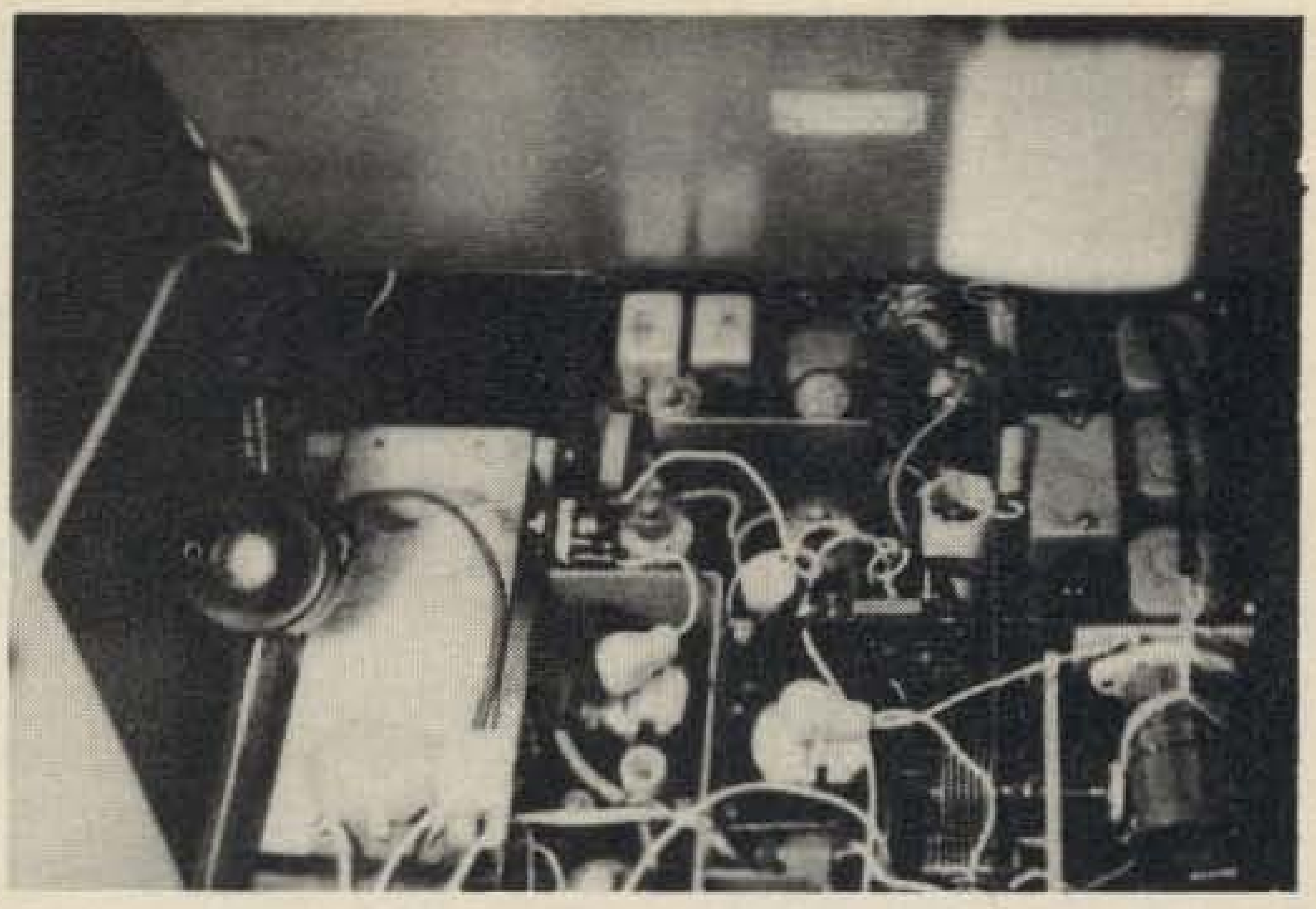


Fig. 3. 10 meter output modification.



Close up top view shows coil location. L1 is 6½ (No. 14) turns on a 29/32 in. wood dowel. All three coils have generously spaced turns.

Link coupling from the doubler plate to final grid coil was used so that the doubler could be tuned to resonance at 29 MHz before and after the final was installed. An attempt to plate and screen modulate the 813 doubler was unsatisfactory. Shorting 2/3 of the turns of the final coil permits doubling in the second 813 for CW output on 6 meters. Circuit constants in the Figures are for 29 MHz because an AM carrier is feasible on 10 meters but not 15. Since the screen of the doubler 813 is not modulated, the G2 connection on terminal 6 of the 811A output transformer must be moved to terminal 7. A new insulated lead is run from terminal 6 to the screen (G2) at lug 3 of the new final 813 socket. Transformer terminals are theaded with nuts.

To save the $5 cost of USAF-NAVY *Operating Instructions* a table lists A and B control settings for band edges and 50 kHz higher.

FREQ. (kHz)	A	B
3500	3	1333.7
3550	3	1455.7
3900	4	673.4 calibrator check point
4000	5	100.1
7000	7	1333.7
7050	7	1394.6
7200	7	1578.9 calibrator check point
10,500	9	1333.7 15 mtrs
10,525	9	1354.1 15 mtrs (advanced class)
12,500	11	407.5 WWV check and 6 mtrs
14,000	11	1333.7
14,050	11	1364.2
14,400	11	1578.9 calibrator check point

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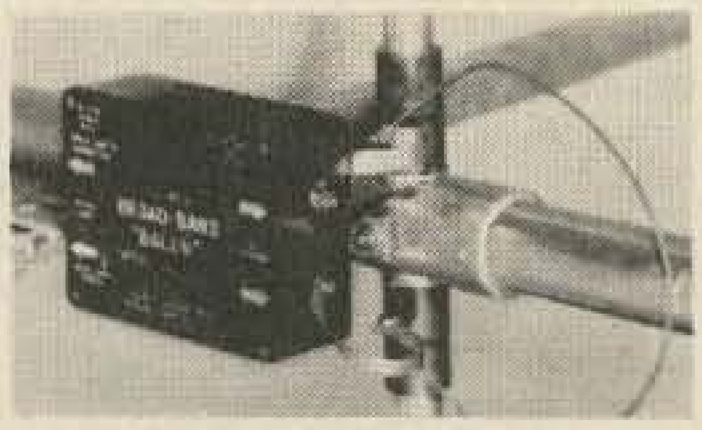

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2M814	- "Monarch", 16 DBD, 8 El., .8 KWP, 1.375" O.D, 14' boom	$ 59.00
6M516	- "Monarch", 13 DBD, 5 El., .8 KWP, 1.5" O.D, 16' boom	$ 63.95

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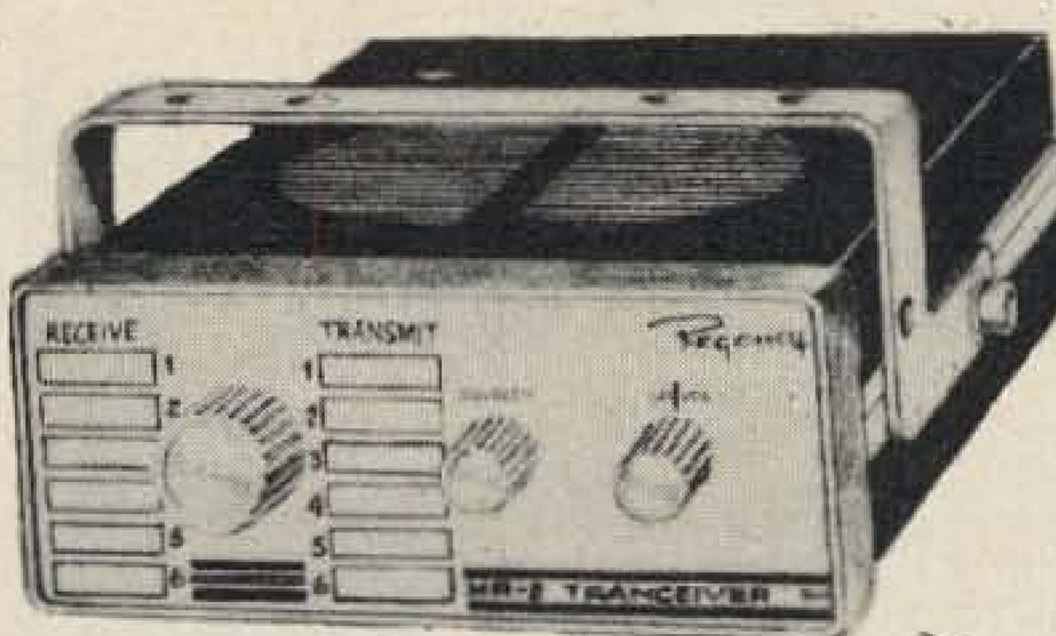
IMPROVING YOUR HR-2



Note: The author of this article is T. L. Greenman WA1KFZ who can be heard daily working CW through the 04/91 repeater on Mt. Greylock, Mass.

Regency HR-2 transceivers are great little rigs for the money: however, like all other ham rigs, there is always room for improvement.

If you are a proud Regency owner and live where split channel repeaters exist, you know co-channel selectivity can be a problem. The HR-2, .2A (03-04 serial prefixes) use a single ceramic filter in the 455 kHz i-f strip for all the selectivity. The easiest way to improve the selectivity then is to change this filter for a more selective unit. The sharper filter which cures the problem without causing other problems is a Murata Model CFR 455D which may be obtained from Murata Corp. of America, 2 Westchester Plaza, Elmsford, New York 10523. Prices are $14.30 each or $11.30 for 3 or more.

The new filter pin locations are shown in Fig. 1. The new filter is longer and narrower than the original filter and its installation requires the drilling of 4 new holes in the P.C. board for its installation. In case Murata changes the case tab location with respect to the ground leads, check the two ground pins with an ohmmeter for continuity.

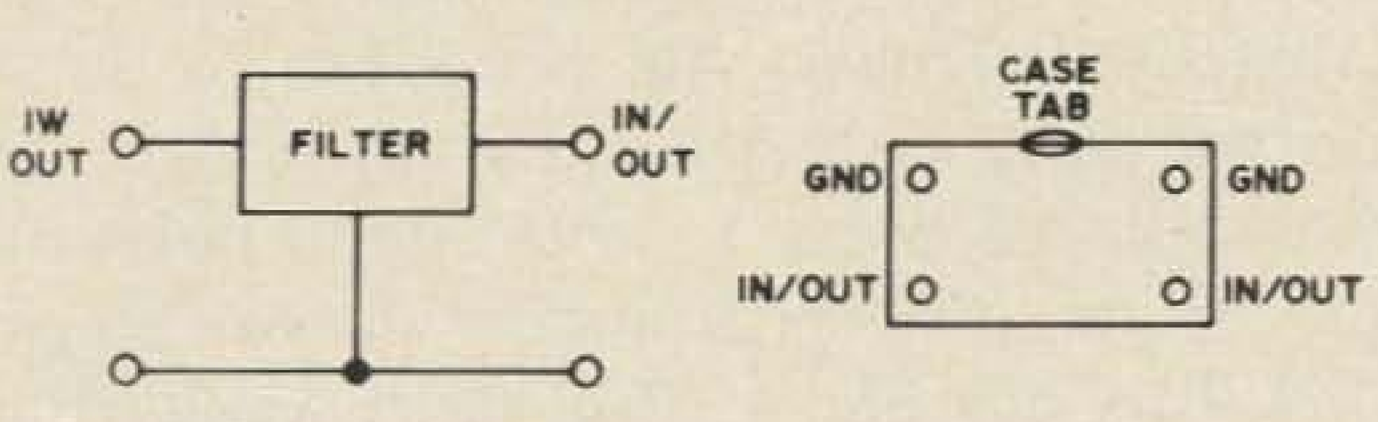


Fig. 1. Schematic diagram.

To install the new filter:

1. Remove the old filter using a small (37W) soldering iron, taking care not to heat the board or pin excessively. The easiest method is to remove the solder from each pin, and then push the filter out.
2. Next, using the new filter pins as a locator and Fig. 2 as a guide, drill four new holes (3 for leads and 1 for case tab). Index the new filter on the lower left pin hole as in Fig. 2.
3. Place the filter into the holes and carefully solder the five places.
4. Inspect the board carefully for solder shorts, etc.
5. Put the unit back into its case and turn on the receiver.
6. Find a channel with a weak signal on it and, using a diddle stick, adjust the quad coil (the i-f looking can next to the relay contacts) for clearest audio.

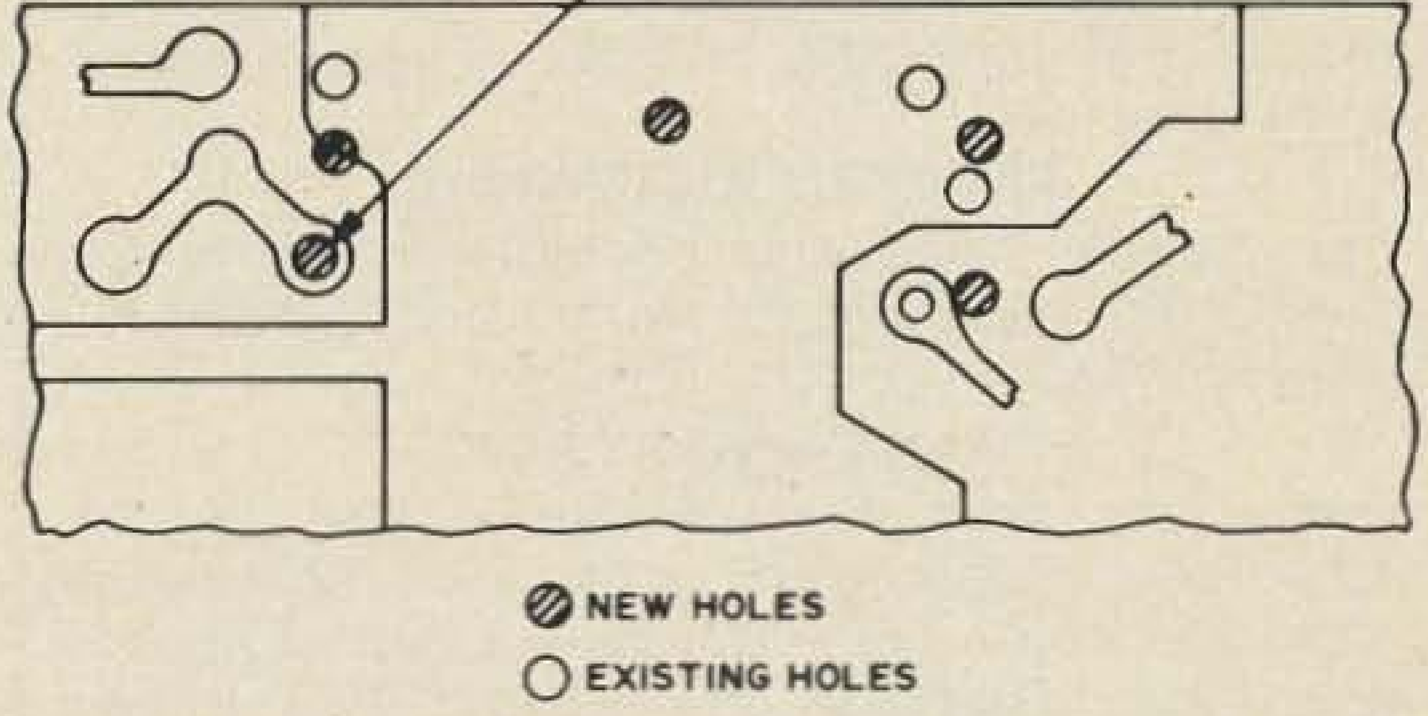


Fig. 2. Bottom view of receive board. Front panel on right.

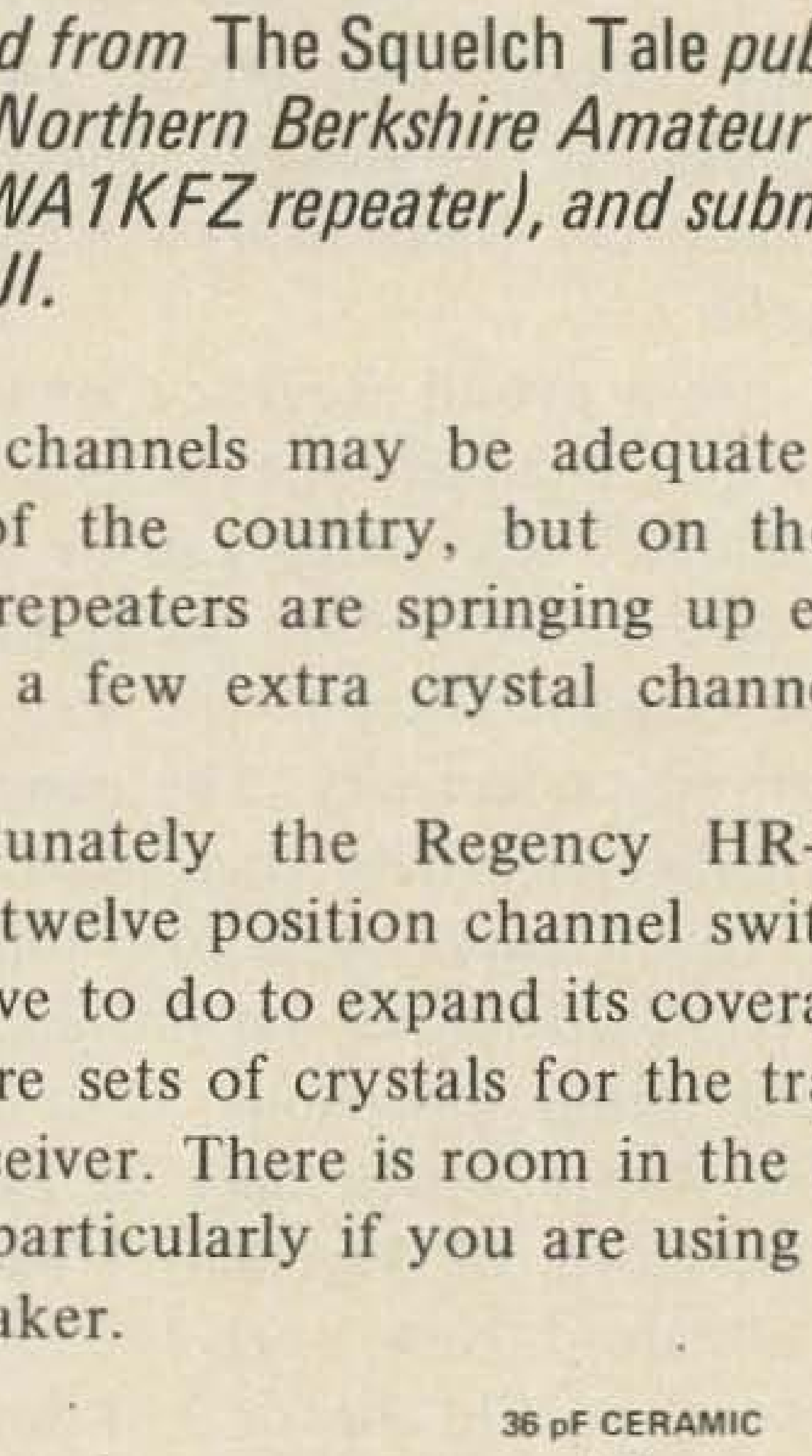
Your selective receiver is now ready to go. You may notice a slight change in the squelch control action, and a slight improvement in receiver sensitivity.

12 Channels with the Regency HR-2

Gleaned from The Squelch Tale *publication of the Northern Berkshire Amateur Radio Club (WA1KFZ repeater), and submitted by WA1KJI.*

Six channels may be adequate in most parts of the country, but on those areas where repeaters are springing up every few weeks, a few extra crystal channels could help.

Fortunately the Regency HR-2 comes with a twelve position channel switch, so all you have to do to expand its coverage is add six more sets of crystals for the transmitter and receiver. There is room in the HR-2 for these, particularly if you are using an external speaker.



The process is simple. The six channels built into the HR-2 run down to the crystal sockets as you can see on page 12 of the instruction manual. All you have to do is add six more crystal sockets on a piece of Vector board 2¼ x 1 with .062" holes on .2" centers, plus six trimmers and six 36 pF capacitors per Fig. 1. Run short wires from the crystals to the switch and ground the other end of the circuit someplace handy. You can work out the mechanical problems or just tape things together, as you wish.

MORSE CENTENNIAL

Next April 2 will mark the 100th anniversary of the death of Samuel F. B. Morse. It is hard today to realize how great a debt the world owes to this painter-inventor and the magnitude of his contribution not only to American life but to communications all over the civilized world. His experiments proved that using a predetermined code, human intelligence could be transmitted long distances over a wire, with the speed of light.

He was born in Cambridge, Mass., 1791, and died 81 years later in 1872 in New York City. As a student at Yale (with a flair for sketching) he attended lectures on the new marvel, electricity. He and his brother Sidney invented a pump which was used on fire engines.

But he needed a means of livelihood and for 22 years he painted portraits in the United States and Europe, where most American artists studied in those days.

In 1832 he learned that a magnet was created if an insulated wire was wound around an iron core, and an electric current was sent through the wire from a Leyden jar. He felt that this property could be used to transmit human intelligence. He made numerous sketches of such a system, and this led to his devising a crude sending apparatus and a code with which to identify the message.

From 1832 to 1837 he worked on his invention at New York University where he was a teacher of the art of design and eked out a poor existence by painting portraits, too.

In 1843 Congress voted $30,000 for the construction of his experimental telegraph line between Washington and Baltimore, and on May 24, 1844, Morse sent over the line, in the presence of many high officials, the famous message "What Hath God Wrought!"

There were other efforts to devise practical telegraphs all over Europe, but all of them were visual systems, leaving no record of the messages. Morse's machine, on the other hand, left a record on tape and was the first practical recording telegraph.

Within a few years the whole Eastern United States was covered by short telegraph lines. Finally, in Rochester, N.Y., a movement began in mid-century to merge a number of them and within a dozen years more than fifty of the various lines had been combined into the Western Union Telegraph Co., which eventually covered the whole country. By 1862 a wire reached California, just seven years before the first transcontinental train got there.

Museums, colleges, railroad organizations, art galleries, professional and amateur telegraph associations, radio, television and historical bodies all will mark the centenary of the death of Samuel Finley Breese Morse, the man who annihilated space, on April 2, 1972. He died in New York City and is buried in the beautiful, park-like Green-Wood Cemetery, Brooklyn, N.Y., under a 15-foot-tall monument, surrounded by the graves of 34 of his kin.

Amateurs interested in more information on the Morse Telegraph Club should write to Joseph B. Milgram, President of the New York Chapter, 952 East 19th Street, Brooklyn NY 11230, to whom we are indebted for this item.

Robert L. Grenell, ex W8RHR
3926 Beech Street
Cincinnati, Ohio 45227

UPDATING AN OLD RECEIVER

You who fear to insert the tip of your soldering gun beneath the lid of your factory-made equipment, read no further. This article will blow your minds, for the project it describes involves removing the crystal filter, diode detector, noise limiter, and part of the avc circuitry from an "outdated" diode detector AM/CW receiver. The parts and circuits removed are then replaced with circuits and systems designed for the best reception of SSB, including just about the smoothest audio-derived agc system to be found anywhere. My conversion project was a 75A2, but the principles and circuits can be used in converting any receiver.

I am presently in the throes of relearning the code. I unwittingly let my W8RHR license lapse through simple inertia, and now must pay the price. (Why don't they make CW men pass an elocution test?) When I'm not copying practice code, I spend my time building and rebuilding, hoping to be ready next spring with a rig which will do justice to the excellent conditions which will prevail on the DX bands when I make my re-entry into the world of amateur radio. Naturally, I'll be

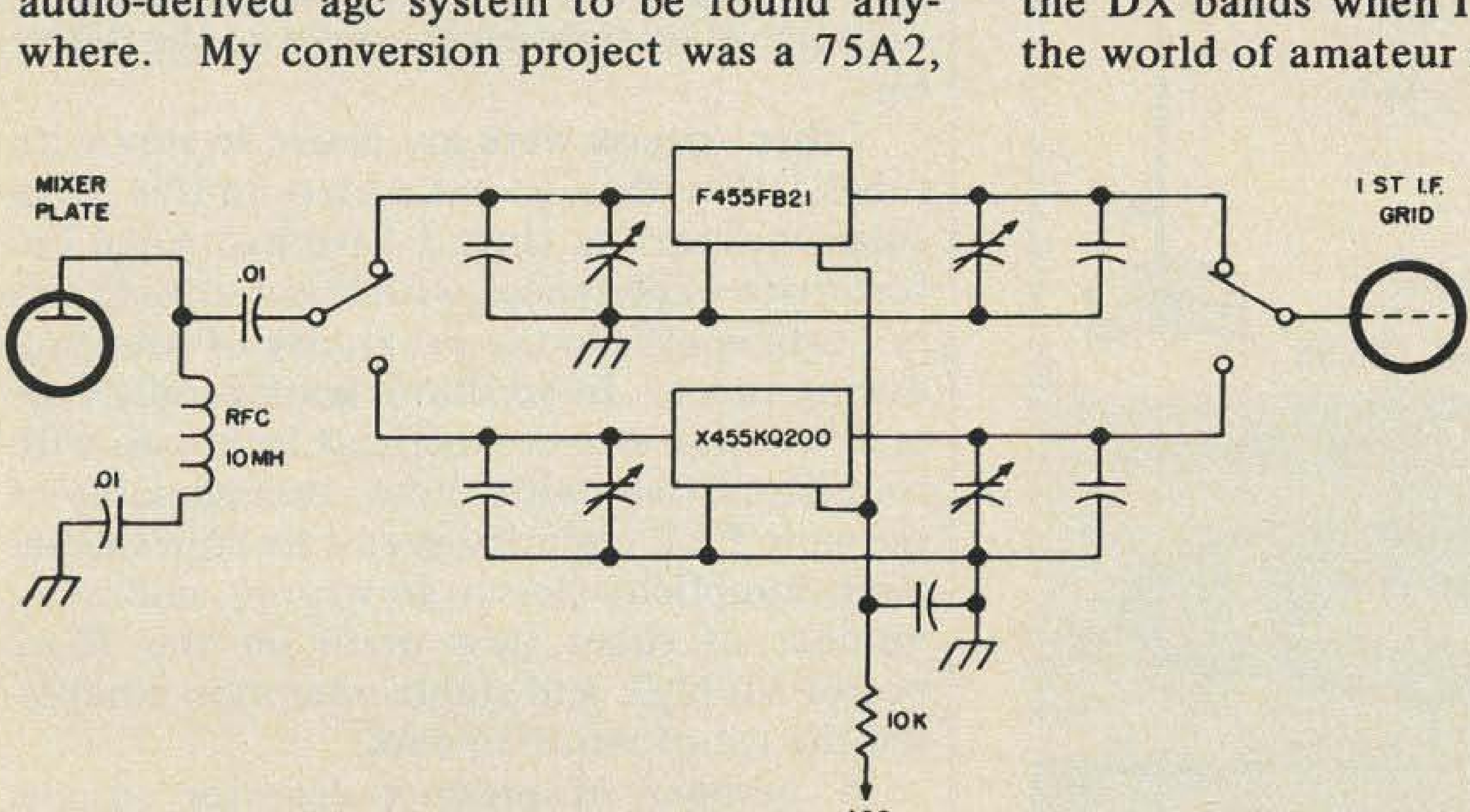


Fig. 1. Installation of Collins mechanical and crystal lattice filters. Fixed padders are 82 pF silver micas, and variables are 50 pF air trimmers.

SSB. The first project on the agenda, therefore, was the conversion of the 75A2 I purchased from a local ham. Of course, a mechanical filter. And a crystal lattice for CW. And a good product detector and agc system. with suitable noise limiting. This article is devoted to all of those who have failed to achieve the desired results when tackling a similar conversion.

Most such failures lie in the area of the product detector and agc. The installation of the filters is no problem; just follow the Collins directions. A Collins F455FB21 and X455KQ200 were mounted with their individual peaking components and the selectivity switch in a minibox. This assembly replaced the crystal filter and its output coil, which were removed. The mixer output coil was also removed, and B+ to the mixer plate was fed in parallel to the filter input coils through a 10 mH *rf* choke (Fig. 1).

The product detector and agc system did not prove as simple. There were a number of criteria which I had to consider in designing this circuitry for the 75A2. It was essential to have a high degree of overload tolerance, a very efficient product detector, and lots of audio to rectify for the agc. These characteristics, always desirable, are an absolute necessity in the 75A2. In this receiver, *rf* gain control is accomplished by varying the grid bias of the *rf* and *if* stages, as opposed to the more usual cathode bias control. The variable bias is tapped into the avc line through a resistive network which shunts the line and loads it rather heavily. In order to derive maximum benefit from the agc system, it is desirable to run the *rf* gain control as nearly wide open as possible at all times. Thus, plenty of agc voltage is required to prevent detector overload, and a high degree of overload tolerance is required of the detector.

Other criteria were my desire to stay with tubes rather than go solid state in this particular application, since I have had some unfortunate experiences with transistor circuitry "taking off" in the proximity of heat-producing tubes. In addition, good product detector action is more difficult to obtain with transistors than with tubes, though some of the new FET circuitry seems to hold the answer. Simplicity (less to go wrong), minimum number of tubes (less drain on the 75A2 power supply), and stable operation completed the list of requirements.

A number of product detector circuits were built, tried, and rejected. The double

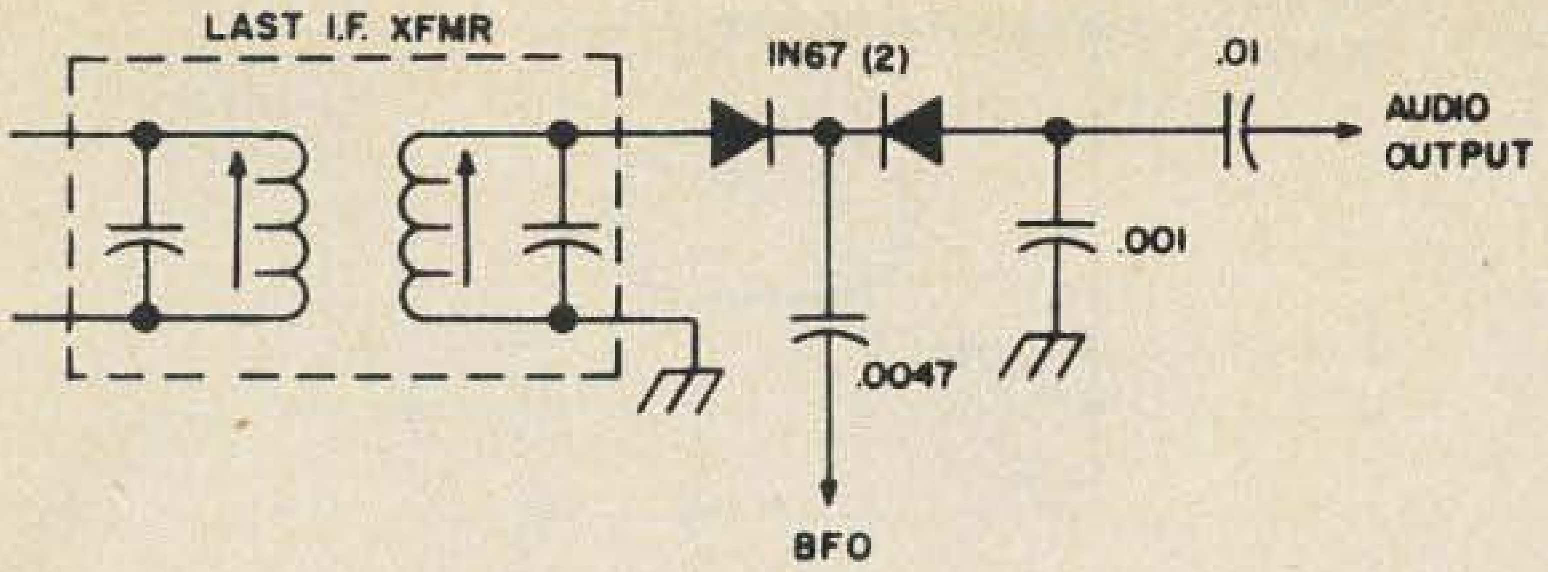


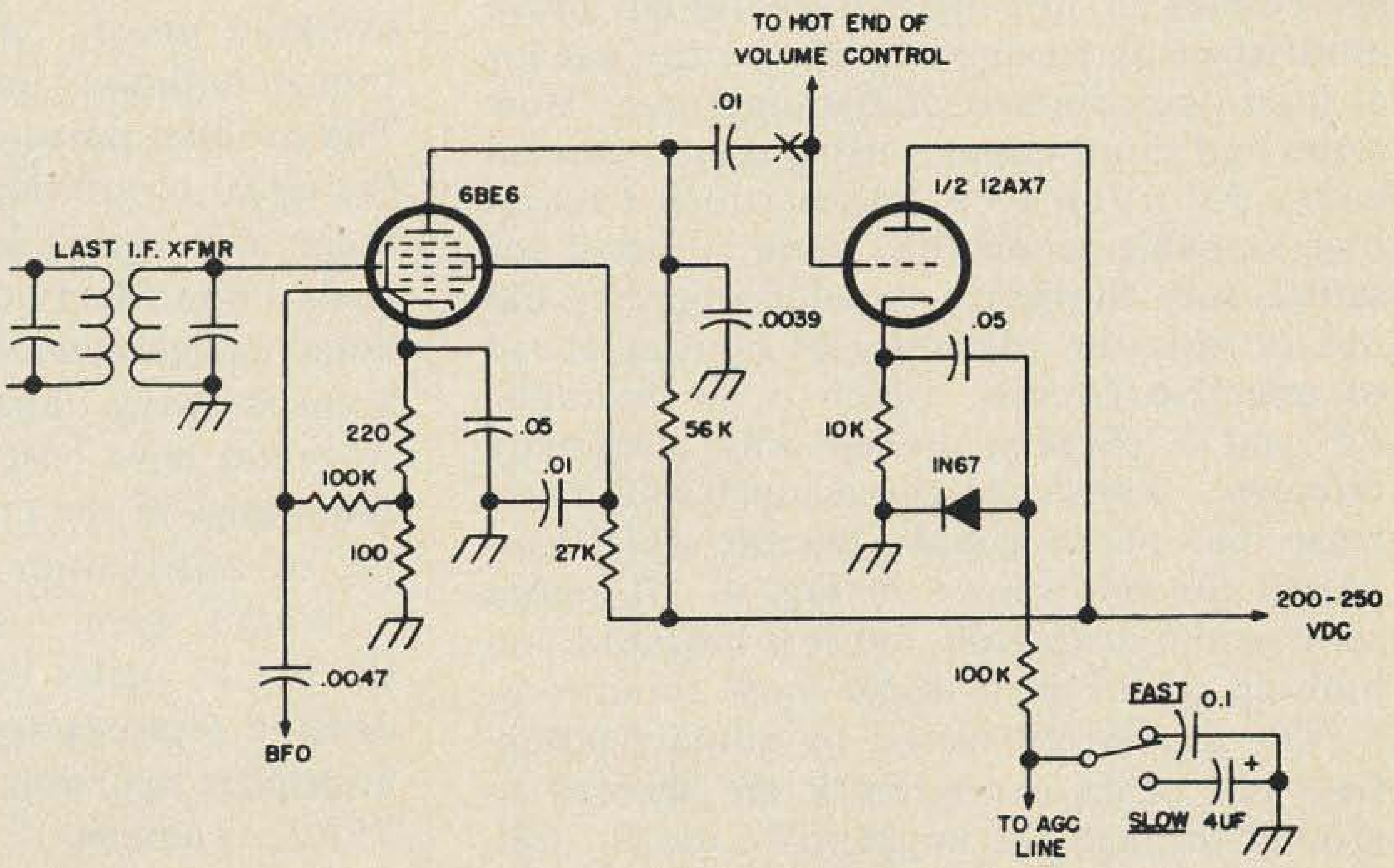
Fig. 2. A product detector having excellent characteristics can be simply installed in most receivers using two 1N67's in the above circuit. For use in the 75A2, however, this circuit did not provide sufficient output for adequate AGC action, even when amplified.

diode type (Fig. 2) using 1N67's back to back has excellent characteristics, but the output is too low to yield the kind of agc action required, even when amplified. Without exception, the triode circuits I tried fed through considerable 455 kHz bfo voltage, even when the output was filtered using tuned traps. Too much stray coupling between audio and *if* stages. The result was erratic agc action and bfo mixing in the *if* strip. Not good. In addition, triode and pentode circuits using cathode bfo injection were quite susceptible to overload. The low impedance presented by the cathode reduced bfo voltage enough to allow the *if* signal to over-ride the re-injected carrier.

Finally, the familiar 6BE6 circuit was chosen (Fig. 3). It out-performed the other circuits tried in practically every parameter. Output was at least as high as with any other circuit...higher than most. It offered by far the best overload characteristics, and remained linear and undistorted through an extremely wide dynamic range, resulting in natural-sounding, undistorted audio. It was duly incorporated into the 75A2. The .0039 μF ceramic by-passing the plate to ground reduces response above 3000 Hz and kills any 455 kHz energy at the output. The circuit is stable and uncritical. The only precaution which should be observed is to keep bfo energy out of the *if* strip. This point could be taken for granted, yet I know that many home-brew product detectors have failed to live up to expectations because the advantages of the circuit were cancelled by bfo mixing in the *if's*. Incidentally, don't neglect to realign the detector *if* transformer. Replacing the heavy load of the diode detector with the light load of the product detector makes quite a difference in the secondary tuning and Q.

With the product detector percolating nicely, I turned my efforts to the development of an equally satisfactory agc system. In my experiments with other product detectors, I had derived agc voltage by rectifying the output of either the detector itself, or its amplified signal, applying the resultant dc to the existing avc line through a 100K resistor. I tried both of these approaches with the 6BE6 and was not able to obtain sufficient voltage by rectifying its output direct, in spite of its high level. When I amplified the output and rectified it, the resulting dc potential was actually too high, but the voltage swing with modulation was still not great enough. Suddenly, the light dawned, and I

Fig. 3. Complete product detector and audio AGC system. Values of the capacitors switched by the "Fast-Slow" switch will vary from receiver to receiver. Cut and try is almost the only way to determine the value of the "Slow" capacitor. The "Fast" capacitor will ordinarily be the original capacitor shunting the AGC line in most receivers. Break at X to include the noise limiter circuit in Fig. 4.



realized that I had been overlooking the obvious impedance mismatch between ghe output of a tube and the low impedance of the diode rectifier. The cathode follower of Fig. 3 was quickly constructed and connected to the hot end of the volume control. A transformer hook-up was tried experimentally, but the cathode follower proved far superior in providing the desirable wide swing of agc voltage for a small variation in input to the detector. The unused 12AX7 triode was originally the avc amplifier in the Collins circuitry. I definitely recommend the cathode follower agc derivation as vastly superior to other methods commonly in use.

The 100K resistor was retained to avoid excessive loading of the agc rectifier. AGC action is so good that I only have to reduce the *rf* gain in the presence of strong local signals. The final touch is the variable time constant. In the CW position, only the original .1 μF capacitor shunts the agc line; switching to the SSB position adds a 4 μF miniature electrolytic, and increases the discharge time to about .6 seconds. The attack is only softened slightly...just enough to prevent the overshoot "click" at the beginning of a transmission or after a pause. Other receivers will require much smaller values of capacitance if their agc lines are less heavily loaded than that of the 75A2.

So far so good. Now for the noise limiter. Not so good. Every conceivable type of noise limiter circuit was tried. At first, I considered a noise blanker, but the cumbersome circuitry, space and power requirements discouraged this approach. I then turned to simpler possibilities. Using fast time constant agc voltage to an early *if* stage did not prove as satisfactory for me as it apparently has for at least one commercial manufacturer. Most series and shunt clippers using diodes created audio distortion to a degree which I found objectionable when they were adjusted for satisfactory limiting. In addition, they did not provide the advantage of limiting ahead of selective circuits, which is so desirable. *RF* and *if* clipping proved only marginally effective. I searched the manuals and magazines, but never found a circuit which surpassed the one shown in Fig. 4. It causes some audio distortion, but it is bearable, and limiting is sufficient under most conditions.

The diodes are biased by contact potential, and peaks exceeding it are shorted to ground through the appropriate diode. Silicon and germanium diodes were tried, but

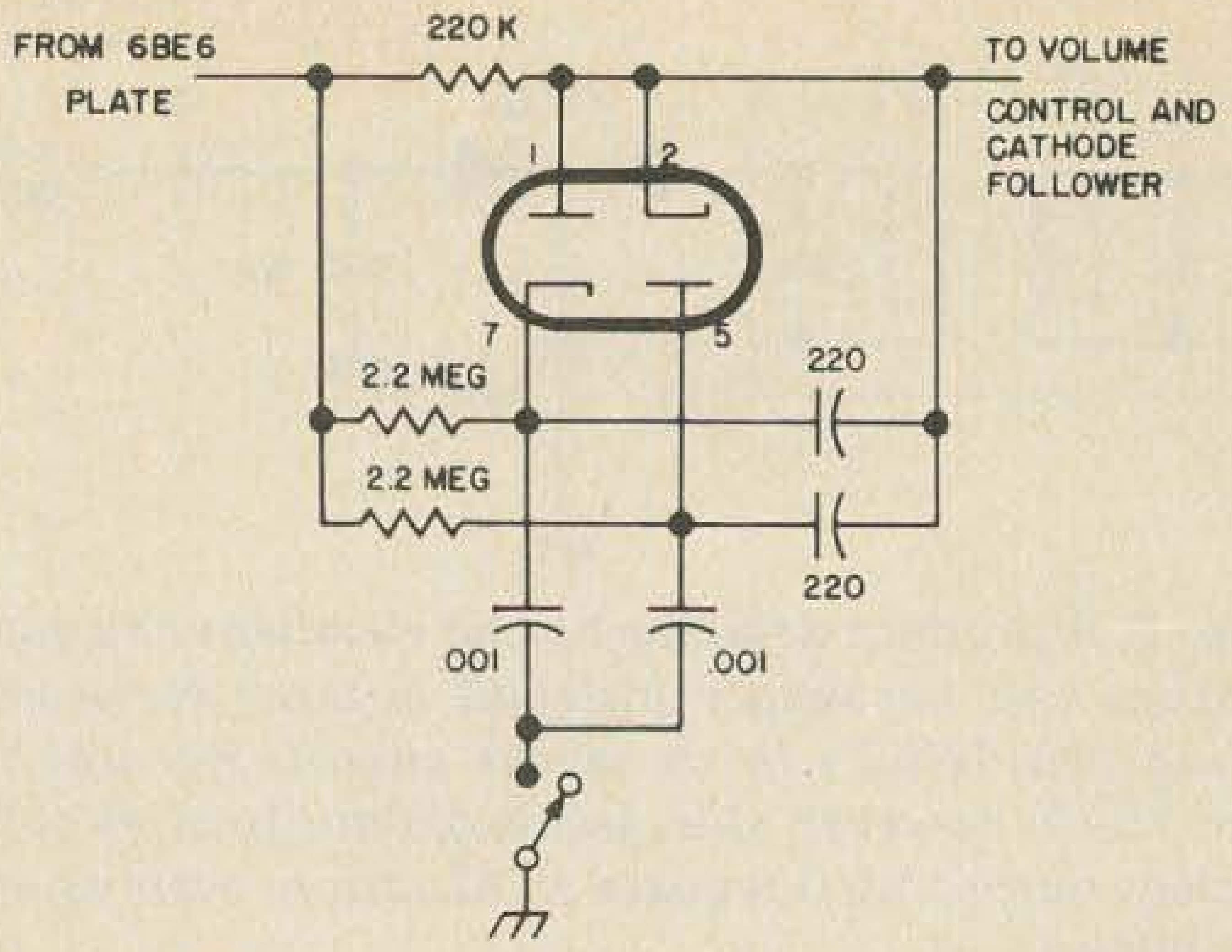


Fig. 4. The noise limiter. Audio distortion becomes objectionable on strong signals, so the limiter should be switched on only when needed. This circuit is at its best on weak signals, which can be copied even through heavy QRM. An i-f noise-blanker would be much better, but space and power considerations required a compromise. It's far from the ultimate, but it works better than most circuits and is at least as good as any other tried.

seemed to cause more distortion than the 6AL5 because of their greater sensitivity. This can be adjusted, but the 6AL5 was there, so I used it. The 220 pF capacitors suppress dc spikes, which are troublesome at high clippink levels and relieve some of the harmonic distortion generated by the clipping action. This clipper definitely cannot be left in the circuit at all times. It should be used only when needed, since strong signals will be clipped and distorted. It is especially useful when hunting through QRN and atmospheric rubbish for weak signals.

The addition of a 5:1 reduction drive and oversized tuning knob completed the first phase of my 75A2 conversion. It's almost overload proof. AM reception is possible, though definitely inferior to diode detection. The product detector–agc system is at least the equal of anything in current commercial usage, and a great deal better than some. All in all, I don't feel I could be better off with a brand new receiver. And that's the beauty of home brewing. I get something for less than it would have cost off the shelf, learned a few things in the process, and got a real feeling of satisfaction out of making it work.

What's next? A 6 meter conversion of the old 11 meter band, continued efforts to develop a satisfactory noise limiter, and a Q multiplier rejection filter built right into the 75A2, of course!

W8RHR

LEARNING FROM EMERGENCIES

Experience is the best teacher, obviously, so it is possible that much can be learned from the problems that arose during the February 1971 Los Angeles earthquake. The Los Angeles SCM has published an interesting and lengthy report on the effort, and I believe that the conclusions he reached will be of value to every club and individual concerned with providing emergency amateur radio communications.

Disaster Preparation

Operators for a particular Emergency Operating Center should be recruited from a diverse physical area. The W6IN Society had many regular members unable to assist as they were personally involved in attempts to provide solely for their immediate families. There is a need for the individual radio amateur to be well prepared as well as the emergency oriented groups in which he participates. He must have his own family cared for in order that he can even be available in time of disaster.

Radio amateurs should establish an emergency kit or list of required items to take on an emergency operation. This kit should contain sufficient items to provide food, clothes, spare parts, etc., which might be needed to render a man self-sustaining for 72 hours in the field.

The telephone tree (one individual calling a list of persons who in turn call an established list on the telephone) usually is excellent for exercises and drills, but it proved useless within this disaster area. There was no telephone service. An activation system involving persons reporting to a gathering frequency or a specific location is to be preferred.

Emergency power and equipment must be tested regularly at definite intervals and for substantial periods to insure its being in suitable operating condition. The Emergency Operating Center generator that failed had been tested weekly on Mondays for fifteen minutes, but had never been run for any substantial period of time. The fuel pump quit, it lacked sufficient radiator water (water mains were broken by the quake), and the fuel supply was low.

Should an Emergency Operating Center become unusable it is vital that some provision be made for a portable command post (preferably a mobile command post) with either permanent equipment installed or provisions made for equipment. A mobile command post should not be stored at the same point as the Emergency Operating Center or both may be lost at the same time.

Contacts established with local business firms, concerning the use of necessary equipment accessories and supplies in time of disaster or need, will prove extremely beneficial.

It must be remembered that amateurs are supporting local government disaster efforts as communicators and are not responsible for much of the planning, securing of goods and administrative decisions. Also a single unpleasant confrontation with a city official can change the image presented by the entire operation.

The role assumed in this effort unfortunately encompassed more than that of a communicator to the extent of becoming an administrator in a decision-making position. In retrospect this is undesirable and undermining to the general efforts of amateur radio to establish better working relations with public administrative agencies.

It is also noted that it is highly desirable to have available to the proper administrative decision-makers the ability to monitor other services (hospital, police, fire, etc.) at the Emergency Operating Center.

A professional appearance of the radio amateurs making contact with disaster officials is highly recommended. This would include proper dress and the presence of mature attitudes.

Overall communications coordination efforts with other amateur radio groups hoping to provide some service in the disaster area is vital. Groups of well-intending amateurs – unless recognized by the coordinating disaster group officials – can defeat the overall effort. Individual radio amateurs should be affiliated with a well-disciplined emergency group prior to a disaster if they expect to be fully productive during a disaster. Amateur radio groups operating in such a situation must have good communications horizontally among those in charge during the disaster situation.

A universally recognized insignia, picture ID card should be established for those with a purpose in a disaster area. Any such ID must also be made clear to proper authorities engaged in the disaster operations.

During the Disaster

To "be prepared" is insufficient. Established communications groups must volunteer their services to affected areas. Without such volunteering W6IN, for example, would have been hard-pressed to provide adequate communications to the City of San Fernando on an emergency basis.

Shifts for communications personnel should be established as rapidly as feasible for continuity and efficiency.

A quartermaster of radio gear, accessories and other equipment to be used during operations is necessary to coordinate their issuance. Some personal radio equipment was "lost" through inadequate control.

Some panic information was disseminated to the public by the news media pointing up the necessity for strict control over any media releases. Speculation and rumors should be discouraged on amateur radio bands as well.

Comments and Conclusions on Health and Welfare Messages

When mail took a significant time to cross the country and long distance calls cost considerable sums, amateurs performed a real service by relaying messages that were mailed for final delivery. The attitude of many amateurs regarding mailing of traffic today can be summed up by one comment :

"When offering to send a message without a phone number to a person with either an unlisted number or a number listed under another last name, the originating station would be well advised to provide the originating party with a free post card rather than essentially offer one at the expense of stations in the delivery area."

Individuals make long, futile efforts to locate numbers. Some attempt to ditch the stuff on someone else, possibly a mile or two closer, although the addressee would be a local call for the first station if a phone number were available. Also it is difficult to get a letter into the postal system at a point where delivery will be prompt. (A card put into the mailbox after the last pickup of the day stands little hope of next-day delivery.) With the present air mail handling of first class mail, any radio message eventually mailed will probably reach its destination later than had it been mailed at the source.

Many of the instant service nets have resorted to not taking traffic listings without telephone numbers and liaison with them is sometimes necessary for the older, basic traffic nets. Especially in a disaster, the delivery stations are sufficiently overloaded with traffic to be justifiably annoyed at having to devote large efforts to researching telephone numbers. Inclusion of telephone numbers on messages cannot be overemphasized.

Additionally it is suggested that the National Traffic System, the three Area Staffs and the ARRL's Communications Manager should establish special provisions for handling large volumes of traffic in disaster situations that can be activated readily. There has been no indication of any special, organized efforts on a large scale within NTS to accommodate the large traffic volume occurring only days after a national exercise in emergency preparedness in the form of the ARRL's Simulated Emergency Test, "SET." Along the same lines more emphasis is needed on faster routing and delivery of traffic in NTS (traffic originating in NTS after the quake typically took three or four days to reach California NTS circuits). In addition to simplified routing techniques the use of simplified message forms (as used on the instant service nets) should be objectively investigated for use in disasters as well as increased use of modes other than CW.

Inquiries into Disaster Areas

Most reports on disaster operations conclude with the thought that inquiries should not be sent into disaster areas. The previous paragraphs are evidence that these efforts have not exactly been heeded. In a disaster where 65 people died out of a population of over 7 million, it could be seen that the answer to "Are you OK?" was "Yes." If there was any need for help, no doubt the affected parties would have requested help. However, the enhancement of the radio amateur's image was felt by the participants to have justified the effort.

Two types of inquiries somewhat amazed a few amateurs. One was an inquiry addressed to a person at an "unknown veterans' hospital in or near Los Angeles." In other words, the originators were so concerned about Uncle Charlie they were glad to take advantage of free services to inquire about his state, but not quite interested enough prior to the disaster to even know where he lived.

The other was a public service group that originated all their health and welfare traffic with the organization's signature rather than the originating party. Delivering amateurs felt somewhat embarrassed at receiving comments like "What is this all about?" when delivering "Are you OK? From the XYZ County, East Coast State Emergency Helpers Organization" message to a person living fifty miles from the quake center.

Overall Conclusions and Comments

It is noted that all disaster communications were handled by voice. With the exception of the Southern California Net on CW and the Navy MARS RTTY circuit, the health and welfare message load was handled by voice. CW, albeit more efficient for exchange of message traffic between experienced operators is a skill that has not been developed by enough amateurs to result in an effective disaster service. Complaints were voiced by Southern California Net members about lack of coverage in many areas which resulted in many messages being delayed even more.

The ease of training operators, reorienting an operation (setting up separate frequencies for different areas, for instance) and making large numbers of people aware of what's happening and capable of helping, makes voice by far the more effective means of disaster communication.

The Future

While it was a learning situation for Los Angeles AREC, this disaster communications operation demonstrated the value and merit of AREC. Several steps are being taken to improve and develop AREC in the Los Angeles Section under the leadership of the Section Emergency Coordinator, WA6QZY. FM has been clearly demonstrated to be a highly effective form of mobile and emergency communication for which reason 146.82 MHz FM simplex has been designated as the section-wide AREC emergency and mobile frequency in the Los Angeles Section.

Through the cooperation of the Edgewood Amateur Radio Society, Inc., the W6FNO repeater will repeat 146.82 MHz to 146.70 MHz. Also the Palisades Amateur Radio Club of Culver City has made their repeater, WB6ZDI, available to Culver City AREC (146.61 MHz in, 147.33 MHz out FM). Hopefully other radio clubs will also provide such support of AREC. 14302 kHz has been designated as the section's health and welfare frequency. A command channel on 2 meter FM for ECs, SEC, SCM and their assistants is being developed as is a high frequency band frequency for use as a gathering point. Discussion is also being given to an information station which would be used on a regular basis as an Official Bulletin Station.

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Solid State Tuneable IF

Fixed-Tuned, 1.65 MHz IF Companion Unit to 28–30 MHz IF in January, 1970 issue of 73

This is the detailed low-down on the construction of some practical i-f stages for amateurs, including windings, cup-cores, etc,. for 1.65 MHz, employing techniques you can use on other frequencies as well.

There are several 455 kHz i-f strips on the market which work quite well, however these are a compromise in the trade-off on low image versus selectivity. The easiest way for the home-brewer to be sure to obtain narrow-band selectivity at low cost and in battery-portable form is to use a low i-f frequency. This means image trouble unless more conversions are used. If this is done both freedom from image *and* selectivity result. And if you tap into the outputs of both i-f's you can have an instant choice of broad or narrow bandwidth on a switch. The business of crystal filters is left to the professionals, resulting in receivers in the hundreds of $.

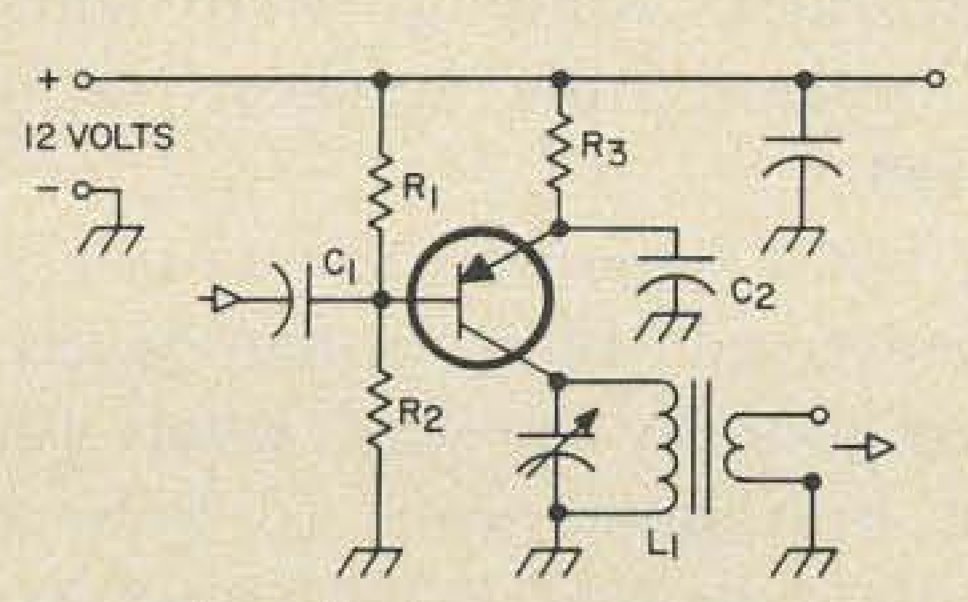


Fig. 1. Schematic of the fixed-tuned first stage.

DC Collector Voltage at the Ground Level

This is definitely good. Fig. 1 shows the simplicity of the first stage, which is fixed-tuned. What could be simpler? And it works very well. One coupling capacitor to the base, one bypass capacitor for the emitter, and that's it. All coils have one side grounded to the copper-clad baseboard.

Base Resistors

A number of tests were run on these items, which were found to be non-critical, as long as the ratio is held to furnish the needed base turn-on voltage. Values from 5K down to 250 ohms were tried for R1 (Fig. 1). At 250 ohms the shunt resistance across the base began to lower the gain. Naturally R2 has to be changed for every change in R1. A ratio of between four to one and six to one is good. I settled for 2.2K for R1 and 12.5 for R2, but this ratio may change a little for other transistors.

Input Tuning Not Required

This also was tested carefully. The output of the mixer from which the 1.65 MHz i-f was derived is already tuned, so it is really a question of how many tuned circuits you want to use. Various arrangements of tuned base coils were tried, with little increase in gain noted, so tuned circuits were left out of the input.

Interstage Coils

A number of different types of i-f transformers were wound and tested, with different iron cores, the matter of size entering here to a considerable extent because there will be a number of stages and also a hand-carried rig has to be kept as small as possible.

You can get real fancy here in the matter of i-f transformers, and wind them up with Litz wire, original German "Litzendraht," which is made up of many strands of small size enamel wire, example, "5/40." This is 5 strands of no. 40 enamel wire, and *below* about 7 MHz it does increase the Q to any remarkable extent. To match the benefits of this wire you can use fancy cup cores of powdered iron from Holland, and end up with a Q of 300 to 400 around 455 kHz. But, and it's a big but, you can't hold it!

The necessary air gap changes, and temperature, moisture, etc., put in their two cents worth also.

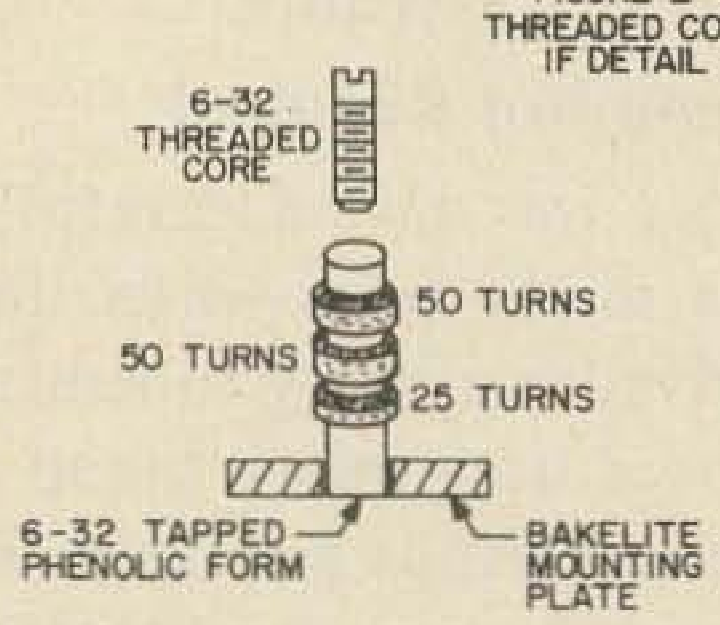
So, in one sense, it is better, at least more permanent and easier for the home-brewer to use more stages each with a lower Q and greater stability. For the narrow-band section we will work on this question a little. One more tuned circuit, with another stage allows all of them to run with conservatively longer life, practically no heating, no feedback, and is much better if you want a little more selectivity.

That problem has already been solved here by having the choice of two bandwidths.

Threaded Core IF's

Refer to Fig. 2 for these items. When you random wind by hand, which is pretty easy and works all right, wind on 25 turns first, then one pi of 50 and then the other, as shown in Fig. 2. These separate pi windings increase the Q quite a bit, helping with random winding which does not have the best of Q ordinarily.

FIGURE 2
THREADED CORE
IF DETAIL



Inserting the 6/32" iron core from the top keeps it in the main body of the winding for Q and coupling, and then reaching into the 25 turn part, serves to tune a little above and below the desired frequency for trimming, which is always needed.

As mentioned, you can make coils this way, or get real fancy. That's up to you. L2 is wound in the low place between the two fifty turn windings. L2 is generally a small number of turns, say from 2 to 5 turns. See final schematic and coil table.

What Not to Do

With three tuned circuits on 1.6 MHz, one in the 28 to 30 mhz mixer collector output, and one in each of the two i-f stages being detailed, it seemed only natural to try and achieve more Q with bigger and better powdered iron cores. Having a large selection of these, from some real small ones like 1/32" diameter O.D., up to the 1/2" loopstick sections, which same can be cut with a file, I wound up some 1.6 MHz coils with various turn numbers from 50 to 100. Well, the Q went up, but so did the troubles! The most nasty kind of feedback you ever saw crept in and then settled down to stay! And I couldn't neutralize it.

To cut it short, it was magnetic feedback, from the collector coil to the base winding on the previous collector coil, as I found out finally by removing the first stage and checking with just one transistor running. It oscillated all right, whenever the base coil was within several inches of the collector coil. Industrial designers (technicians) in large receiver companies can well laugh, someone else is paying for *their* days! Even though these windings were separated by more than three inches, trouble still occurred.

At last I remembered building a 16 to 18 kHz sideband filter some years ago (it worked good by the way) where I had to use tinned iron shield cans to keep down the magnetic coupling. It all came back to me then.

The Answer

The solution for compact units is to enclose the *outside* of the winding with powdered iron as well as having a center core. This causes the magnetic field to curve back in a sense, into the coil again, instead of travelling through the "near field" over to the base coil winding, where you most decidedly do not want it.

These kind of cores are known as cup cores, and there are millions available practically for free. Most of the i-f transformers made for *tube* i-f's have some beauties in them. Actually, two each. One is illustrated in Fig. 3A., with the winding I used, in Fig. 3B. I just happen to have (did I mention my 45 foot junk box?) a lot of these because of some ten years of work with sub-miniature battery tubes, like the 1V6, 1AD4, etc. So, you take the insides right out of one of these transformers, like a Miller no. 10C, and there are the two cup cores which are good for at least 455 khz up to several mhz.

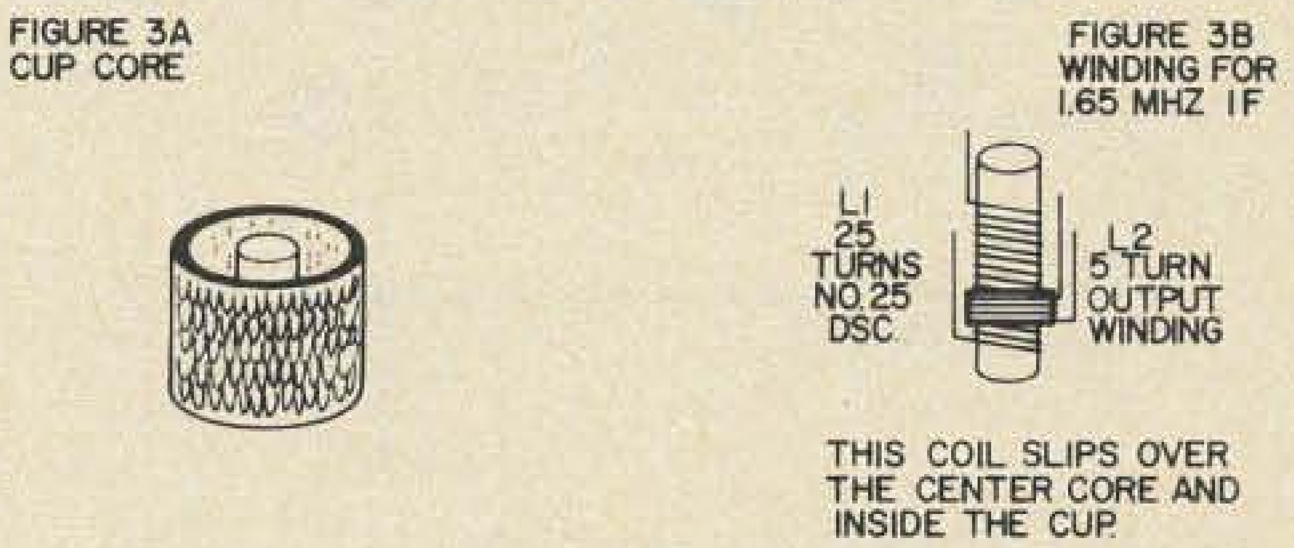
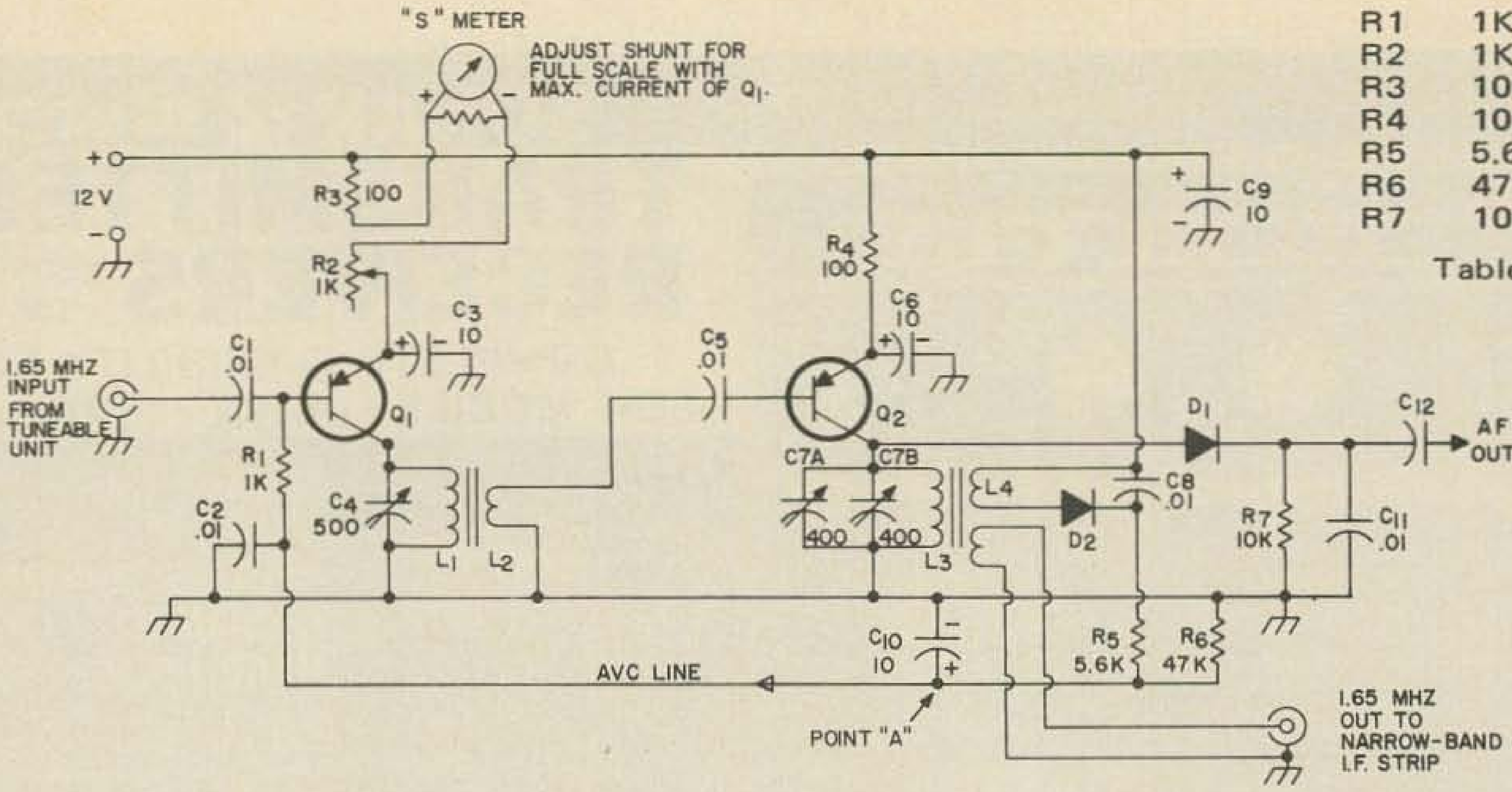


Fig. 3. A. Cup core and B. winding for 1.65 mhz i-f.

They do a swell job on 1.65 mhz, with plenty of gain, no neutralization needed (so far) and, using 500 pf or more tuning, the variations in collector capacity with current on avc action can be eliminated.

The use of a large C also drops the impedance down for a better match with the transistor collectors.

A completely enclosed cup core in one i-f stage with a cover over the top, shown open in Fig. 3A, can be used very close to another stage without feedback, due to the greatly lessened external magnetic coupling. When you go in for real compact assemblies you will have to watch out for the electrical coupling (by capacity). Toroid coils are



R1	1K
R2	1K pot.
R3	100 ohms
R4	100 ohms
R5	5.6K
R6	47K
R7	10K

Table 1.

Fig. 5. Final schematic.

often used for this purpose but they run into money and are much harder to wind.

A Special, Simplified AVC

For some time now I have not been completely satisfied with the avc system found in most books for economical type circuits, which I have often used myself. This one is shown in Fig. 4.

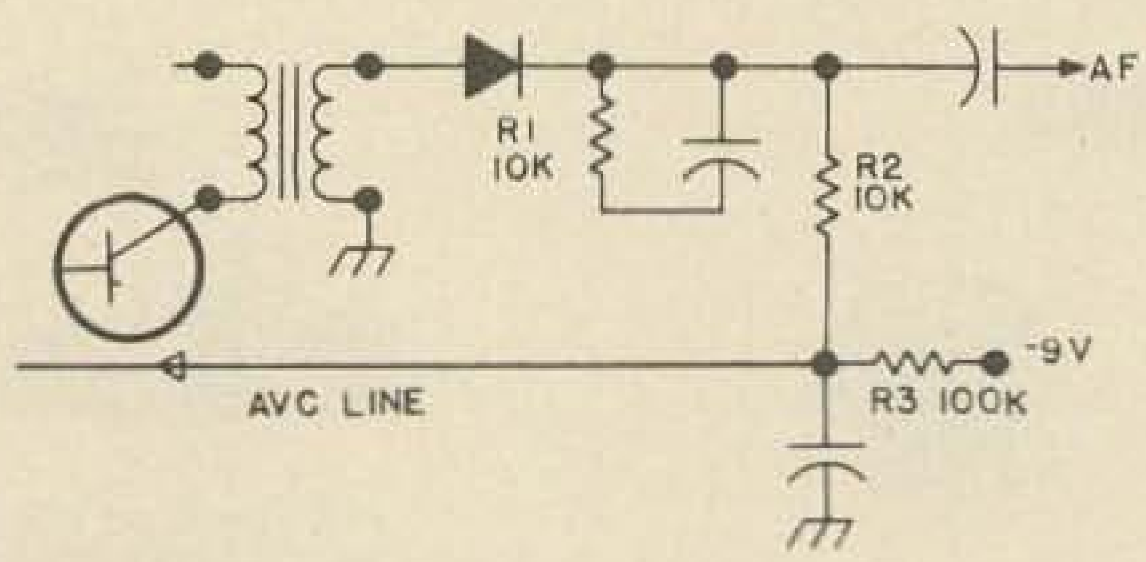


Fig. 4. "Old" avc circuit to be avoided.

R2 and R3 tend to load the diode with dc when you adjust them for best operation of the controlled stage, resulting in af distortion at certain levels of signal. As noted in Fig. 4., do *not* use the circuit shown there. Use the one shown in **Fig. 5**, the final and complete schematic, which has the new simplified circuit. It still does not use an additional transistor, but it does isolate the af from the avc action and produces beautiful af, by using two diodes.

D1 is a regular amplitude demodulator used solely for af. A secondary winding and D2 generate the dc voltage for the avc line.

In the absence of a signal, point A sits at about one volt negative from the plus 12 volt bus, resulting from the combination of D2, R1, and R2, and the negative bus which is also the ground plane in this i-f unit. This causes Q1 to operate at normal gain with a few milliamps of current.

An incoming i-f signal will build up a dc voltage through D1 making point A go through zero volts and, on a very strong signal up to around 2 volts positive with respect to the 12 volt bus. This of course automatically reduces the curent and gain of the avc controlled first i-f stage.

R1 and R2 can now be juggled for the best avc action with no effect at all on the af demodulation.

Completed Circuit

As mentioned, Fig. 5 shows the final schematic which operated in an excellent fashion with the 28 to 30 MHz tuneable section. The use of this tuneable i-f section allows the assembly of hand-carried battery portable rigs using crystal control all the way from the transmitter through to the local oscillators. The bandwidth of this fixed i-f on 1.65 MHz is about 50 to 100 kHz, depending on signal strength, and makes an excellent unit for search, tune-up, and medium distance reception with various front ends, antennas, converters, etc., on 432, 1296, and 2400 MHz. This amount of bandwidth allows your converter local oscillator crystal as well as the transmitter crystal of the lad on the other end of the QSO to "move" a little (they will!).

. . . K1CLL

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CHECKING ZENER DIODES

Over the past several years the cost of producing ultrapure silicon and the resultant devices has decreased at an extremely rapid rate. This reduction has been reflected in the cost of all silicon semiconductors. Perhaps the area in which the change has been most noticeable is in bipolar transistors, but at the same time the same reductions have been made in zener diodes too. Almost monthly one magazine or another features an article on the subject of testing and grading the "10 for" or "100 for" type of transistor. The subject of putting surplus zener diodes to use has not been popular and perhaps for this reason the price of unmarked zeners is extremely low. One large mail order house currently lists an assortment of 20 for less than $2. What then is needed to test and categorize these diodes? Fortunately the procedure and the equipment are simple.

First of all we must supply a voltage in excess of the zener point of the diode under test. This may be a special power supply built for the purpose or voltage may be taken from a bench supply or stolen from other equipment. We must also limit the current through the diode to a safe value in order not to exceed the dissipation rating of the device.

The diagram shows the simple setup in use at this QTH. The fixed resistor serves a current limiting function only. The voltmeter, which may be any VOM, VTVM, or panel meter, measures the drop across the zener. The potentiometer acts as a voltage divider and allows the voltage applied to the diode to be varied above and below the regulating point. If you are fortunate enough to have a bench supply available, the internal variable feature may be used and the potentiometer eliminated.

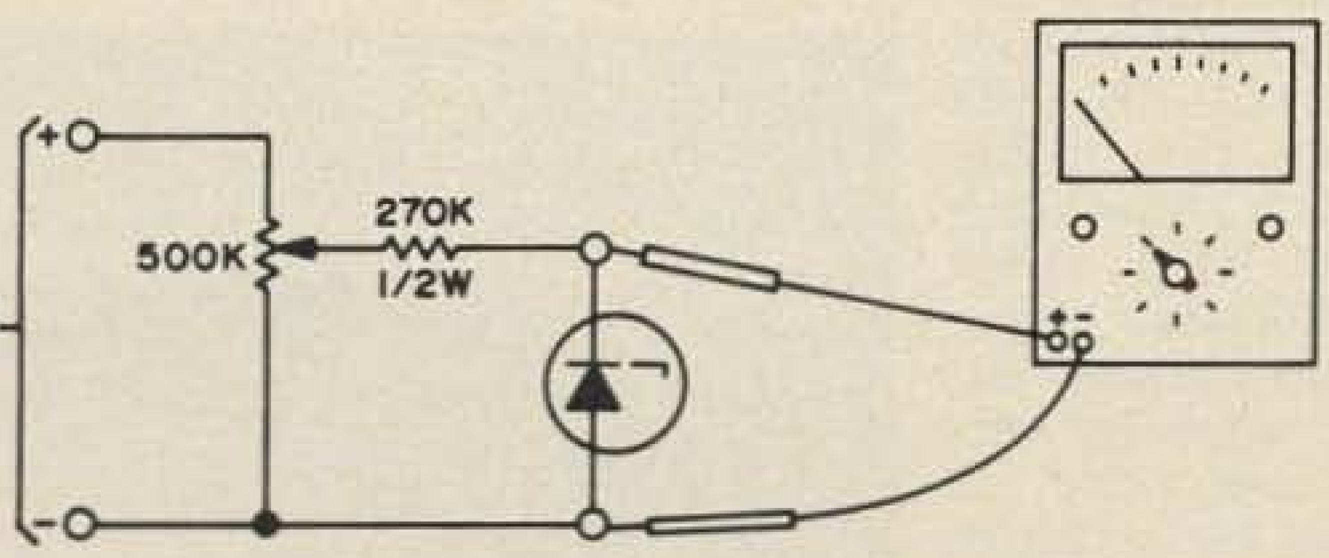


Fig. 1.

The constants given were chosen with an eye to minimum dissipation within the diode. The maximum current is limited to 1 mA, making this setup usable for a wide range of diodes types and sizes. Other constants may be selected if only higher power types are to be checked.

In use, the unknown diode is connected across the terminals with the indicated polarity. (Use trial and error if the diode is completely unmarked.) Always start with the potentiometer at the low voltage position and slowly increase the applied voltage until there is little or no increase in meter reading with increase in voltage. This is a rather abrupt indication. You will have no trouble detecting it. This is the voltage at which the diode will regulate. As they are checked, mark each diode with the correct voltage. A scrap of masking tape is a simple way of doing this.

A shorted diode will give no meter reading at any voltage – an open diode will allow the meter to read the supply voltage.

There remains one fly in the ointment. You will have to learn by experience the dissipation ratings of the various physical sizes of diodes. A short look at the actual size pictures in parts catalogs will be a good start.

. . .WAØABI

HIGH GAIN • LOW NOISE

35 dB power gain, 2.5—3.0 dB N.F. at 150 MHz, 2 stage, R.F. protected, dual-gate MOSFETS. Manual gain control and provision for AGC. 4-3/8" X 1-7/8" X 1-3/8" aluminum case with BNC receptacles and power switch. Available factory tuned to the frequency of your choice from 5 MHz to 350 MHz with approximately 3% bandwidth. Up to 10% B.W. available on special order.

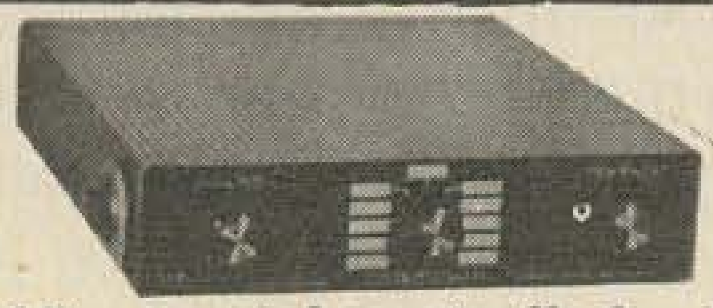
Model 201 price:
5—200 MHz . . . .$21.95.
201—350 MHz. . . . .$24.95.

UHF 3 to 5 dB MAX. N.F. 20 dB MIN. POWER GAIN

The Model 202 uses 2 of T.I.'s super low noise J-FETS in our special circuit board design which gives a minimum of 20 dB power gain at 450 MHz. Stability is such that you can have mismatched loads without it oscillating and you can retune (using the capped openings in the case) over a 15—20 MHz range simply by peaking for maximum signal. Available tuned to the frequency of your choice between 300—475 MHz. 4-3/8" X 1-7/8" X 1-3/8" aluminum case with BNC receptacles and power switch.

Model 202 price: . . . . . .$31.95.

VHF FM RECEIVER 11 CHANNELS • 135—250 MHz



• 11 crystal-controlled channels. • Available in your choice of frequencies from 135—250 MHz in any one segment from 1—4 MHz wide. • I. F. bandwidth (channel selectivity) available in your choice of +/— 7.5 kHz or +/— 15 kHz. • 8-pole quartz filter and a 4-pole ceramic filter gives more than 80 dB rejection at 2X channel bandwidth. • Frequency trimmers for each crystal. • .2 to .3 μvolt for 20 dB quieting. • Dual-gate MOSFETS and integrated circuits. • Self-contained speaker and external speaker jack. • Mobile mount and tilt stand • Anodized alum. Case, 6" X 7" X 1 3/8".

Model FMR-250-11 price:
135—180 MHZ. $109.95
181—250 MHz $119.95
Price includes one .001% crystal. Additional crystals $6.95 ea.

40 dB GAIN 2.5—3.0 N.F. @ 150 MHz

2 RF stages with transient protected dual-gate MOSFETS give this converter the high gain and low noise you need for receiving very weak signals. The mixer stage is also a dual-gate MOSFET as it greatly reduces spurious mixing products — some by as much as 100 dB over that obtained with bipolar mixers. A bipolar oscillator using 3rd or 5th overtone plug-in crystals is followed by a harmonic bandpass filter, and where necessary an additional amplifier is used to assure the correct amount of drive to the mixer. Available in your choice of input frequencies from 5—350 MHz and with any output you choose within this range. The usable bandwidth is approx. 3% of the input frequency with a maximum of 4 MHz. Wider bandwidths are available on special order. Although any frequency combination is possible (including converting up) best results are obtained if you choose an output frequency not more than 1/3 nor less than 1/20 of the input frequency. Enclosed in a 4-3/8" X 3" X 1-1/4" aluminum case with BNC receptacles, power and antenna transfer switch.

Model 407 price:
5—200 MHz . . . . $42.95.
201—350 MHz. $44.95

Prices include .005% crystal. Additional crystals $5.95 ea.

WEATHERPROOFED AND D.C.POWERED THROUGH ANTENNA CABLE

Models 101 and 102 only are available enclosed in a die-cast weatherproof case for mounting at the antenna in series with the lead-in cable and includes a filter for sending 12 VDC through the cable. Can be used only for receiving unless you put a TR switch at the antenna. Available with your choice of VHF, BNC or type "N" receptacles. Especially useful for eliminating antenna line loss and thereby improving signal-to-noise ratio of weak signals such as those from weather satellites at 137 MHz.

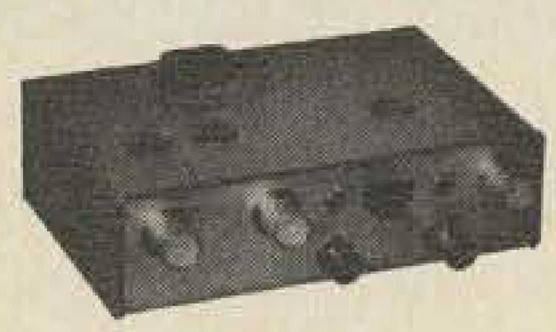
Price: Add $10.00 to pre-amps.

LESS THAN 2 dB N.F. GAIN: 20 dB @ 150 MHz. SIZE: 2½" X 5/8 X 1"

Features a super low noise J-FET rated by T.I. as typically 1.2 dB N.F. @ 150 MHz (transistor data curves supplied with unit) and guaranteed by our lab to give under 2 dB actual N.F. in our circuit. Transistor is mounted in a socket with gold plated contacts. 4 precision trimmers make possible tuning for optimum desired results over a wide range of conditions. We supply it tuned for minimum noise figure across 50 ohms input and output resistance. Fully shielded in aluminum case with feed-thru solder terminals. Supplied with mounting kit for installing inside or outside your receiver. Tuned to the frequency of your choice from 135 MHz to 250 MHz with approximately 2—4 MHz bandwidth.

Model 102 price: . . . . . .$19.95.

UHF 20 dB MIN. GAIN 3 to 5 dB MAX. N.F.



This model is similar in appearance to our Model 407 but uses 2 low noise J-FETS in our specially designed RF stage which is tuned with high-Q miniature trimmers. The mixer is a special dual-gate MOSFET made by RCA to meet our requirements. The oscillator uses 5th overtone crystals to reduce spurious responses and make possible fewer multipliers in the oscillator chain which uses 1200 MHz bipolars for maximum efficiency. Available with your choice of input frequencies from 300—475 MHz and output frequencies from 14—220 MHz. Usable bandwidth is about 1% of the input frequency but can be easily retuned to cover more. This model is now in use in many sophisticated applications such as a component of a communications link for rocket launchings.

Model 408 price: $51.95
.005% crystal included.

HOW TO ORDER:

State model, input and output frequencies and bandwidth where applicable. Remit in full, including sales tax if you reside in N.Y. State, direct to Vanguard Labs. Prices include postage by regular parcel post. For air mail or special delivery include extra amount; excess will be refunded.

Vanguard Labs

196—23 JAMAICA AVE., HOLLIS, N.Y. 11423

GENERAL CLASS LICENSE STUDY GUIDE

Questions & Answers Part II

27. Define Ohm's Law. How does it relate to resistive and reactive impedance?

Ohm's Law states that the potential across an impedance, in volts, is equal to the product of current through the impedance, in amperes, and the impedance itself, in ohms. Stated algebraically, E = IR. Ohm's Law applies to any impedance, whether resistive, reactive, or a combination of the two. When dealing with ac, however, rms values for voltage and current must be used, and when dealing with a mixture of resistive and reactive impedance, appropriate complex-number arithmetic is necessary. (General course, Part I)

28. Describe ways of equalizing the reverse voltage drops across series connected silicon diodes.

To equalize reverse dc voltages across series-connected silicon diodes, moderately high valued resistors should be connected in parallel with each diode. 470,000 ohms is a typical value. This is enough smaller than the reverse resistance of the diode itself to equalize the voltage, yet large enough not to degrade the diode action. To equalize ac voltage spikes, low-value (.001 μF) capacitors should be connected in parallel with each diode. In many cases, both the resistors and capacitors are used. (General course, part VII)

29. What is the maximum legal dc power that can be delivered to the final amplifier of an amateur transmitter? How is this power determined?

The power applied to the final stage of an amateur transmitter cannot exceed 1000W (on some bands, 50W), as measured from the voltage and current at the dc input to the final stage. If power exceeds 900W, accurate means of measurement must be provided. (General course, part VIII)

30. Define instantaneous power, average power, sideband power, audio power, and peak envelope power. How is each related to the voltage and current that produced it? How is each related to the unmodulated carrier power?

Instantaneous power is the product of instantaneous voltage and instantaneous current, all taken at the same instance. It is a fictional concept; current exists only in relation to time, so that "instantaneous current" cannot be defined. Instantaneous power is, however, a useful concept, in that it is the highest power level likely to be encountered in a circuit.

Sideband power is the difference between average envelope power and unmodulated carrier power, and is not normally determined on the basis of voltage and current.

Audio power is the audio-frequency power produced by a modulator, and is the product of rms audio voltage and rms audio current. This is very close in value to sideband power, for a high-level-modulated AM transmitter, differing only by losses introduced in the modulated amplifier.

Peak envelope power is the product of

peak envelope voltage and peak envelope current, both measured at radio frequency.

Average power of a 100% modulated AM signal is 1.5 times the unmodulated carrier power. Sideband power is half the unmodulated carrier power, as is audio power required for 100% modulation. Peak envelope power is 4 times unmodulated carrier power. Instantaneous power may be any value between 0 and peak envelope power, depending upon the instant chosen. (General course, part III)

31. What is meant by the bandwidth of a signal? Compare the maximum necessary bandwidth occupied by a CW signal, an SSB signal, a double sideband signal, and an ordinary voice signal.

The bandwidth of a signal is the measure of the amount of rf spectrum space occuped by that signal, and is the difference (in hertz) between the highest frequency component of the signal and the lowest frequency component. Assuming a band-limited modulating signal in which no component is higher than 3 kHz for all voice signals, an SSB signal will require 3 kHz bandwidth, while both double sideband and ordinary AM voice require 6 kHz. Bandwidth required by a CW signal depends upon the transmission speed in wpm. Very slow transmissions (1 wpm or so) may use as little as 1 Hz bandwidth. Normal CW requires approximately 50 Hz. High-speed CW may require as much as 250 Hz. (General course, part IX)

32. What is neutralization and how does it contribute to proper amplifier operation? What procedure should be followed to properly neutralize an rf amplifier?

Neutralization is the process of canceling out all undesired feedback from an amplifier, and contributes to proper operation by preventing regeneration and self-oscillation of the amplifier. One method of properly neutralizing an amplifier is to disconnect all plate and screen voltages, leaving grid bias and heater voltages in place, and then applying normal input signal to the circuit while monitoring the output circuit with a sensitive rf indicator. The neutralization adjustments are then moved through their range until no feed-through of energy can be detected. This is the point of correct neutralization. (General course, part VIII)

33. What are the distinguishing features between series-tuned and parallel-tuned resonant circuits? How is the resonant frequency determined? Define the "Q" of a resonant circuit.

In a series-resonant circuit, the opposite-value reactances are in series with each other, making total circuit impedance equal to only the resistive component of the tuning components. Impedance is thus low at resonance, and current is high. In a parallel-resonant circuit, the opposite-value reactances are in parallel with each other, and the current circulates within this parallel circuit, making external current low and impedance high at resonance. The resonant frequency is that at which the reactances are equal, for series tuned and high-Q parallel tuned circuits. For low-Q parallel tuned circuits, several different frequencies of "resonance" are defined and the choice depends upon the particular application. The "Q" of the circuit is the ratio of energy stored to energy released per cycle, or roughly, the ratio of reactance to resistance. (General course, part IIB)

34. How does an ac power supply produce a dc voltage? Distinguish between a choke-input and a capacitor-input filter and compare their operating characteristics. What is dynamic regulation and how can it be improved? How do the output voltages of a full-wave center-tapped and a full-wave bridge rectifier compare?

An ac power supply produces dc output by means of rectification, a valving action in diodes which permits current to flow more readily in one direction than in the other.

A choke-input filter contains inductance as its first reactive component, while a capacitor-input filter has as its first reactance capacitance. The choke-input filter provides better voltage regulation with variations in load than does the capacitor-input filter, but produces less output voltage under light load conditions. The capacitor-input filter produces higher output voltage, but puts more strain on the rectifiers and transformer of the power supply.

Dynamic regulation refers to changes in power supply output level caused by changes in load current. It can be improved by providing additional energy storage (bigger capacitors) in the power supply's output circuit, or by reducing the power supply source impedance by any other means such as electronic regulation.

For the same transformer, the full-wave bridge rectifier produces twice the dc output voltage of the full-wave centertapped rectifier circuit, because the end-to-end voltage capacity rather than the end-to-centertap capability of the transformer is used. Not all transformers will withstand the high voltage which appears at the centertap under the bridge connection, however. (General course, part VII)

35. How do resistors combine in parallel and in series to give total resistance? Capacitors? Inductors?

Resistors in series produce a total resistance equal to the sum of the individual values of each resistor in the chain. Inductors add inductance in similar fashion, if mutual coupling is excluded. Capacitors in parallel also accumulate value to the sum of the individual values.

Resistors in parallel, capacitors in series, and inductors (without mutual coupling) in parallel divide the current in such a manner as to produce a total value smaller than any individual value. The total is the reciprocal of the sum of the reciprocals of the individual values. (General course, part I)

36. How does voltage division occur across series-connected resistors? Capacitors? Inductors?

Across series-connected resistors, an applied voltage will divide proportionately to the values of the resistors, with the highest-value resistor developing the greatest voltage across it. The same is true of capacitors and of inductors, so long as the applied voltage is ac. The division in this case is proportional to the reactance of each component rather than the resistance. (General course, part I)

37. What does it mean to connect circuit elements in series? In parallel?

When circuit elements are connected in series, the same current flows through every element in the circuit. When elements are connected in parallel, current flowing through one element does not flow through any other element, but the same voltage appears across every element in the circuit. (General course, part I)

38. What is inductive reactance? Capacitive reactance? How is their value determined? How do like reactances combine in series? In parallel?

Inductive reactance is a measure of the degree by which the voltage in a circuit is retarded in phase with respect to the current. Capacitive reactance is a measure of the degree by which current is retarded relative to voltage. Inductive reactance is calculated from the formula $X_L = 2 \pi f L$, and capactive reactance from the formula $X_C = 1/(2 \pi f C)$. Like reactances combine in series and in parallel just as do resistances. (General course, part II)

39. Describe the transmission characteristics of the amateur bands below 30 Mc/s (MHz). List several propagation factors that influence signal transmission and reception in these bands.

Noise, both natural and manmade, and ionospheric conditions, which depend upon many factors, both strongly influence transmission and reception in all bands below 30 MHz.

1.8 MHz: Only groundwave useful during day. Range at night limited to only a few thousand miles, and that only when band is at its best. Noise usually high both day and night.

3.5 MHz: Noise high both day and night, especially in summer. Ground wave and very short range skip (200 miles or so) useful during day. At night may reach worldwide range but usually limited to one hemisphere.

7.0 MHz: Noise not so severe as on lower bands. Similar to 3.5 MHz during day but with somewhat greater range. At night, worldwide coverage possible and good coverage of hemisphere usual.

14 MHz: Very little noise except during

solar storms. Long range both day and night. Coast-to-coast skip during day, worldwide at night as usual matter.

21 MHz: Like 14 MHz, but band not usually open during sunspot minima. At its best, worldwide coverage during daylight.

28 MHz: Worldwide coverage for 2 years out of 12, useful primarily for local work rest of time. MUF usually too low for this band, but worldwide daytime DX possible when conditions are at their best.

(General course, part XII)

40. List the basic stages of a conventional superheterodyne receiver and tell what function each stage performs.

The rf amplifier stage isolates the mixer stage from the antenna, reducing unwanted radiation. The mixer stage converts the incoming signal to the fixed intermediate frequency. The first (or local) oscillator provides a signal to the mixer which selects the desired incoming signal. The i-f amplifier stage amplifies the signal, and provides selectivity. The second detector converts the signal from intermediate frequency to audio frequency, using the output of the beat frequency oscillator if necessary (for CW and SSB reception). The audio stages then amplify the detected signal to the desired amplitude to drive headphones or a speaker. (General course, part X)

41. How is the approximate length of a half-wave dipole related to its resonant frequency? Compare the operating characteristics of a half-wave dipole and a grounded antenna.

The length of a half-wave dipole antenna is approximately equal to 468/(resonant frequency in MHz) feet.

The half-wave dipole is electrically balanced; the grounded antenna is not. Feed impedance of a half-wave dipole in free space is 73Ω; that of a grounded antenna is approximately 35Ω. The half-wave dipole has a directional pattern, with nulls off the ends of the wire; the grounded antenna is omnidirectional. The half-wave dipole produces high-angle radiation; the grounded antenna's radiation is concentrated at low vertical angles. In general, the half-wave dipole provides better short and moderate range coverage, while the grounded antenna provides greater range for DX. (General course, part XI)

42. What do high- and low-pass constant-k filter circuits using balanced and unbalanced π-and T-sections look like?

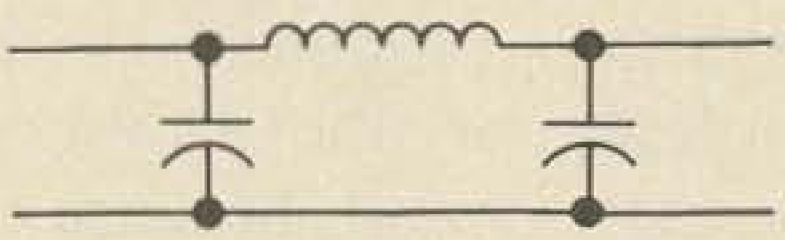


Fig. 1. Constant-K unbalanced π-section low-pass filter.

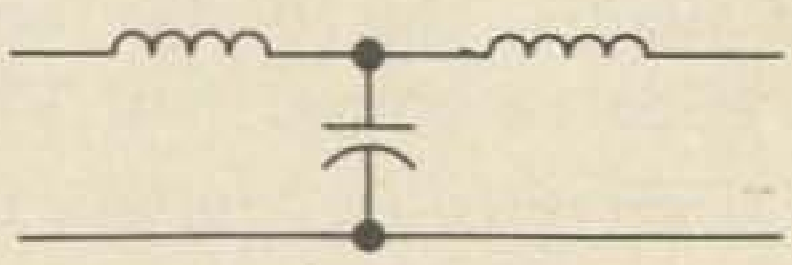


Fig. 2. Constant-K unbalanced T-section low-pass filter.

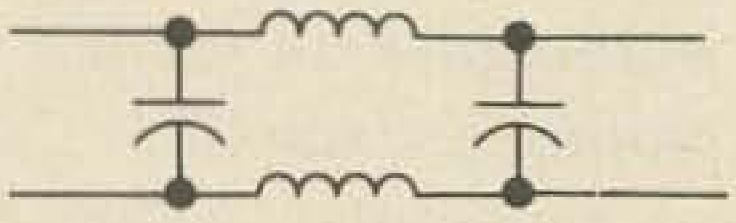


Fig. 3. Constant-K balanced π-section low-pass filter.

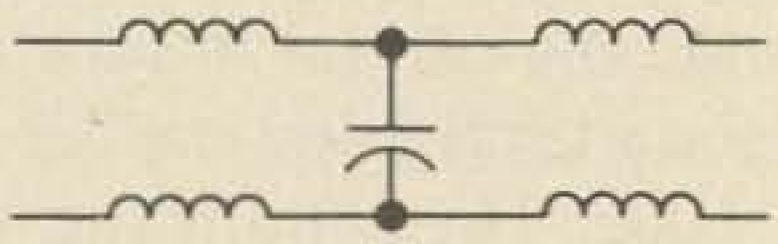


Fig. 4. Constant-K balanced T-section low-pass filter.

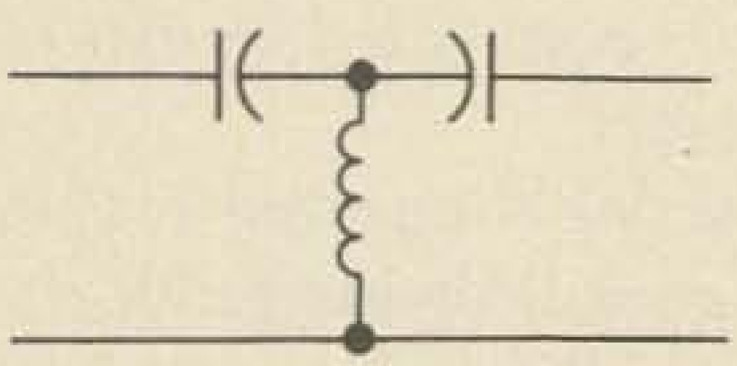


Fig. 5. Constant-K unbalanced T-section high-pass filter.

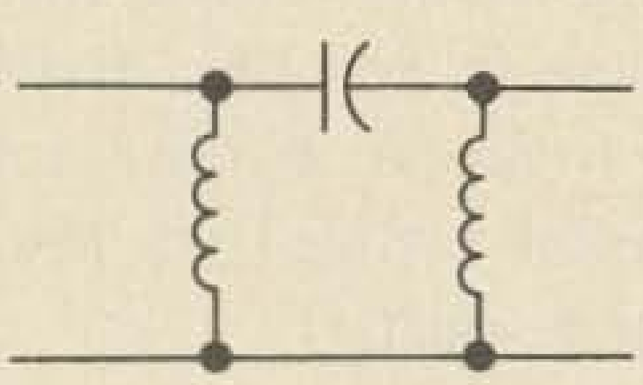


Fig. 6. Constant-K unbalanced π-section high-pass filter.

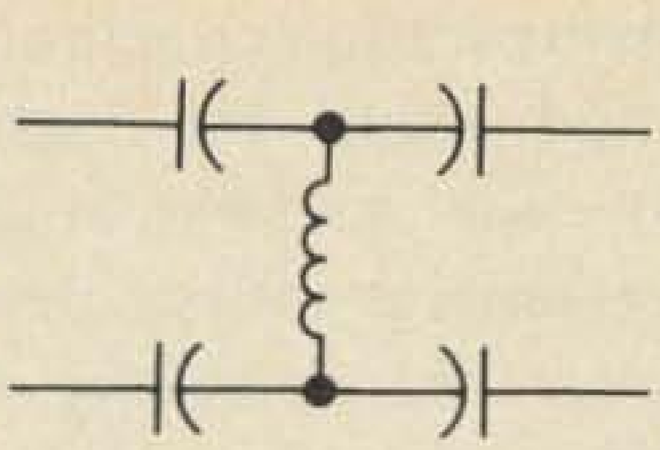


Fig. 7. Constant-K balanced T-section high-pass filter.

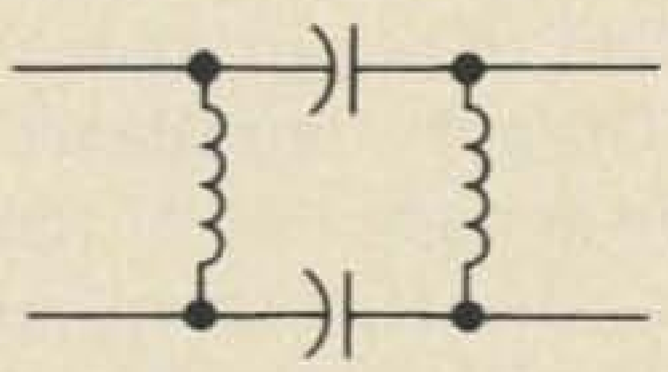


Fig. 8. Constant-K balanced π-section high-pass filter.

43. How can amateur equipment be protected from lightning discharge?

By means of a grounding switch. (General course, part XI)

44. What are the basic stages of a single sideband (SSB) receiver and transmitter and what purpose does each serve?

Basic stages of an SSB receiver are the first mixer, first oscillator, if strip, second mixer, second oscillator, and audio sections. The first mixer converts the incoming SSB signal to an SSB signal at intermediate frequency, by means of the output of the first oscillator. The i-f strip amplifies this signal, and provides the necessary selectivity. The second mixer (sometimes called a product detector) uses the output of the second oscillator to demodulate the SSB signal into audio, which is then amplified by the audio section.

Basic stages of an SSB transmitter are the SSB generator, the frequency determining circuits, and linear amplifiers. Within the SSB generator are included audio circuits and mixers, to generate an SSB signal at fixed frequency. This fixed frequency SSB signal is then mixed with a variable frequency signal to produce the final output signal, which is then amplified by linear amplifiers.

The transmitter and receiver are almost exact inverses of each other, which has led to the development of transceivers which share common stages between transmitter and receiver functions. (General course, part X)

45. List the three main classes of amplifier operation and explain the use for which each class is best suited.

The three main classes are A, B, and C. Class A amplifiers are best suited when low distortion is required, as for receivers and hi-fi amplifiers. Class B amplifiers provide higher efficiency and are best suited for use in portable and mobile equipment where long battery life is essential. Class C amplifiers are best suited for high-power rf amplifier application where their distortion can be tolerated. (General course, part VI)

46. What are "images" in a receiver?

Images are spurious responses in a superheterodyne receiver caused by the presence of an unwanted signal on the "wrong side" of the local-oscillator signal. If the receiver is designed to make use of the "input-minus-local-oscillator" difference frequency as its i-f, the "local-oscillator-minus-input" difference frequency is an "image." (General course, part X)

47. What is meant by "flat-topping" of a single sideband signal and what are some possible causes of it?

Flat-topping is a form of distortion in which the output signal's peaks are flattened rather than being reproduced accurately. It may be caused by excessive level of input signal, or by incorrect bias or loading in the amplifier stage. (General course, part VI)

48. What does grid current flow in a class A amplifier indicate?

In most class A amplifiers, grid current flow indicates incorrect operating conditions. The usual cause is severe overdriving of the input. It may also be caused by a failure of grid bias voltage. (General course, part VI)

49. Briefly discuss how a multiband "trap" antenna operates.

A multiband trap antenna includes parallel-resonant tuned circuits at critically spaced points in an otherwise normal half-wave dipole. At the frequency at which the trap circuit is resonant, the tuned circuits act as insulators and disconnect the ends of the antenna, so that the inner portion of the antenna acts as a half-wave dipole at this frequency. At lower frequencies, the net reactance of the trap circuits is inductive, and so the traps act as loading coils to electrically lengthen the wire. The full length of the wire (as electrically lengthened) then acts as a half-wave dipole at the lower frequency. By adding additional pairs of trap circuits, and by proper adjustment, the antenna can be made to cover all amateur HF bands. (General course, part XI)

50. How can the power input to the final amplifier of an SSB transmitter be determined?

The power input to the final stage of an SSB transmitter is determined by measuring plate voltage and plate current with dc meters having a time constant of at least ¼ second, and using the highest values indicated by the meters under normal modulation. (General course, part VIII)

51. Compare the operating features of the grounded grid and grounded cathode amplifiers.

Input of the grounded grid circuit is low impedance; that of the grounded cathode is moderate. Output impedance of the grounded grid is high; that of the grounded cathode is moderate. Current gain of the grounded grid is less than 1; that of the grounded cathode is moderate. The grounded cathode circuit reverses phase between input and output; the grounded grid does not. (General course, part V)

52. How is the bandwidth of an FM signal related to the bandwidth of the modulating audio signal?

The bandwidth of an FM signal is related to the bandwidth of the modulating audio signal in a complex manner which depends upon the modulation index. At low values of modulation index, when only the first pair of sidebands is significant, the FM signal's bandwidth (like that of an AM signal) is twice that of the modulating signal. As the modulation index increases, the bandwidth increases also. At a modulation index of 5 (used in commercial FM broadcasting), the bandwidth is 10 times that of the modulating signal. (General course, part IX)

This concludes the study list questions for the General class license. These questions also apply to the Technician and Conditional class license examinations, which embody the same technical content as the General class.

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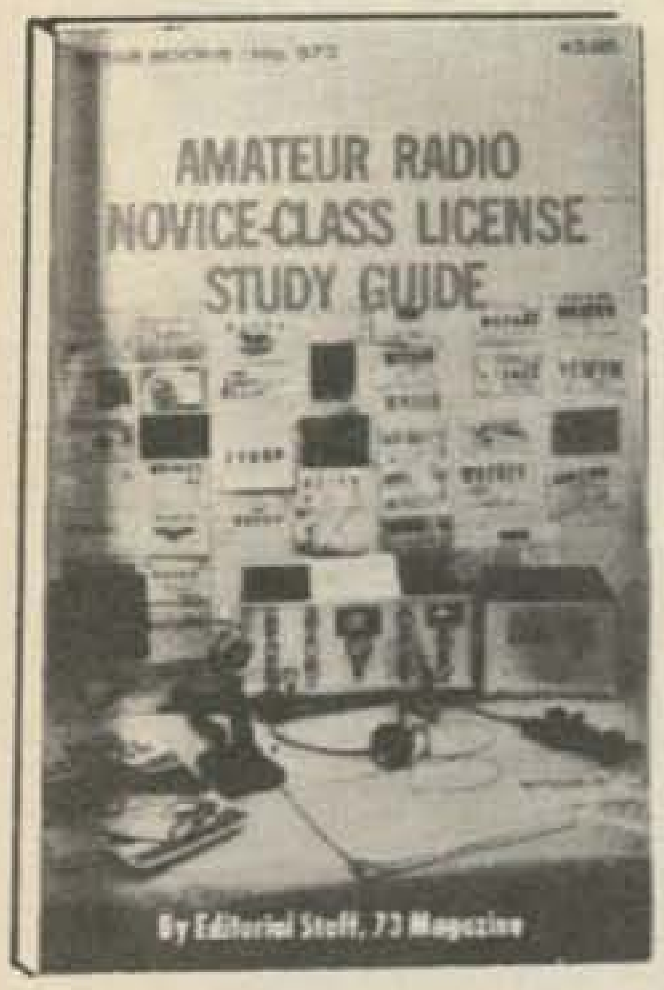

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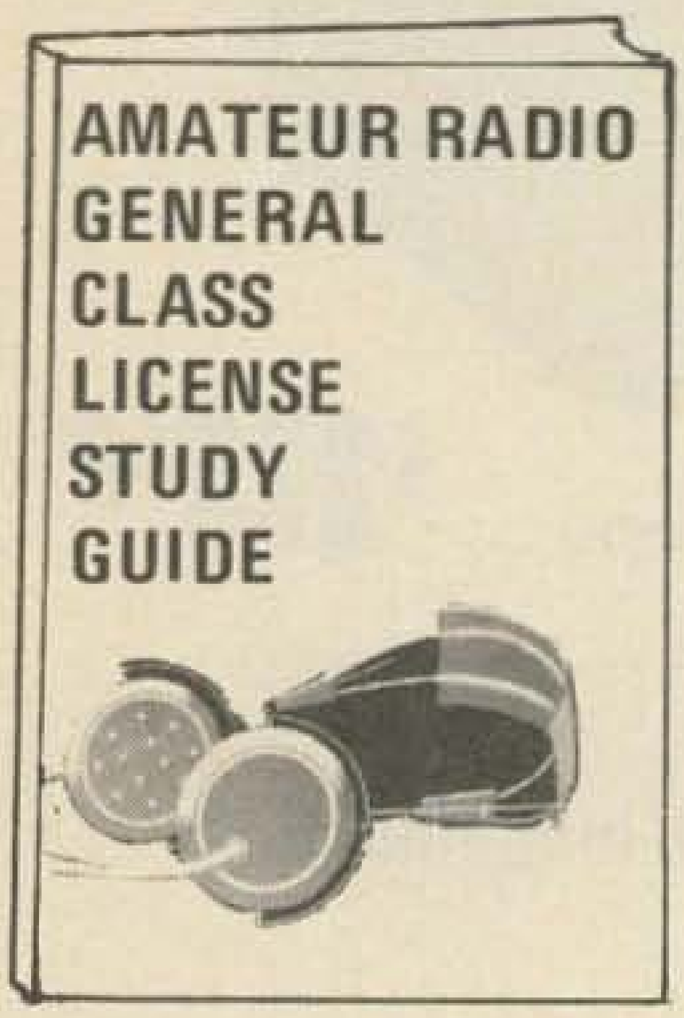

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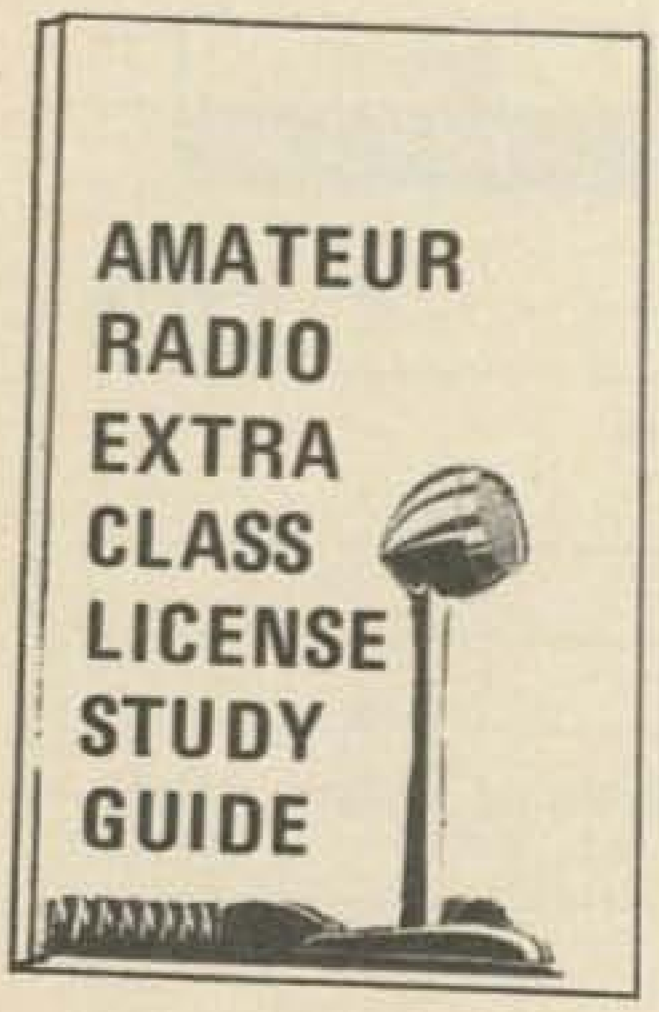

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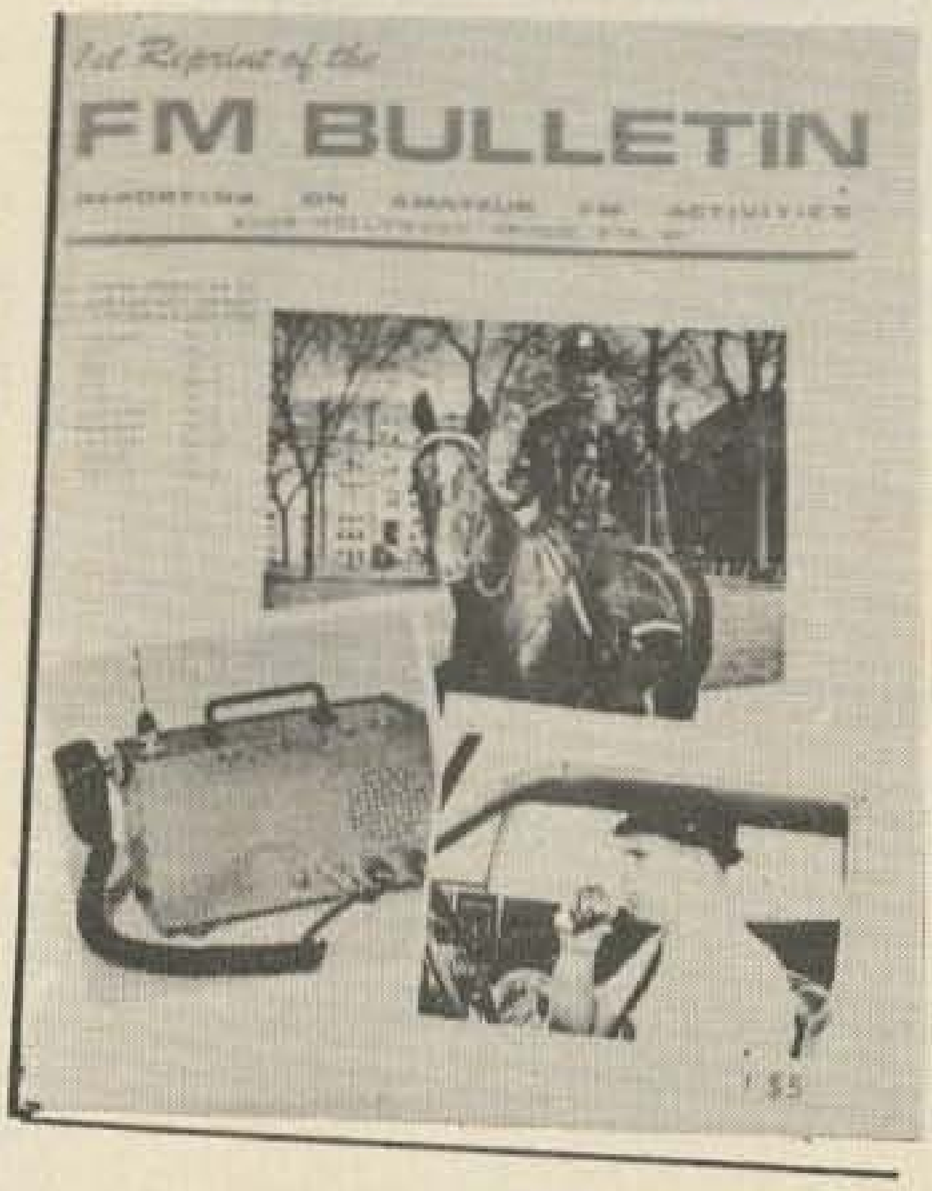

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H Transistor Projects for the Amateur is crammed with over 40 interesting construction projects covering receivers, converters and transmitters, many in the VHF region. If you like to build you will blow your mind over this book.

TECHNICAL AID GROUP

The Technical Aid Group is a group of hams who have indicated a willingness to share their knowledge and skills with others. They have volunteered to be of service to fellow hams and do so without compensation. If you have a technical question, look over the list to see who has competency in the area of your question. For many of the TAG members, descriptions of all areas of expertise would be lengthy, so an abbreviated description is given. When stating your problem, give as much information as possible and clearly state the difficulty. Enclose a SASE for reply.

For those hams who have a desire to share, the TAG is the thing for you. Send a brief note requesting the membership form, fill it in and send it back. It asks a few questions about your qualifications, and there is a check-list to indicate your fields of competence. These cover all modes currently used by hams, antenna design and theory, transmitter and receiver design for HF, VHF, and UHF, logic, ICs, general help, and other areas. As more members are added, their names and addresses will be published.

This list is not complete, but represents those former TAG members who have responded to a recent mailing and have expressed a desire to continue in the program. Comments from them indicate that they have enjoyed helping and all have been contacted frequently for advice.

Robert Perlman WB2VRW, 3 Josten Place, Hudson NY 12534. Electrical engineering student. Will help with Novice transmitters and receivers, and any help for beginning hams.

Thomas Laffin W1FJE, Box 133, Hillsboro NH 03244. Radio communications technician. Special aid to ex-CBers and those who need terms in easily understood terms; aid to Novices and Techs interested in MARS, RACES, CD, and CAP; how to build and scrounge parts; assistance on ham history, ATV, microwave, and general help.

Theodore Cohen W4UMF, 8603 Conover Pl., Alexandria VA 22308. Geophysicist. Specially prepared to answer questions about SSTV and ATV.

J. Bradley Flippin K6HPR, 116 Montecito Ave., Apt. M., Monterey CA 93940. Electronic engineer. Help with RTTY, data processing and programming, general.

Ira Kavaler WA2ZIR, P.O. Box 54, Flatbush Sta., Brooklyn NY 11226. Electrical engineer. Assistance offered in theoretical aspects of electricity and electronics from dc to UHF, design of equipment, computer programming, and signal circuit (failsafe) design.

Jon Teich WB2JAE, 22 Olden Rd., Edison NJ 08817. High school student. Novice and others, transmitter and receiver problems, logic, and general.

David Felt WB6ALF, P.O. Box 261, Sierra Madre CA 91024. Electronics engineer. Qualified help in logic, digital and analog design, solid state, AM and TV.

Robert Groh WA2CKY, 65 Roxborough Rd., Rochester NY 14619. Communications engineer. Bob can lend a hand in HF and VHF transmitter and receiver design as well as solid-state logic and digital techniques.

Carl Miller WA6ZHT, 334 Paragon Ave., Stockton CA 95207. Computer technician. Carl's specialty area is solid-state QRP.

George Daughters WB6AIG, 1560 Klamath Dr., Sunnyvale CA 94087. Research associate. HF transmitter and receiver, SSB, and solid state, are George's fields.

D. Hausman VE3BUE, 267 Northcrest Pl., Waterloo, Ontario, Canada. Student. Novice transmitter and receiver problems as well as logic, digital techniques and ICs.

Hugh Wells W6WTU, 1411 18th St., Manhattan Beach CA 90226. Electronics instructor. Hugh can help with AM, Novice problems, VHF-UHF receivers and converters, solid state, test equipment, FM and repeaters, and general help.

Charles Hill WA7LQO, 4005 Campbell St., Baker OR 97814. Student. TV, Novice transmitter problems, and logic.

John Perhay WAØDGW, Route 4, Owatonna MN 55060. EE technician. John will help with RTTY, AM, SSB, Novice gear, HF transmitters and receivers, solid state, ICs, and test equipment.

Jim Jindrick WA9QYC, 801 Florence Ave., Racine WI 53402. Consulting engineer. General help as well as HF, VHF, and UHF antennas, transmitters, and receivers.

William Welsh W6DDB, 2814 Empire Ave., Burbank CA 91504. Electronic engineer. Beginner's problems, code instruction, theory and regulations.

Ken Knecht K8VNT, Box 39, Clintondale NY 12515. Television engineer. TV, logic, and digital techniques.

Tom O'Hara W6ORG, 10253 E. Nadine St., Temple City CA 91780. Communications engineer. RTTY, TV, AM, SSB, VHF antennas, transmitters and receivers for HF through UHF, solid state, and general help.

Bruce Creighton WA5JVL, 2517 Metairie Ct., Metairie LA 70002. Electrical engineer. Antennas, Novice problems, solid state, logic, digital techniques, test equipment, and general help.

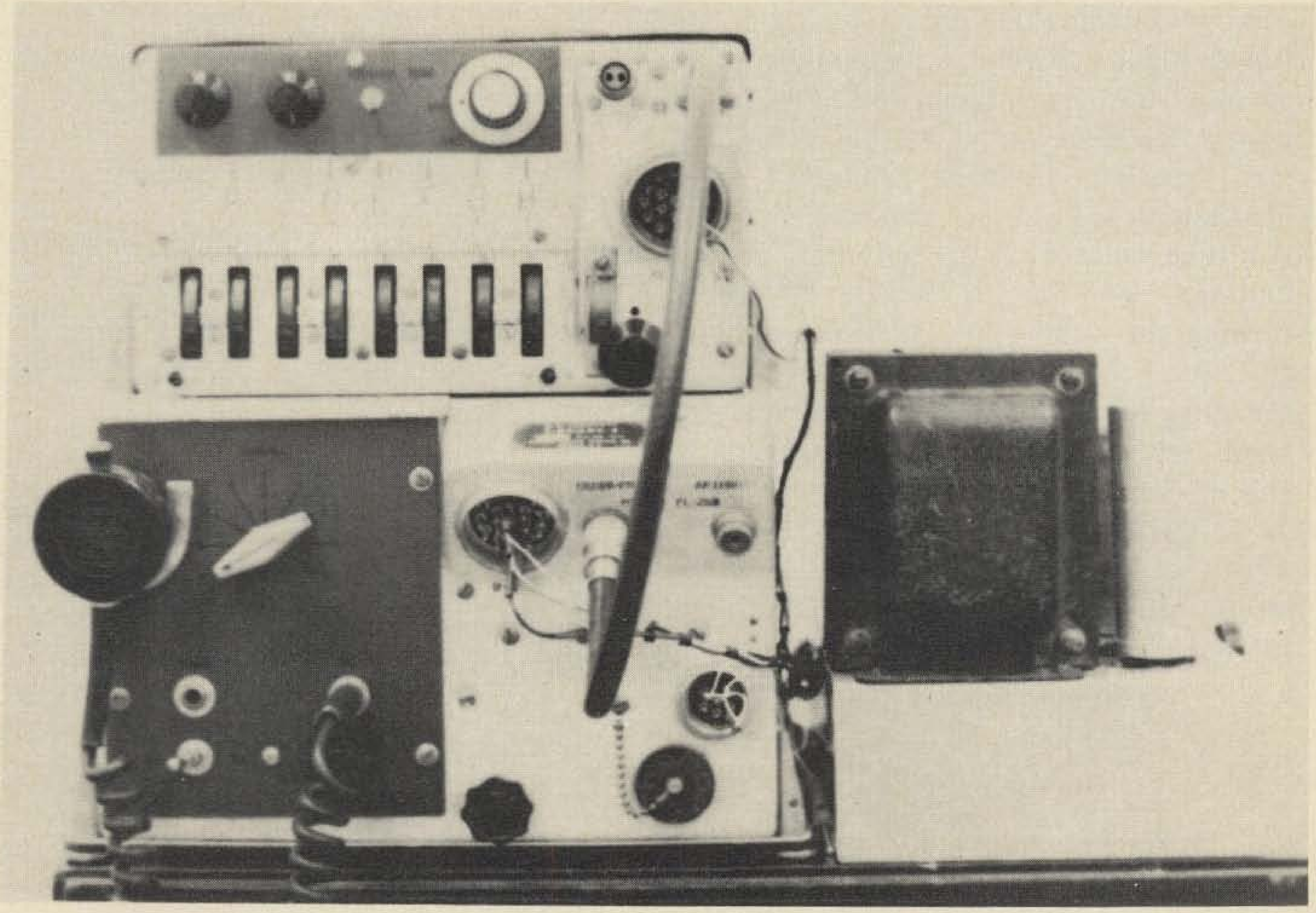
Tom Borok WB2PFY 215-33 23 Rd., Bayside NY 11360. Student. Tom is especially qualified to help Novices with their problems with transmitters and receivers, HF and VHF antennas, HF receivers, test equipment, and surplus, Morse code instruction.

Roger Taylor K9ALD, 2811 William St., Champaign IL 61820. Engineer. Roger is adept with AM, SSB, antennas, solid state, logic and digital techniques, ICs, test equipment, and other general help.

Orris Grefsheim WA6UYD, 1427 W. Park St., Lodi CA 95240. TV technician. Orris is capable of assisting in all fields of amateur work, DC through UHF, logic as well as Novice help.

John Allen K1FWF, 112 Edgemoor Lane, Ithaca NY 14850. Technical director. John's areas of assistance are VHF and UHF antennas, receivers, and transmitters, solid state and digital techniques, ICs, and SSB.

Putting The ARC-3 On Two



Neale C. Hightower WA4NAI/4
160 Fourth Street NW
Atlanta GA 30313

For the amateur who wants a step up from the lunchbox class of 2 meter equipment (no slurs intended) the AN/ARC-3 offers an excellent low-cost opportunity. A moderately stocked junkbox and a little scrounging can put the units on the air for an additional $10–15 cash outlay.

The ARC-3 system consists of five basic units: receiver, transmitter, control box, antenna, and dynamotor assembly. Only the transmitter and receiver are used in this conversion. Mating plugs are a matter of preference and cost. For fixed work a scheme is presented to avoid the need for these plugs. For a mobile installation, it is probably advisable to purchase these units if they are available. A good schematic is essential for this work, as is the case with most conversions. If one is not available from the supplier of the units, Bill Slep Co.[1] will supply separate schematics of the units. The price is $1 each.

Very few amateurs have the same needs or desires in equipment. Thus this conversion is presented as a number of "subconversions." Almost all are independent of each other. One can tailor the conversions to suit his particular application by installing the features most useful to him.

Before starting the conversion, it is a good idea to have a rough idea of how the system works. Figure 1 shows a block diagram of the receiver system. The layout is conventional except for the automatic tuning mechanism and the harmonic generators. All frequencies (100–156 MHz) are tuned in 7 bands using 8.0 to 8.5 MHz crystals on their 11th to 18th harmonics. The harmonic generator chain is fairly narrowbanded; therefore, when it is detuned slightly from its center (the stages are not tuned to integral multiples of the crystal frequency), the output drops rapidly. Once a new channel is selected, relays change the appropriate crystal and a control tube senses that the harmonic chain is detuned. The tuning motor is started, turning the tuning mechanism. Normally, the tube would cause the motor to tune to the next harmonic and shut off when the chain output equaled the 14V reference. But if the previous channel was on the 12th harmonic and a frequency using the 17th harmonic was desired, the system would stop at the next harmonic (13th) instead. To prevent this the coding wheels

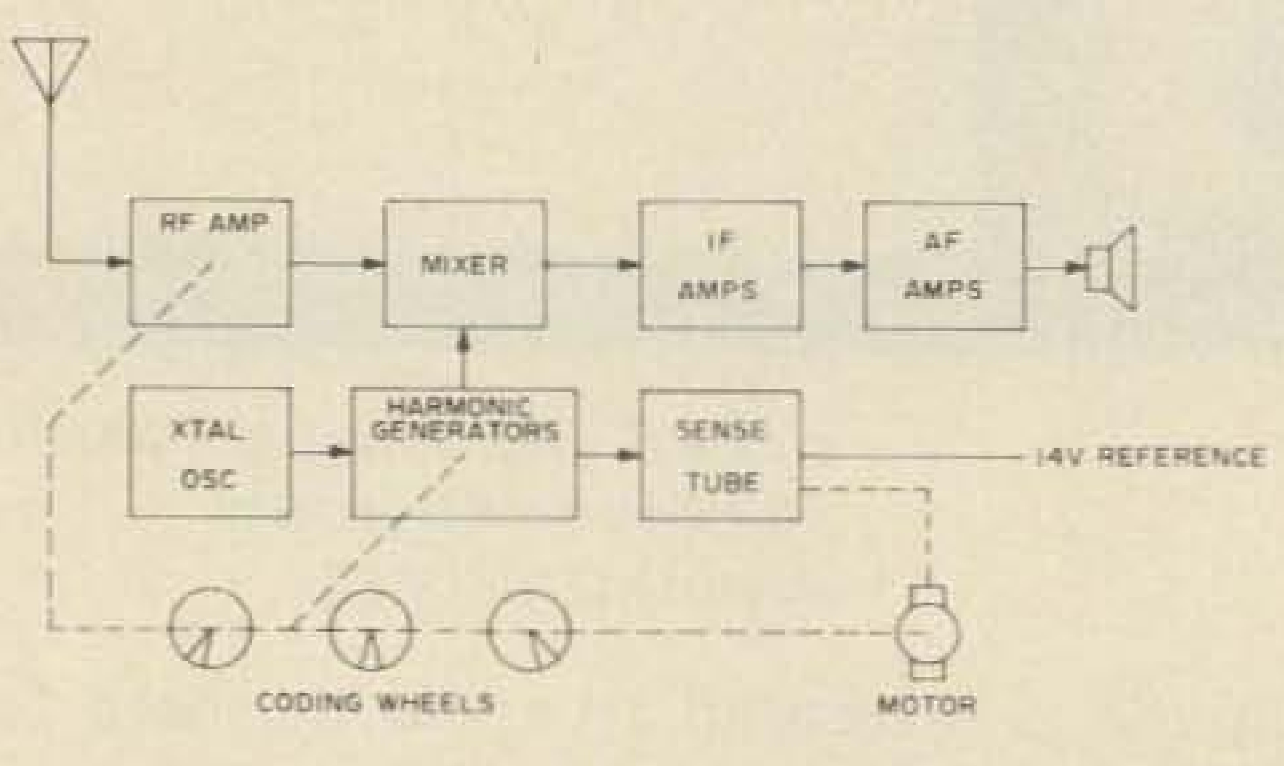


Fig. 1. Block diagram of receiver system.

are added. They select the proper harmonic and "kill" the harmonic chain output until the tuning mechanism is in the proper range. Then the output of the harmonic generators is applied to the sense tube for exact tuning.

The transmitter block diagram is shown in Fig. 2. Since it uses crystals from 5.5 to 8.6 MHz, all on the 18th harmonic, it is

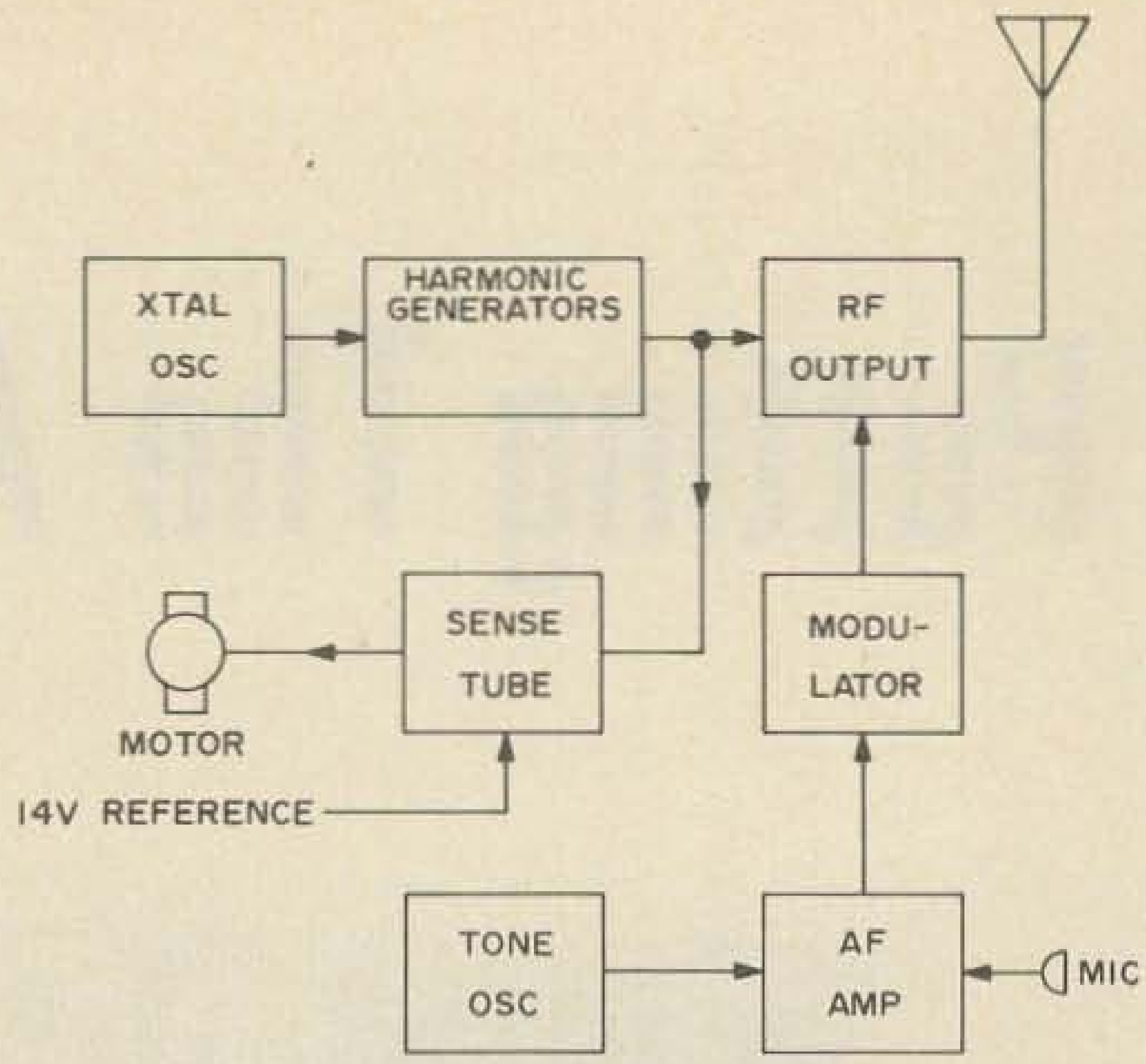


Fig. 2. Block diagram of transmitter.

only necessary to determine when the multiplier and output stages are in tune. The tuning mechanism is basically the same as that of the receiver except that the coding wheels are not employed.

Converting the Receiver

Unless it is to be used in some configuration very similar to the original, the following changes are recommended for the receiver:

1. Rewire the filament string for 12V
2. Provide an external B+ supply
3. Add an external audio gain control
4. Add external speaker (or headphones)

Two other features may be added:

5. Manual (continuous tuning)
6. Rf gain control

Filament String Conversion

The 24V filament lines may be converted for us on 12V (ac or dc) by the following procedure:

Identify R-201 (252Ω). It shunts the filament of V201; one side is connected in five leads, two on one post, three on another. The posts are jumpered together. Remove the jumper and all five wires. One wire goes back to V201. Reconnect it to the R201 post and add a jumper from this post to ground. Another wire goes to V205 through C206, the center feedthrough capacitor beside the tube. Identify this lead with an ohmmeter and attach it to the R201 post. Attach the other three wires to

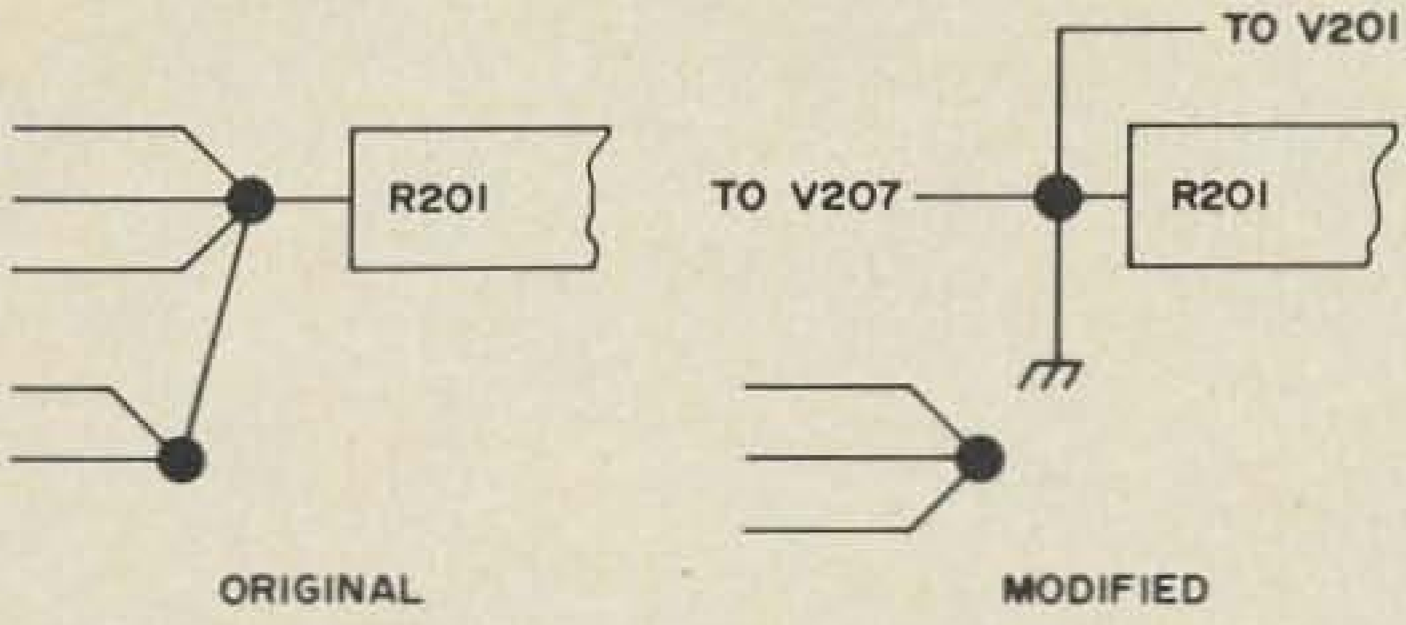


Fig. 3. Detail of 12V filament conversion.

the now empty "other" post. This change is described in Fig. 3. Identify the three posts on the rear of the brake, K202, which is located near the motor gearbox assembly. Two white wires are connected to the centerpost. One goes to pin 8 of V216. Connect this wire to some nearby groundpost. Replace the other wire Now run a new wire (20 AWG or larger) as indicated in Table I.

Table I. ARC-3 Wire Routing

From	Pin	To	Pin
V216	7	V215	8
V215	8	R291	7
R291	7	V212	7
R291	7	V207	7*
V207	7	V203	3
V216	7	V209	4**

*If the filaments are to run on ac, disconnect R225 from pin 7.

** This is best done at a post near V209 to which R202 is connected.

Remove the lead from pin 2 of V207 and connect it to pin 7. Ground pin 2. If dc filaments are to be used, the conversion is now complete. The filament supply is now pin 12 of P202. Remove R291.

For ac operation (and utilization of the automatic tuning) a small dc supply must

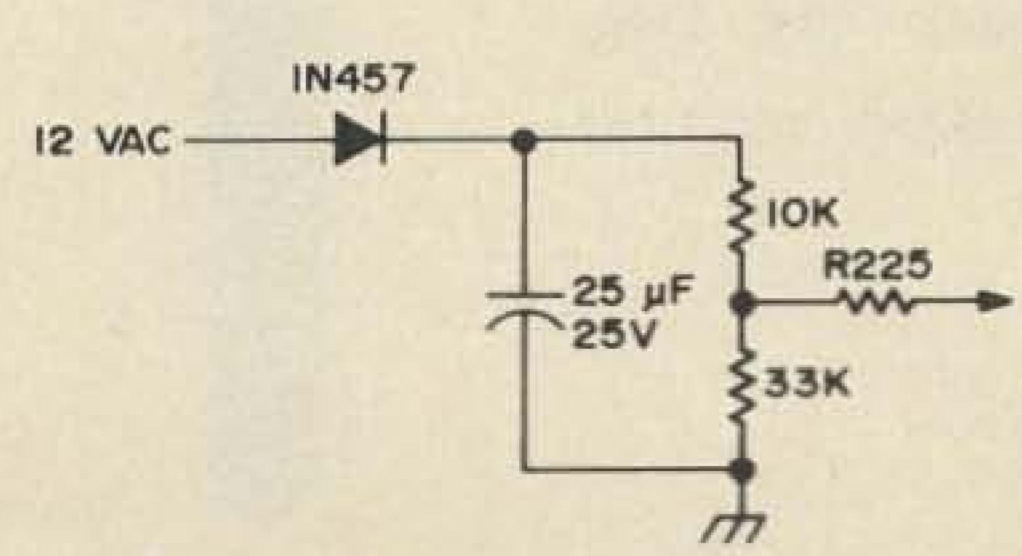


Fig. 4. Power supply for autotune operation.

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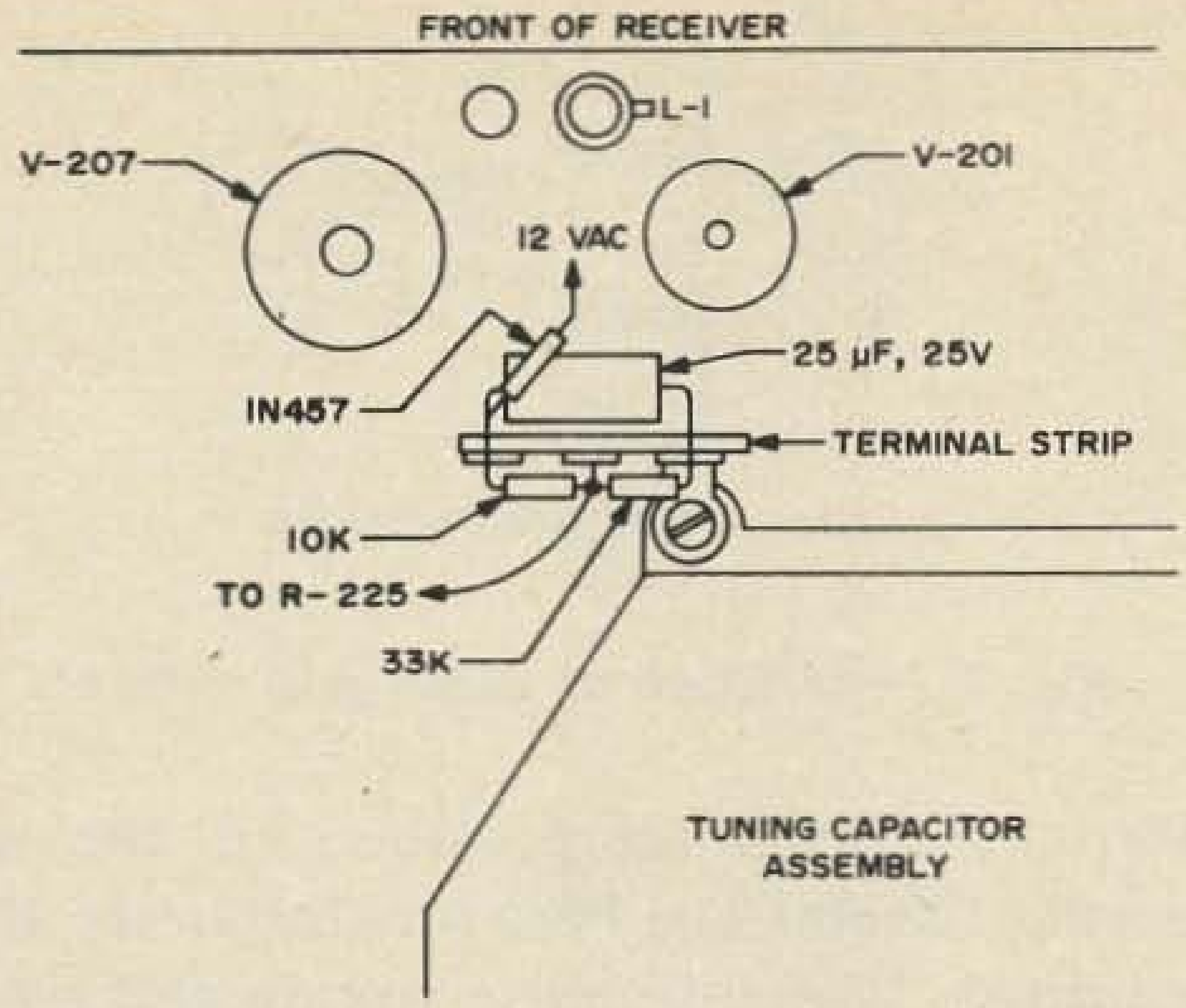

Fig. 5. Detail of autotune power supply mounting.

be added to produce the 14V reference. (If the filaments are ac powered and the autotune is unused, remove R225.) This reference voltage was originally derived from the center of the filament supply for V207 and V210. A peak rectifier and voltage divider may be added as shown in Fig. 4. The diode can be almost any type. The supply is mounted on a 3-terminal strip between V201 and V207 (Fig. 5). The ground lug is mounted under one of the bolts securing the tuner assembly to the chassis.

External B+ Supply

The supply shown in Fig. 6 is for both the transmitter and receiver. For those contemplating a mobile supply, the data in Table II should be helpful.

Table II. ARC-3 Voltage Requirements

Function	Power
Filament	12V, 7.5A
Receiver B+	225V, 100 mA
Transmitter B+	410V, 325 mA
Relays	28V, 500 mA

Table II. ARC-3 Voltage Requirements

To power the tuning motors, it is necessary to have a supply capable of delivering about 6A at 28V. Any less capacity will cause the autotune mechanism to malfunction. Thus automatic tuning for fixed (ac) work is not recommended.

The power transformer used was scrapped from an old (very old) television. It has a centertapped 12V winding to handle the necessary current. An exact replacement is not known, but only transformers from "monster" TVs will work. Instead, for most work it would probably be better to use two transformers. The inductors were removed from old TVs. As can be seen, the parts used are mostly junk, so feel free to substitute.

Connection to the receiver and transmitter was effected by removing the pin connectors from an octal socket. The older "wraparound" type were employed. If these are not available, most hobby shops carry small brass tubing which could be used.

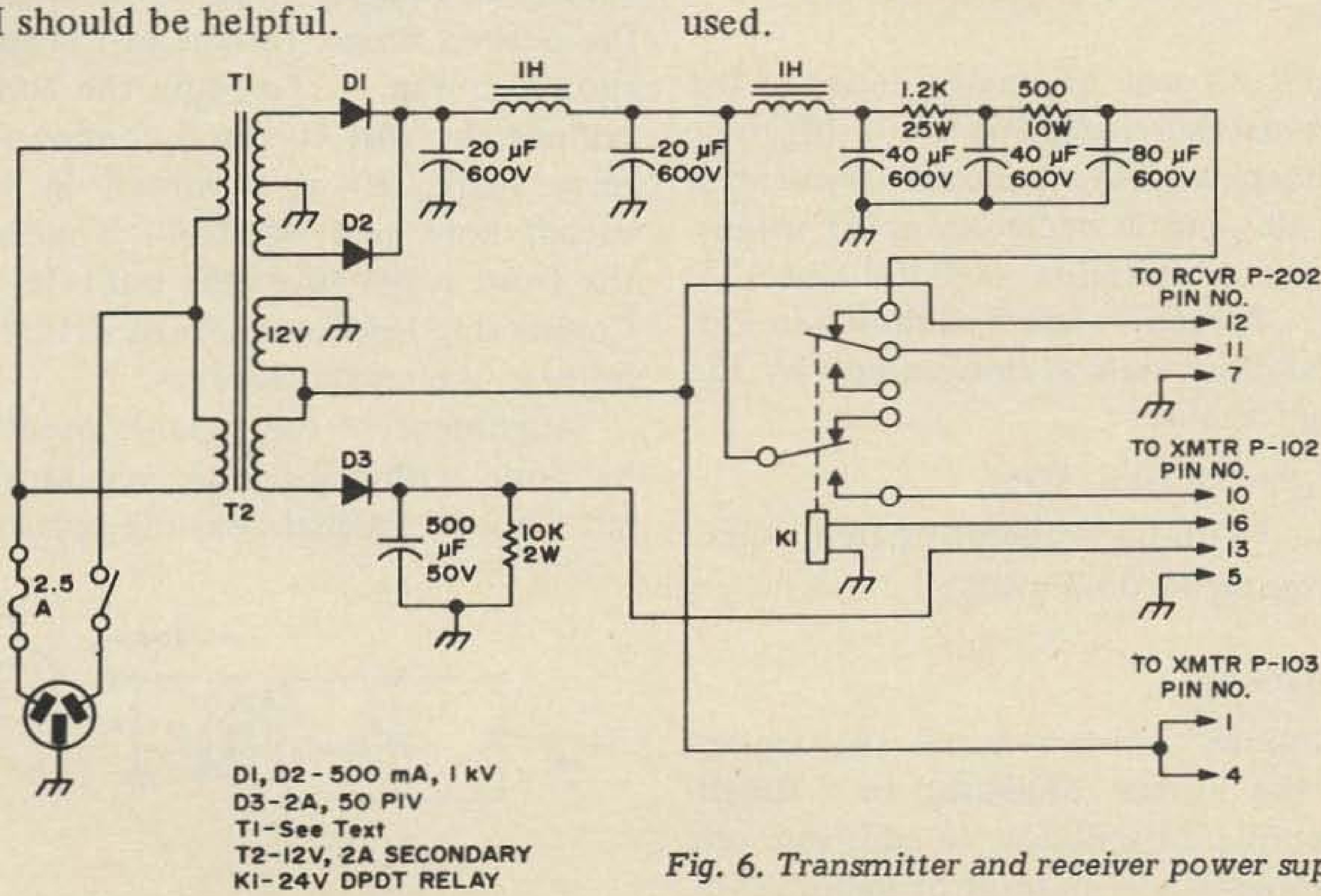

Fig. 6. Transmitter and receiver power supply.

The power supply used at WA4NAI was adapted from use on another project. A supply using a different layout would be more practical and esthetically pleasing.

Audio Gain Control

Disconnect C294 from pin 1 of V216. Remove R280, C296, R289, and R290 from the other side of C294. The last three components are mounted on the rear of the chassis on a point-to-point board. Remove R281 and R284. Add the audio gain control as shown in Fig. 7. One of the points cleared by the removal of C294 may be used as a tie point. If the leads are to be extended beyond the chassis, it would be wise to shield them. Moving one side of C294 significantly increases the gain of the stage.

External Speaker

Two output impedances are available for a speaker at pins 16 and 17 of P202. Pin 16 is 50Ω and pin 17 is 600Ω. The 600Ω output could be used directly with headphones. A 600Ω line-to-voice-coil transformer may be installed to match a 4 or 8Ω speaker. One might also use a 45Ω speaker directly across the 50Ω output. Those wishing to replace the output transformer can use the Stancor A-3879. If the 12A6 tube is defective or missing, it can be replaced with the more common 12V6.

Tuning

The ARC-3 was originally designed for crystal-controlled reception on 8 different preset channels. If channelized operation is desired, all that is necessary is to supply 28V to the A+ terminal of P202 and 12V to pin 12. Attach a switch as shown in Fig. 8 and install crystals as determined by the following formula:

Where: F_C = xtal freq, MHz.

$F_C = (F_O - 12)/n$ F_O = operating freq, MHz.

n = harmonic $(8.0 \leqslant F_C \leqslant 8.5)$

Manual Tuning

Continuous tuning requires the conversion of the crystal oscillator to a tuned-grid-tuned-plate oscillator. In addition, one must arrange some method of keeping the rf and multiplier stages in tune. Several different schemes are possible, but the one presented seems the best for simplicity and versatility. The automatic tuning and relay logic are simply left unused by a combination of electrical and mechanical methods.

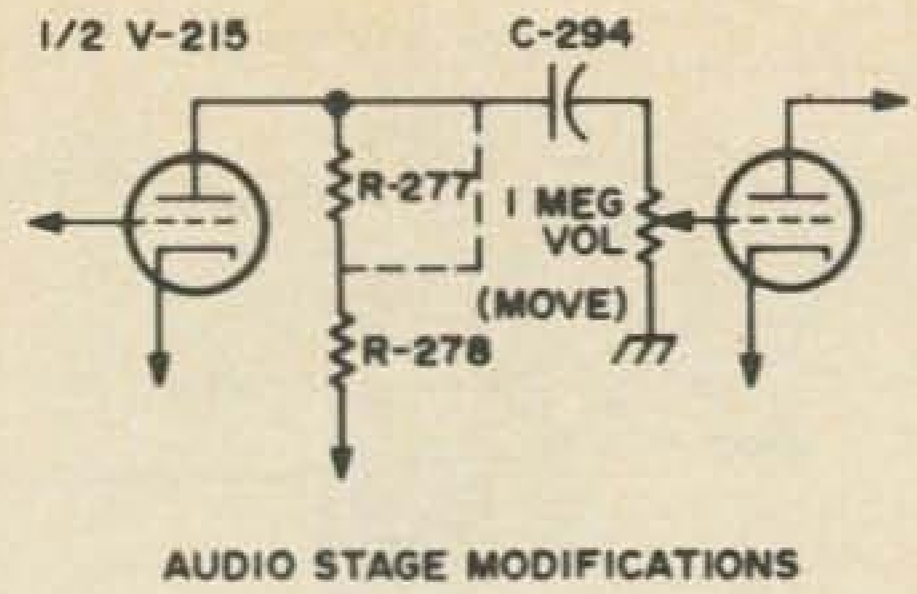

Fig. 7. Installation of audio gain control.

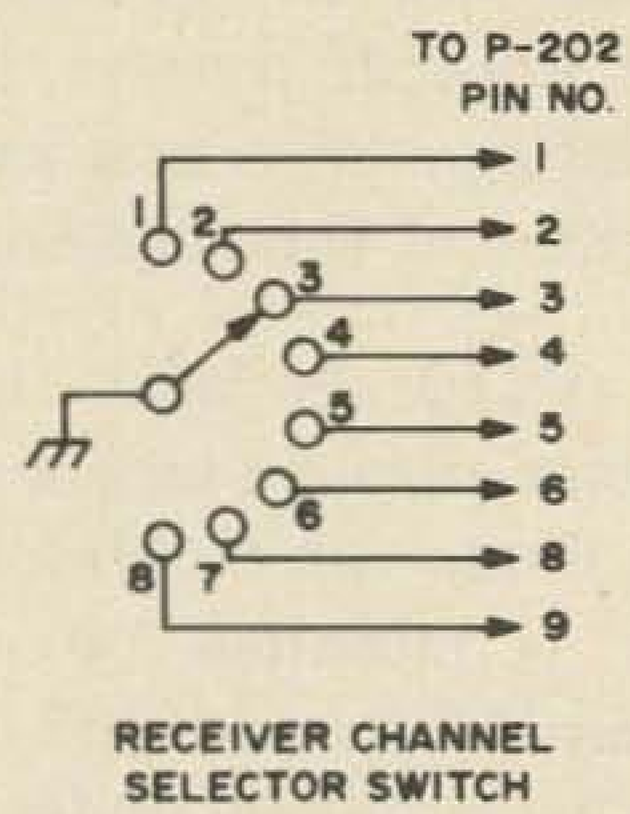

Fig. 8. Hookup for channelized reception.

Oscillator Conversion

Conversion of the oscillator involves replacing the crystal with an LC circuit tuned to roughly 8 MHz, adjustable over the desired range. Details of the circuit are shown in Fig. 9. To begin the conversion, remove the wire to pin 6 coming from the relay bank. L1 is mounted in the now vacant hole near V201. C1 is mounted on the front panel (over the old relay cavity). Connecting leads are threaded through the holes in the crystal sockets.

Alignment of the tunable oscillator can be done with reasonable accuracy on the air. Choose a signal near the bottom of the

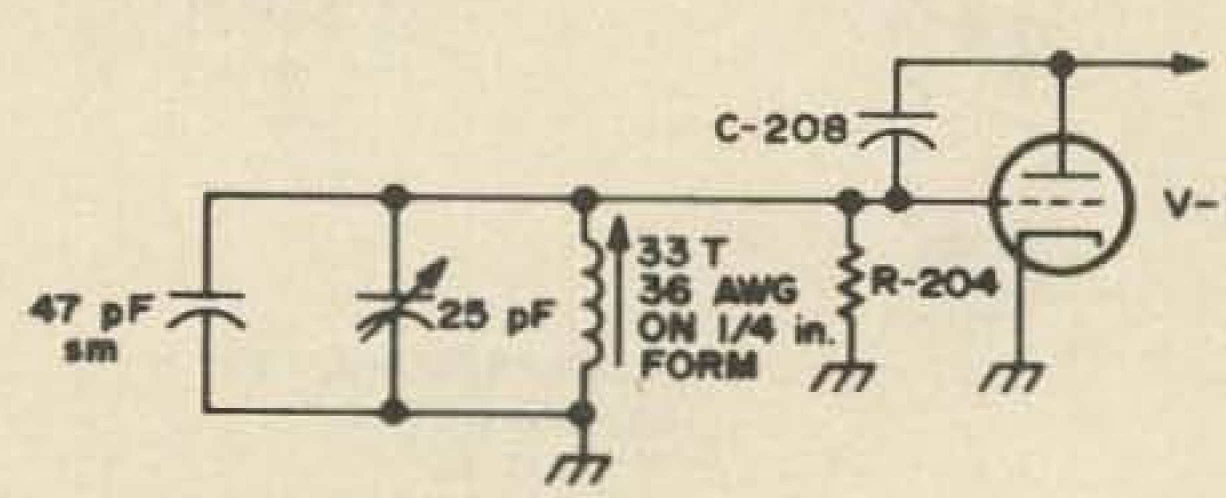

Fig. 9. Conversion of crystal oscillator to VFO.

band of known frequency and set the tuning capacitor to about 90% meshed. Now tune in the signal with the slug of L1 (it may be necessary to add or remove one or two turns). Three signals spotted across the band should give a reasonably accurate dial scale. Of course, a better job can be done with a signal generator.

In a mobile installation, it might be desirable to tune the oscillator remotely with a varactor. A suggested hookup is shown in Fig. 10.

Continuous Tuning

For fixed station use, a shaft and gear system are installed in the old squelch level access hole, and the control is moved to the rear of the chassis above the 12H6 detector. Begin by turning over the receiver and loosening the front, removing five screws on each side. Press the brake mechanism manually and turn the tuning shaft so that both setscrews designated in Fig. 11 can be reached with a splined wrench without again turning the shaft (this assures that alignment will not be lost between the tuning capacitors and the front dial). If the screws don't come out easily, heat them with a soldering iron and they will almost fall out. Carefully slide the front loose and remove the squelch control and bracket. Disconnect the control and mark the leads so that they can be extended to some other location. Drill out the brad which holds the slide assembly covering the squelch access hole. Mount an old potentiometer bushing in the access hole (ream it slightly). Figure 12 shows the mechanical details of the conversion. The gears used in this conversion are from the depths of a friend's junkbox. One could also use gears from an erector set (write the company or bargain with Junior), a slot car supply center, or belt and pulleys from an

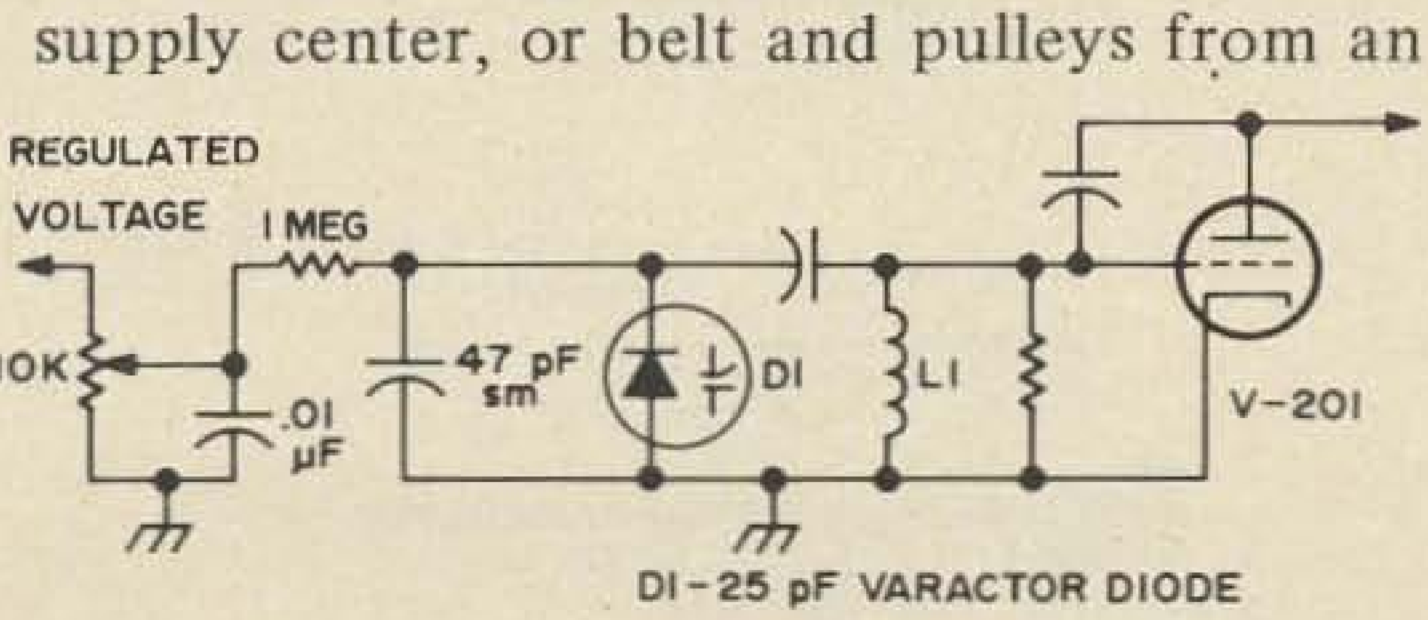

Fig. 10. Remote oscillator tuning circuit using a varactor.

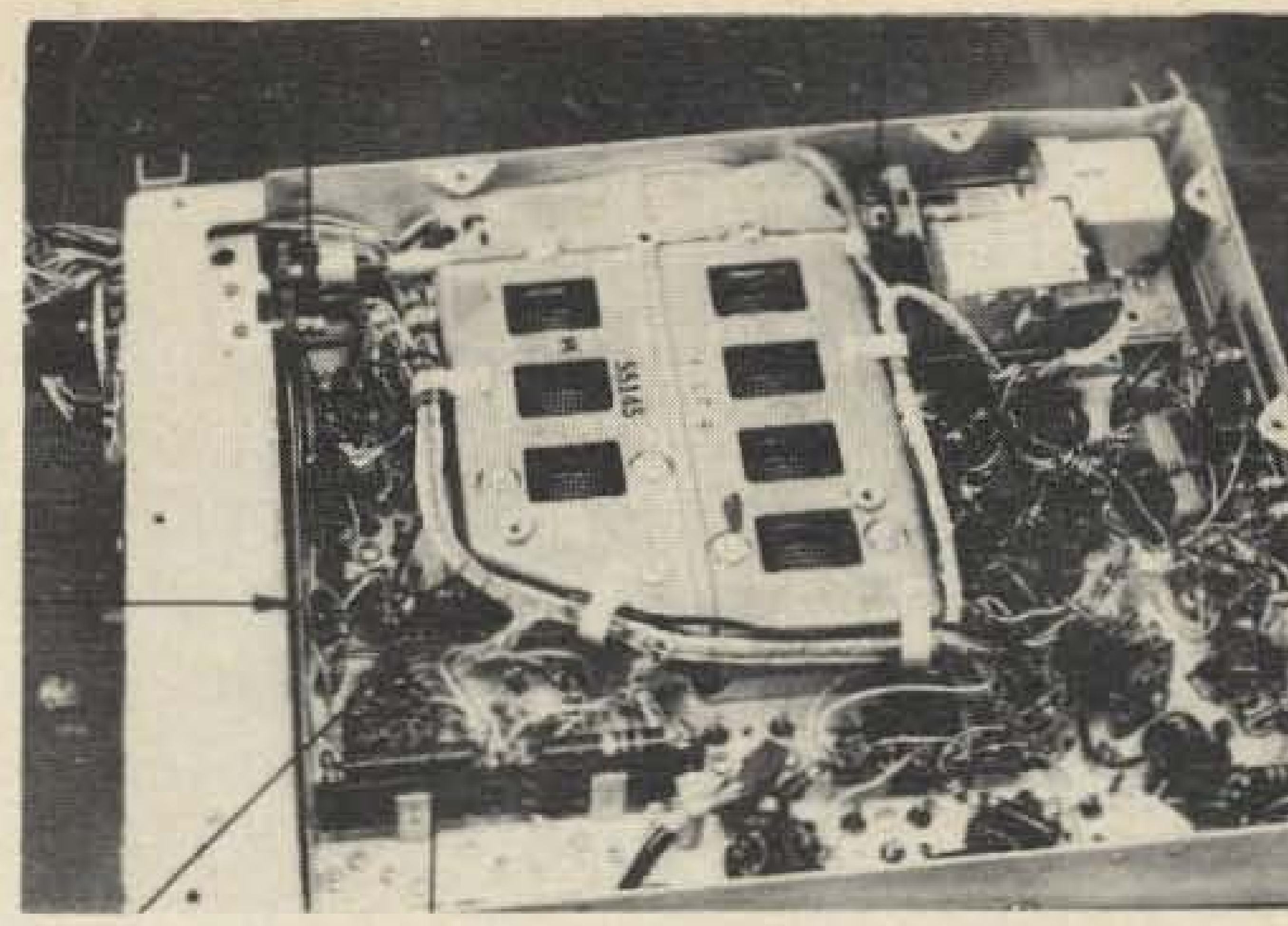

Fig. 11. Photo of manual tuning conversion.

old phono motor (use your imagination). Certain surplus equipment such as old bombing navigation devices is often a good source of small gears. Finally remove or loosen the setscrews shown in Fig. 11.

Tuning the receiver is like tuning a communications receiver having a preselector. Choose the approximate frequency of operation with the rf stages then tune the signal with the oscillator. Finally peak the RF stages.

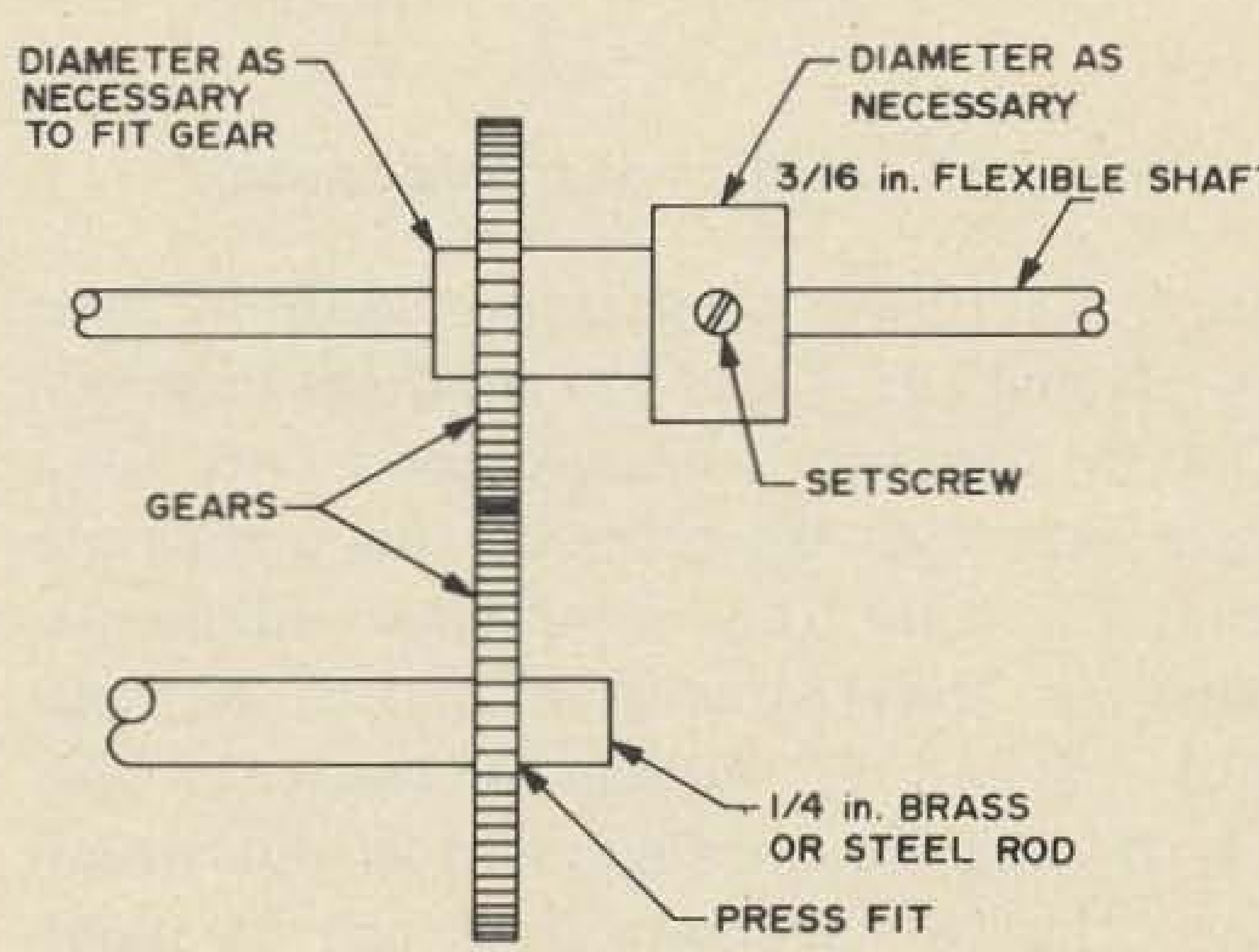

Fig. 12. Mechanical details of manual tuning conversion.

Rf Gain Control

An rf gain control may be added without too much trouble. The hookup is shown in Fig. 13. The pot is a half-watt unit, and any value near 25 kΩ will do.

Begin by removing the cover plate over the section of the tuner assembly which mounts V208 and V209. Carefully lift the ground end of R236 and add a one-lug terminal strip directly outside the side plate. Extend the ground end of R236 to the lug. One can now run a wire from this lug to the front panel.

Transmitter Conversion

The transmitter involves somewhat less conversion than the receiver, since the output is left crystal-controlled. The bulk of the labor involves attaching a front panel and extending control leads to it. Additionally, a manual peaking feature for the rf stages is presented to avoid use of the automatic tuning motor and its accompanying 28V high-current supply. Provisions are made for a relative output indicator and a 12V filament supply.

12V Filament Supply

The transmitter filaments draw about 4.5A at 12V. In many cases, a transformer capable of handling this load is expensive.

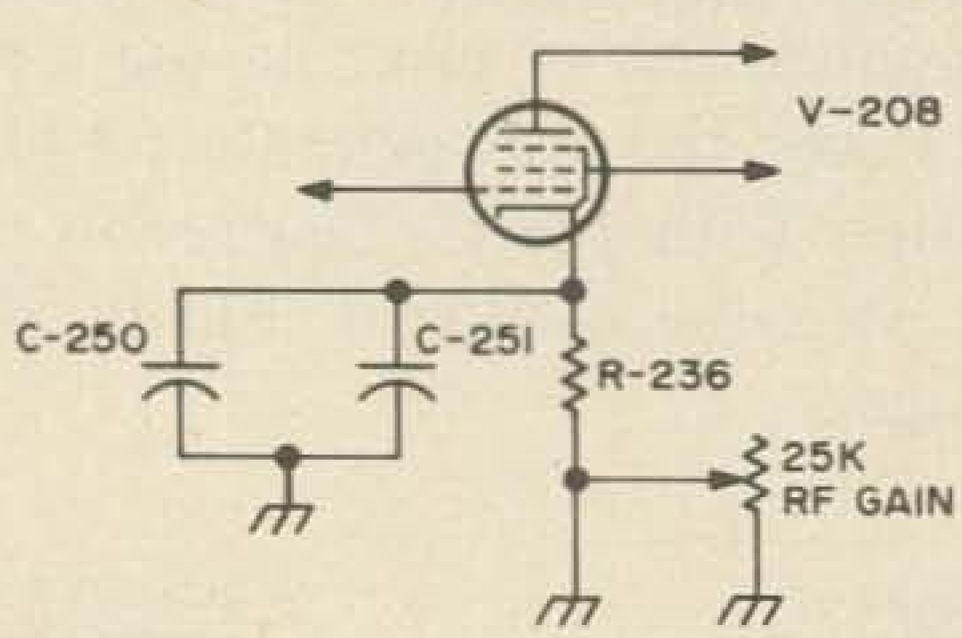

Fig. 13. Addition of rf gain control.

But a TV power transformer could be used by placing the 6 and 5V windings in series. The 5V winding is usually good only for a little over 3A. By bringing out a separate lead for the 6L6 modulator filaments, however, the filament drain can be split into 3.5 and 1A sources, as shown in Fig. 14. If such an arrangement is not necessary, the two separate lines can be paralleled.

Identify R132. Three leads are connected to one side. One goes to pin 7, V108. Remove and ground it. Remove the other two leads, solder and tape them together. Identify R131. Place a jumper across it or remove it and tape the leads together. Identify and remove R133 and the lead going from it to pin 7, V105. Remove R129 and R130, taping up the remaining leads.

Identify pin 7, V103. Remove both wires and solder and tape them together. Ground pin 7. Remove the lead from pin 7

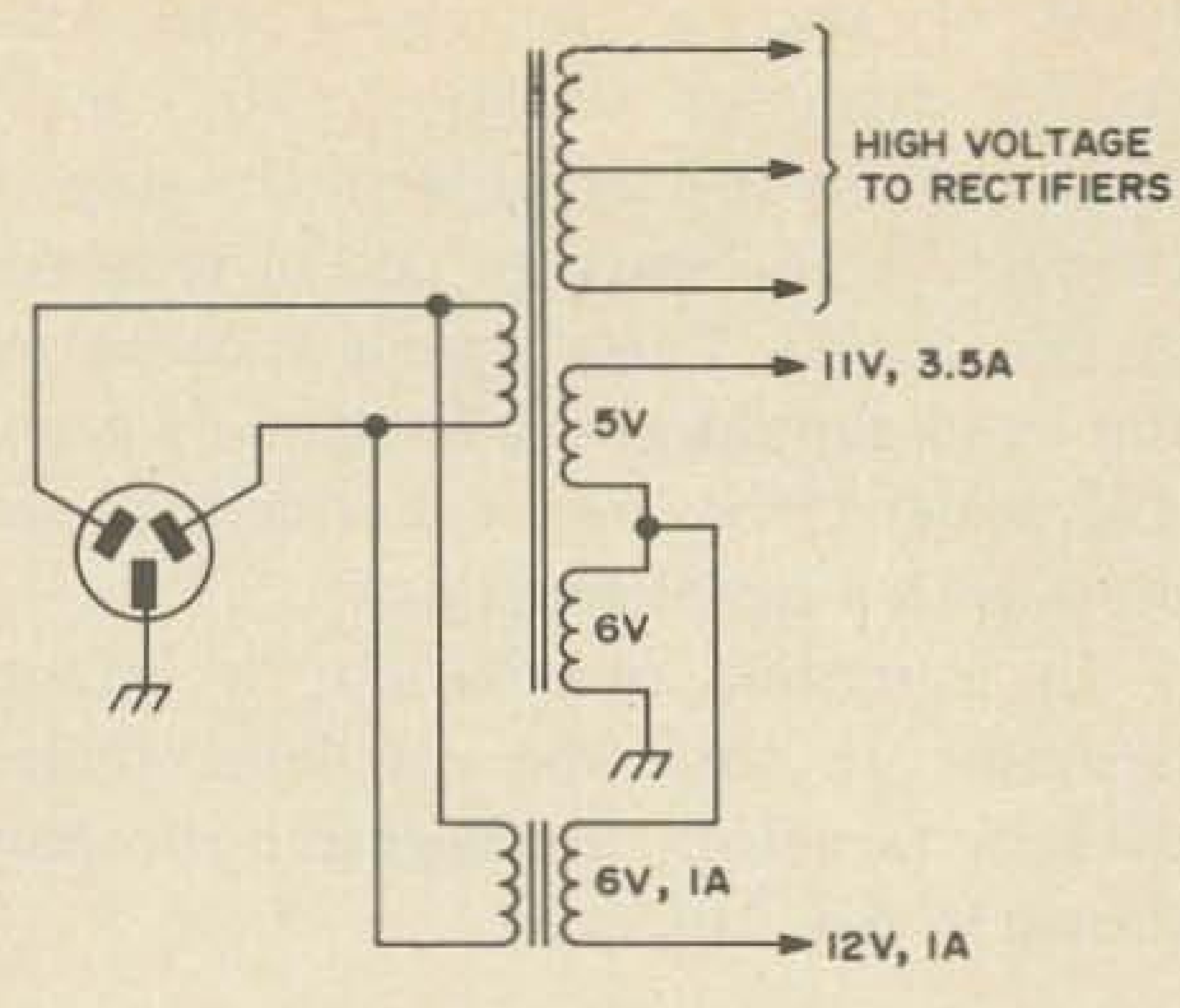

Fig. 14. 12V filament power supply.

of V102. Run a 20-gage or large wire via the following chart:

FROM	PIN	TO	PIN
V104	1	V105	7
V105	7	V102	2
V102	2	R132	tap
V105	7	P103	1
V107	2	P103	4

The 12V (ac or dc) can now be fed into pins 2 and 4 of P103 with 3.5 and 1A sources.

Front Panel Controls

Remove the crystal compartment door and fit a new piece of aluminum for the front panel. This is best done by using four sheet-metal screws. Removal of the relay contact covers should provide sufficient clearance for jacks, switches, etc. Details of

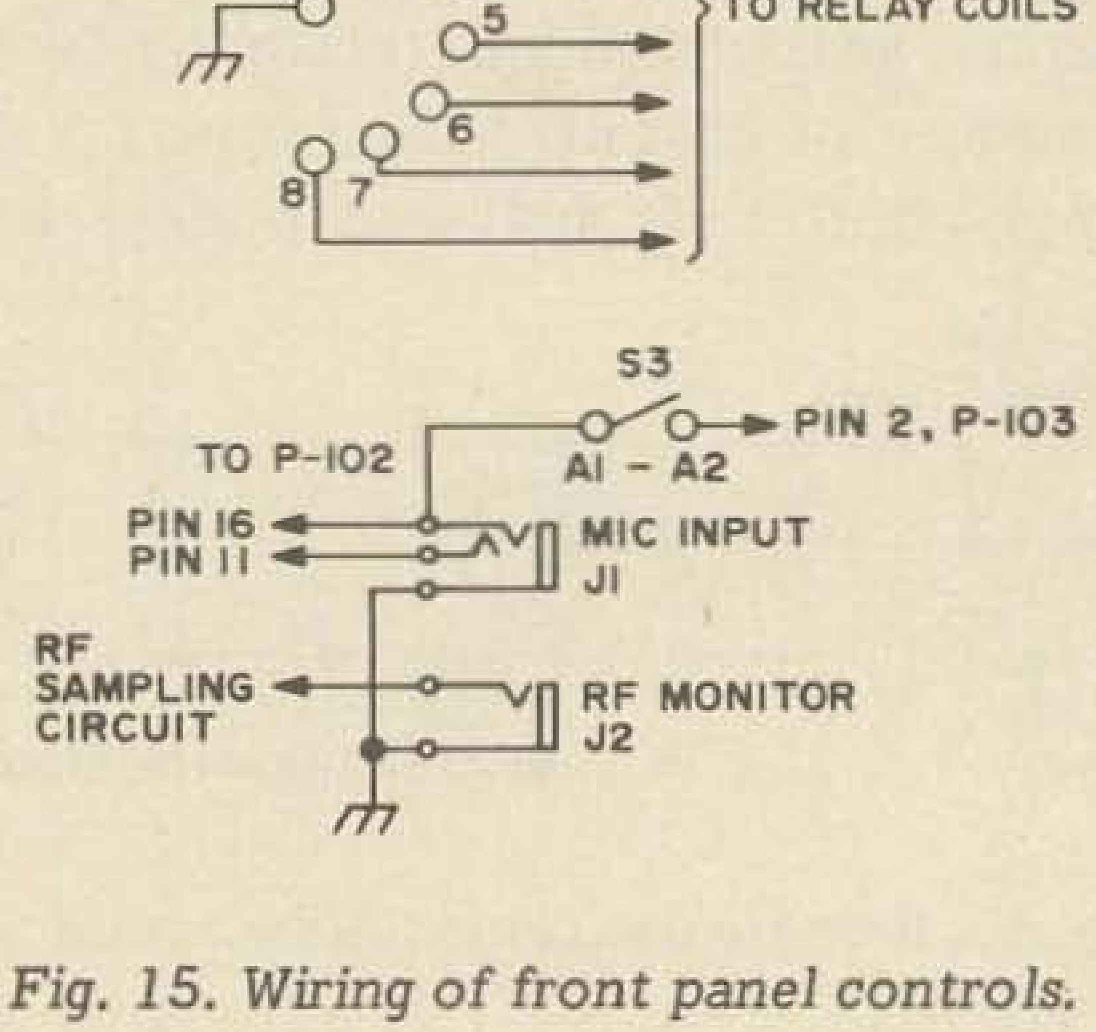

Fig. 15. Wiring of front panel controls.

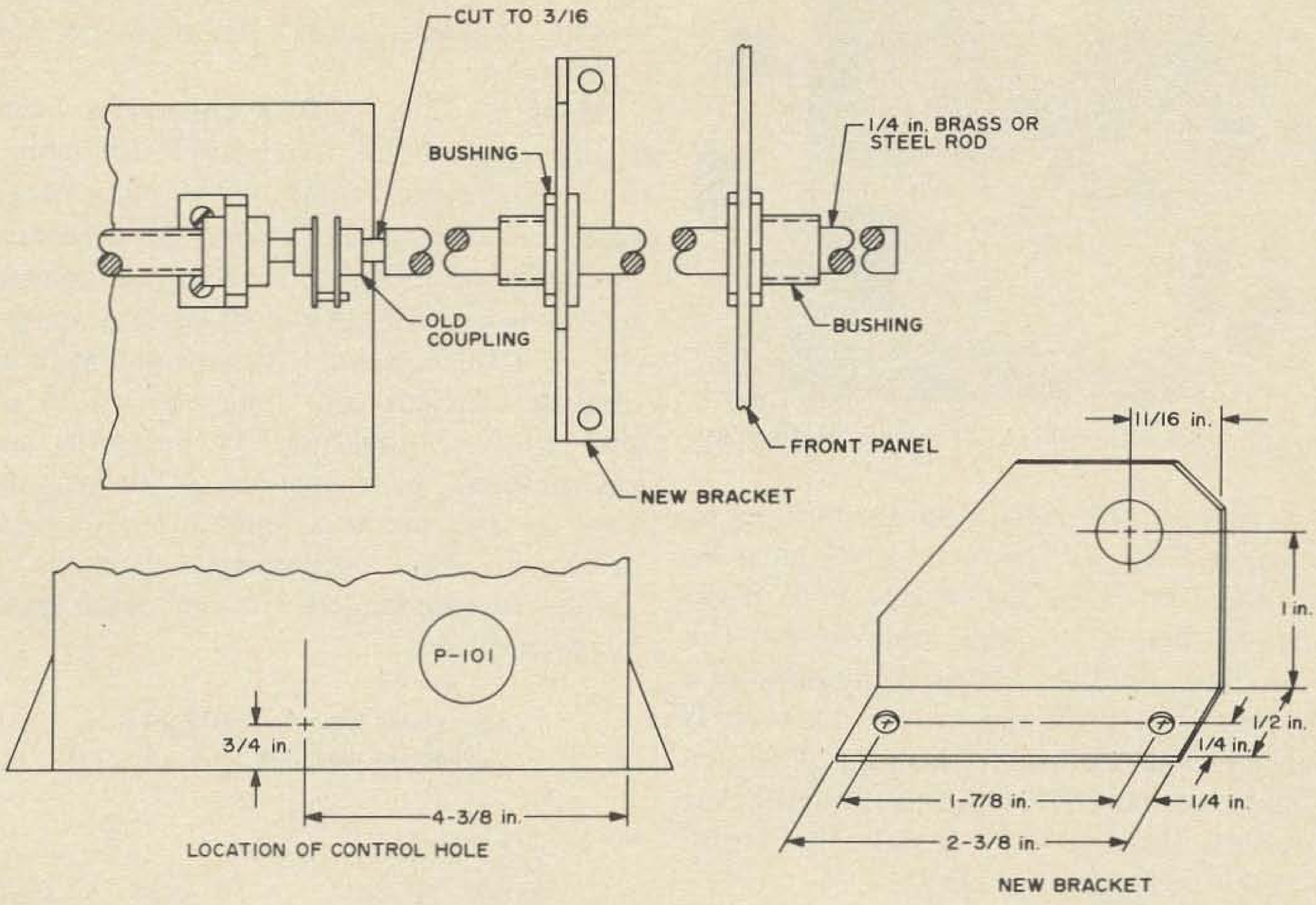

Fig. 16. Mechanical details of manual peaking control.

the hookup are shown in Fig. 15.

Microphone volume was originally controlled by an aneroid barometer attached to a potentiometer. This is the large can or cylinder directly behind the crystal switching relays and is marked R142 on the schematic. Remove and disassemble it, extending the connecting leads to the front panel. Extract the potentiometer and remount it on the front panel.

To avoid making a number of connections to the front of P102, I decided to connect S2 through the relay rack compartment directly to the coils. This involves removing the phenolic covers and cutting a small hole in the top cover to clear the leads. Removal of the back cover involves some unusual arrangements. There are two wires going through it which must be unsoldered to effect its removal. Instead I extended the slit through which they ran to the bottom of the plate. This can be done with a hacksaw blade or small file. Wires were then soldered to the side of the relay coil not having a jumper to one of its own contacts.

Power leads are attached in the same manner as to the receiver. The A1–A2 switch allows the transmitter to be keyed A2 with its internal oscillator with the microphone PTT connection. For A1 or A3 it is left in the A1 position.

Manual RF Peaking

Unless a 28V, 6A power supply is available, automatic tuning is not recommended. The supply shown in Fig. 6 is not capable of handling the load of the tuning motor, but will feed the keying and crystal switching relays nicely. Manual peaking of the rf stages requires relatively little conversion.

Begin by locating motor B101. It is mounted by six screws which attach through the main chassis to standoff posts. Remove all six screws and the motor–brake assembly. Cut and tape all three leads connected to it. Using a splined wrench remove the drive coupling from the end of the asssembly. Also remove the two center standoff posts and reinstall them on the chassis in their old location. Drill a hole

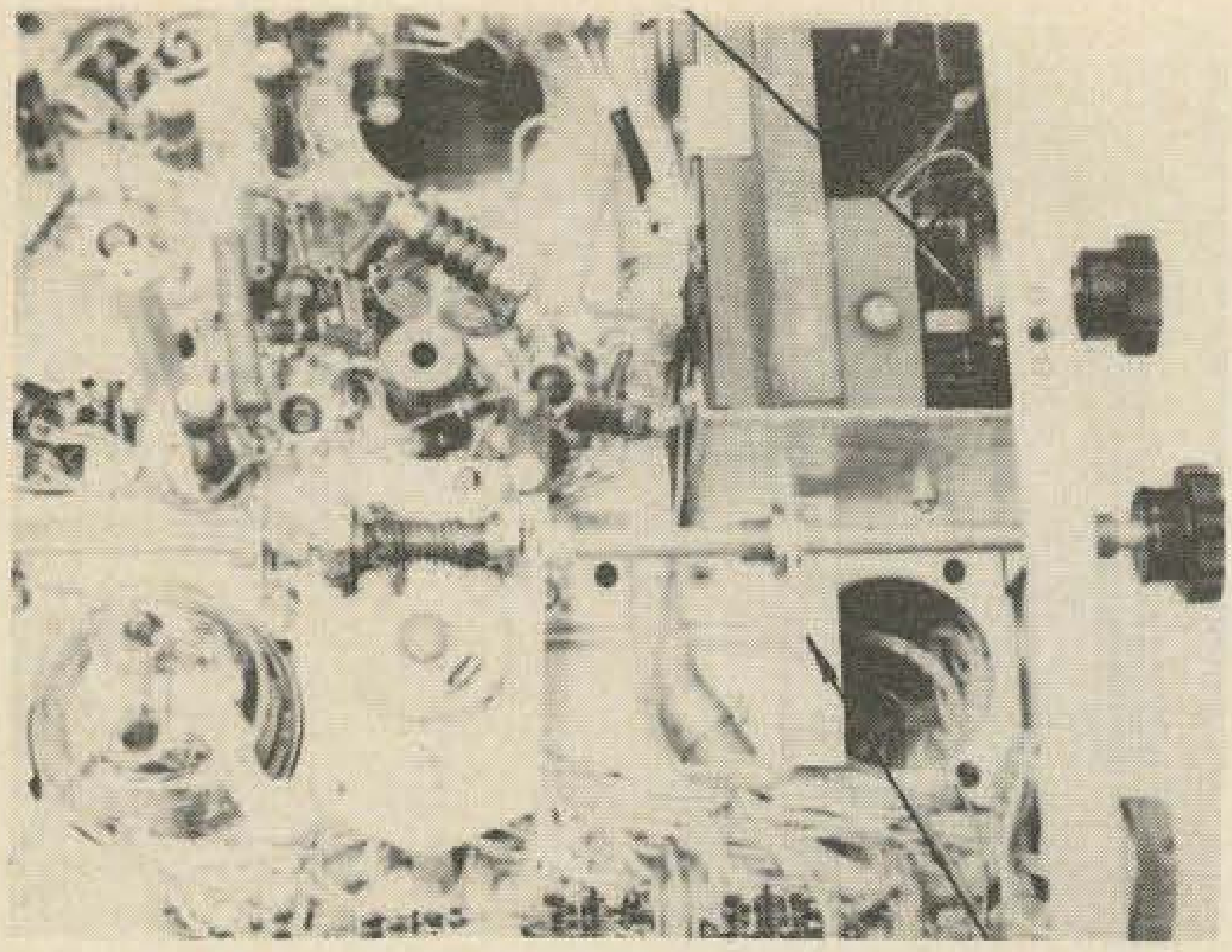

Fig. 17. Installation photo of manual tuning feature.

to accept an old potentiometer bushing as shown in Fig. 16. The ¼ in. shaft must be cut down to 3/16 in. on one end. If no other method is available, one can put the rod in the chuck of a ¼ in. drill and hold a file against it until the proper diameter is reached. The method is crude, but works. Mount another bushing in the new bracket described in Fig. 16. Install the entire assembly as shown in Fig. 17.

Locate K107. Remove the jumper going from the coil to one of its own contacts. This frees the PTT system to work without the tuning mechanism.

In operation the transmitter is peaked up by observing the output. A relatively small excursion of the tuning knob covers the entire 2 meter band.

Relative Output Indicator

The output indicator is shown in Fig. 18. The diode can be almost any rf type. Output is about 1–2V.

Afterthoughts

The speaker in my receiver was mounted in the top of the cabinet over relay K201 and V207. It was necessary to remove these items to obtain clearance for the speaker and transformer. Others may wish to use another mounting location or speaker size.

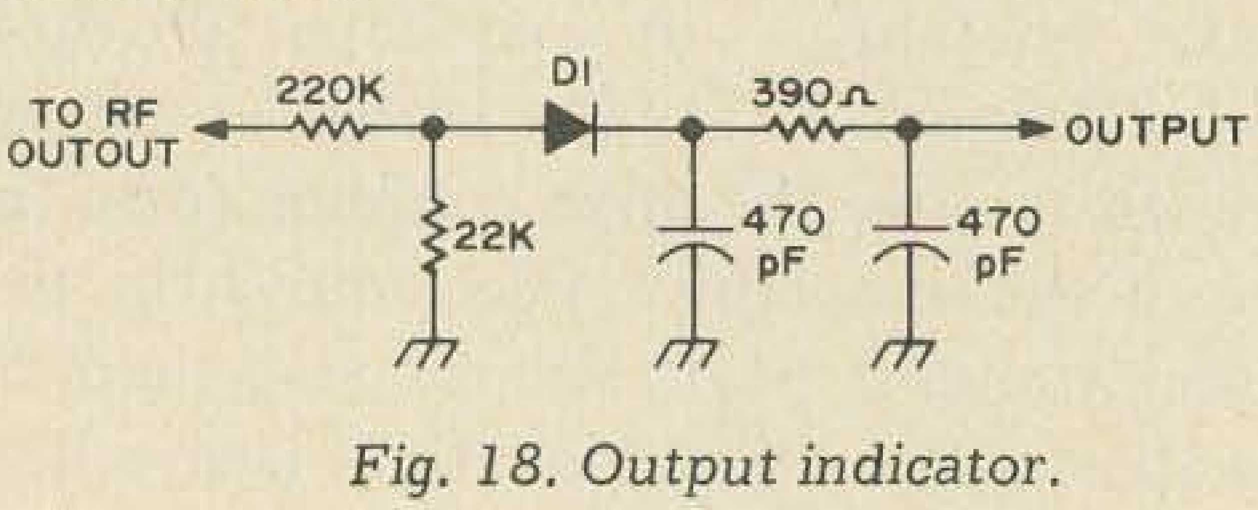

Fig. 18. Output indicator.

Figure 19 shows some of the connector layouts and a few miscellaneous dimensions which may be of help in the conversion of these units. All diagrams are front views.

Many of these ARC-3 units have been sitting unused in warehouses for some time. Therefore components may have aged considerably and it may be necessary to repair the units before they are converted. A borrowed 28V high-current supply can be used to operate the equipment in its original configuration long enough to assure proper operation. If problems are encountered, be suspicious of the capacitors, as they are wax units and often leak or short. This preliminary checkout is highly recommended. It can save many headaches later.

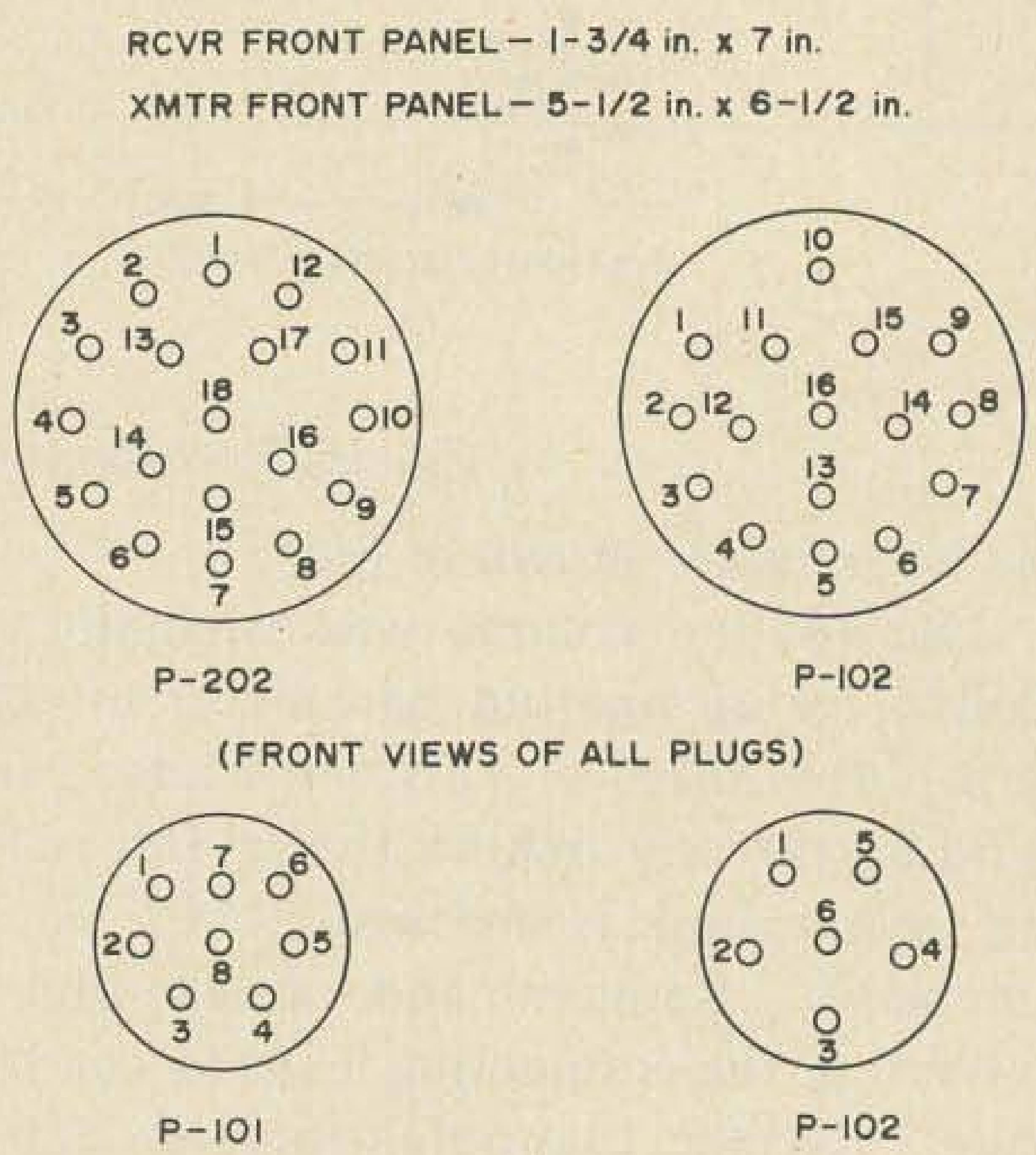

Fig. 19. Connector pin diagrams.

The transmitter was originally set up to cover the entire 100–156 MHz band. By peaking the rf chain in the center of the 2 meter band, considerably more output is available than for the wider band coverage. The tech manual gives complete information on the procedure.

Thanks to Paul G. Branson, Richard Patisaul (WA4ARQ), and Thomas F. Evans for their assistance and encouragement in this work.

. . .WA4NAI■

1. Drawer 178P, Highway 301, Ellenton FL 33532

Ed Baker WØEDO
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BLOWN FUSE INDICATORS For LOW VOLTAGE

At first glance the unit to be described would appear to be strictly a luxury, but use it once, and you'll wonder how you ever got along without it.

It is a well known fact that individually fused circuits not only give increased protection to equipment, but simplify troubleshooting by isolating the defective circuits. But it also means more fuses to check when troubleshooting.

In ac equipment it is a simple matter to connect a neon bulb directly across each fuse; thus, when all is well all bulbs are out (being shorted by the fuse). When a fuse blows, the bulb is placed in series with the load and, glows (without allowing enough current flow to damage the defective circuit). A look at Fig. 1 will make this operation clear.

I "borrowed" the idea from a piece of military gear several years ago, and have used it ever since. Many hours have been saved by knowing exactly which unit to check when something "went south."

Many times I have wished that such a system could be applied to the mobile rig, but since the 6V in my VW (or the 12 in your Cadillac) will not light a neon bulb it seemed out of the question. Then a light came on in the think department. How about incandescent bulbs? Theory could not find a flaw in the idea (at least not my limited theory) so it was decided to give it a

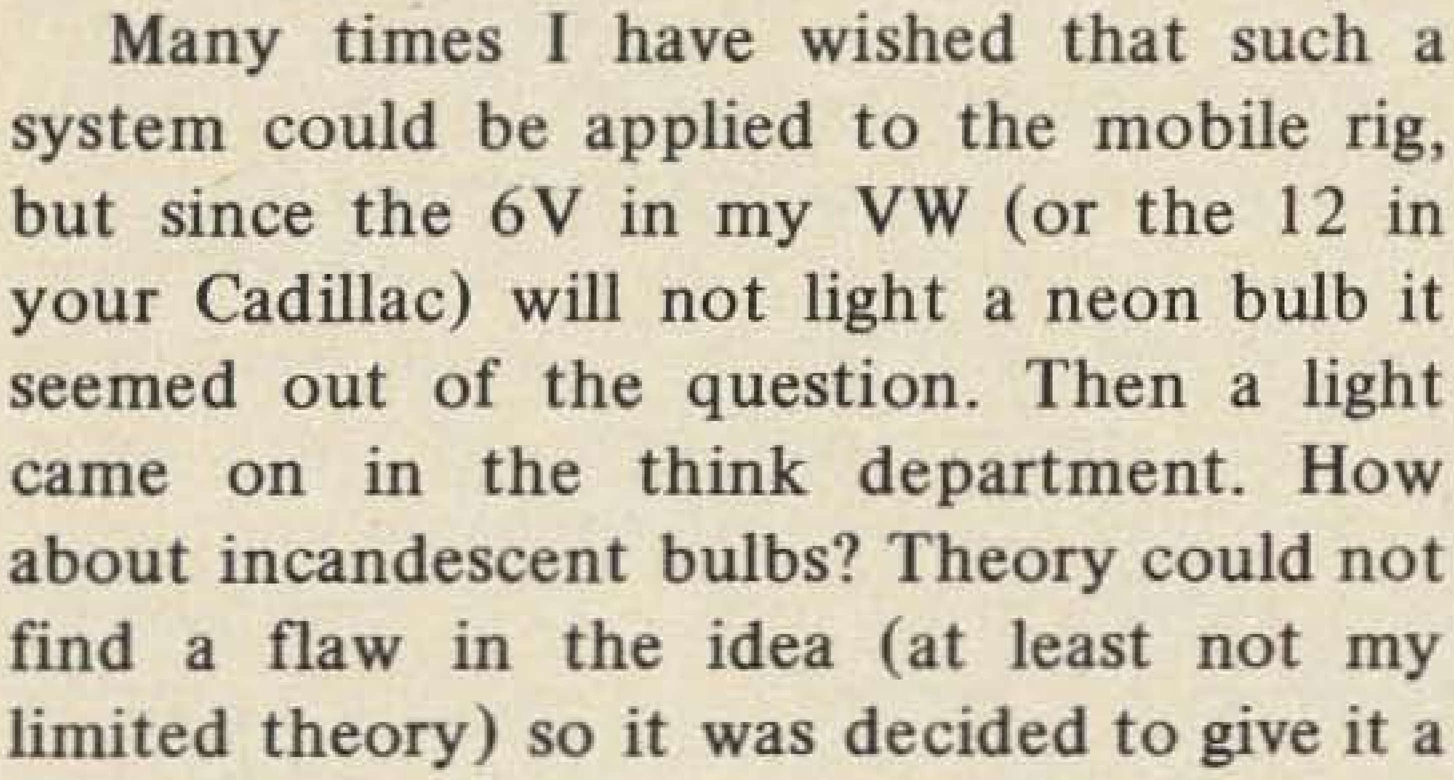

Fig. 1.

practical test, using a sealed beam unit from a headlight as a "load." It worked!

The values used were selected for easy calculation, but the theory will hold in any

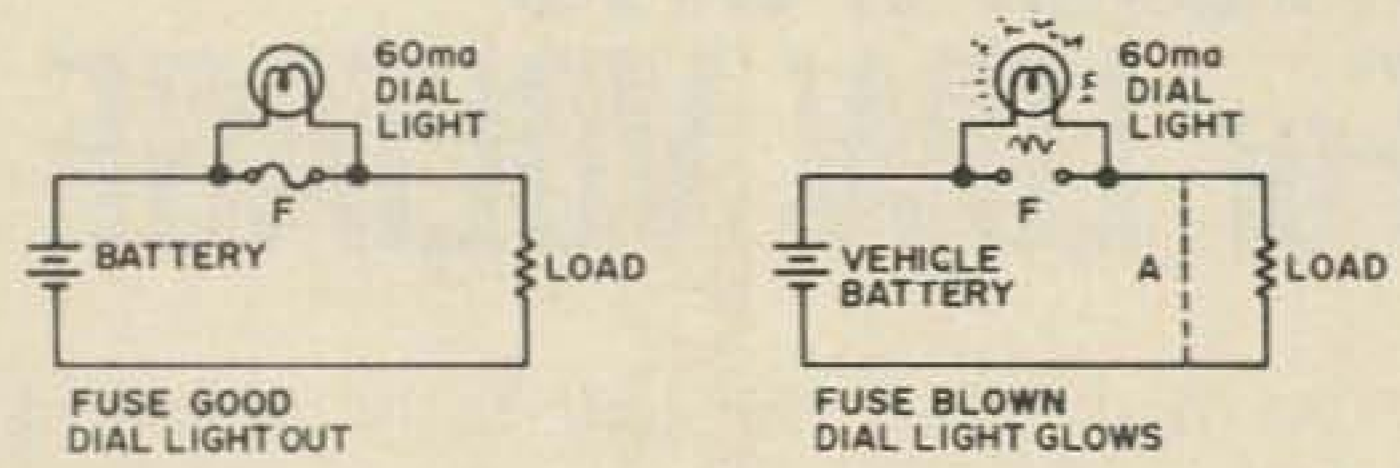

Fig. 2.

case. Assume, for example, a 6A load. The next higher rating of fuse is 10A, which should give adequate protection. Now, connect a 60 mA pilot lamp across the fuse. If all values are considered to be exact (of course they never are, but this is theory) our circuit may now conduct 10.06A before the fuse blows. If a short develops at point A in Fig. 2, the fuse will blow, but the lamp will merely have its normal brilliance, announcing to one and all that F1 has blown. If the short is only momentary, the bulb will be placed in series with the load, but application of Ohm's law will show us that our 6A load has a resistance of only 1.0Ω, while the 60 mA bulb has a resistance of 100Ω, thus most of the applied voltage will be dropped across the bulb, and it will still light.

This method worked out so well on the mobile rig that it was also applied to the entire automobile, with all the bulbs installed on a single panel just below the dash.

Unless you have a large supply of pilot light sockets and jewels on hand, this would at first appear expensive, but there is a sneaky way around this. Bulbs mount nicely in a grommet set into a hole, and coating them with a special paint made for putting orange parking lights on older model cars makes a very attractive installation. In the event the bulbs tend to creep out of the grommets, a drop of Duco cement applied to the bulb and grommet will cure this, and replacement is so seldom that connection may be made by soldering directly to the bulbs.

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Addendum To The W1PLJ Counter

One of the best amateur radio-oriented frequency-counter articles, in my opinion, was published in *73* magazine in February 1968 by W1PLJ.

Although the W1PLJ counter was designed around RTL logic, considered to be obsolete for new designs by many engineers, it still has much to recommend it in terms of price and performance. RTL is a logic form that was first to be IC-implemented and so has a few features upon which the newer IC logic families have improved. RTL is, however, still probably the most durable IC logic form in the hands of the beginner. Mistakes in wiring or inadvertent shorting of leads together in testing are usually forgiven by RTL. Also, since most hams are used to devices being turned "on" by a voltage input, RTL is easier to understand than the more sophisticated "current sinking" logic forms (DTL or TTL).

The original counter article was written in such a way as to allow the builder to choose from a number of ICs (Fairchild or Motorola), and so IC pin numbers were not given. As such, the article was not *really* a construction article.

I began construction of the W1PLJ counter by the hand-wired method used in the original article. After making two of the

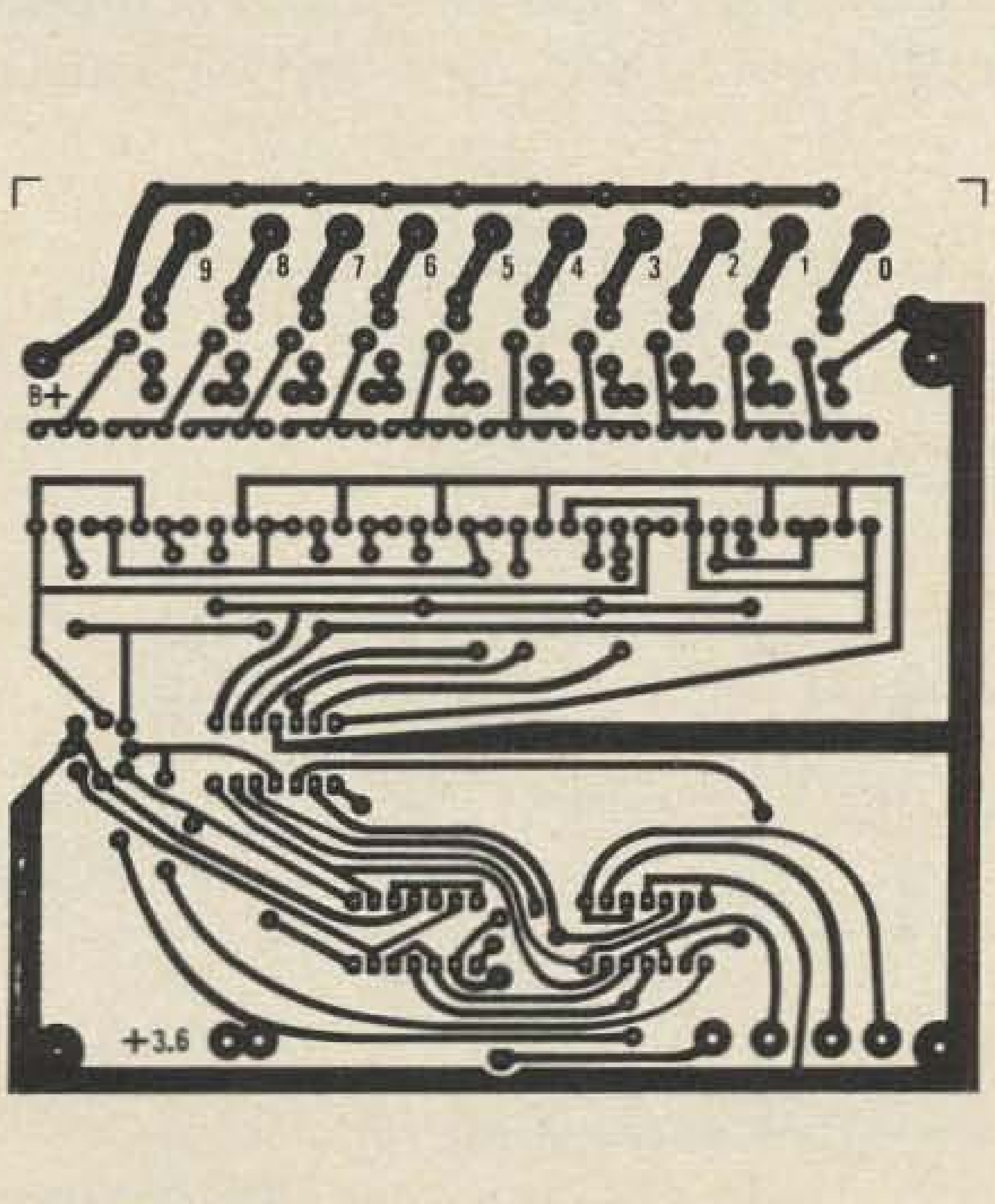


Fig. 1. DCU board layout. Boards will be made available by Stafford Electronics Inc., 427 S. Benbow Rd, Greensboro NC 27401.

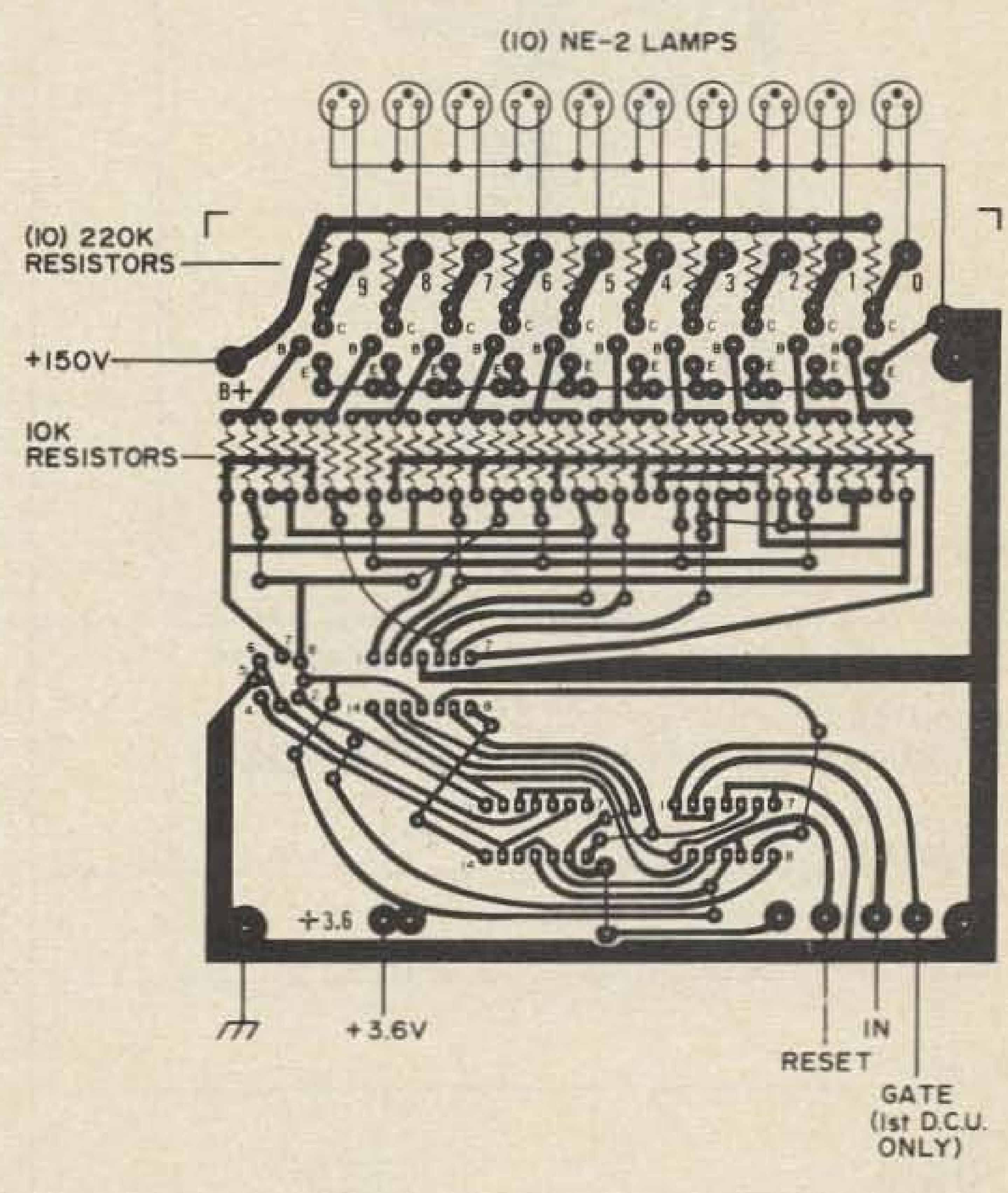


Fig. 2. Parts layout of DCU.

Decade Counting Units (DCUs), the task seemed to have no end in sight. This much of the counter was a "shot in the arm," however, as I could hook the DCUs up to +3.6V, +150V, and a pulse generator, and watch them "count" and display. In order to simplify the repetitive job of constructing DCUs, a PC board was taped up, as shown in Figs. 1 and 2. This board makes building the counter much easier, combined with another simplification. The neon indicator systems were pulled off old Hewlett Packard AC4A tube type DCUs (the ones that had four 12AU7s in them). These are often available in surplus stores, and really speed up the mechanical implementation of the display, since the numbers and so forth are all there. Similar DCUs that are suitable were made by Berkeley and Detectron, but the H.P. units were the easiest to use in my opinion. I personally wouldn't pay much over $3 for an old AC4A (without tubes) since the price of ten NE2s is only about $1 and that of the least expensive "nixie" (Burroughs B5750) is only $6.75.

The particular transistors used on my DCU boards were 2N720As which I happened to find a "good deal" on, but the 2N1893s or 2N3877s recommended by W1PLJ will also fit the board. The ICs chosen for the PC board *do* cause some restriction, but those specified are the least expensive choice for eight RTL inverters in two IC packages, and two dual JK flip-flops. (The Motorola HEP parts will be somewhat

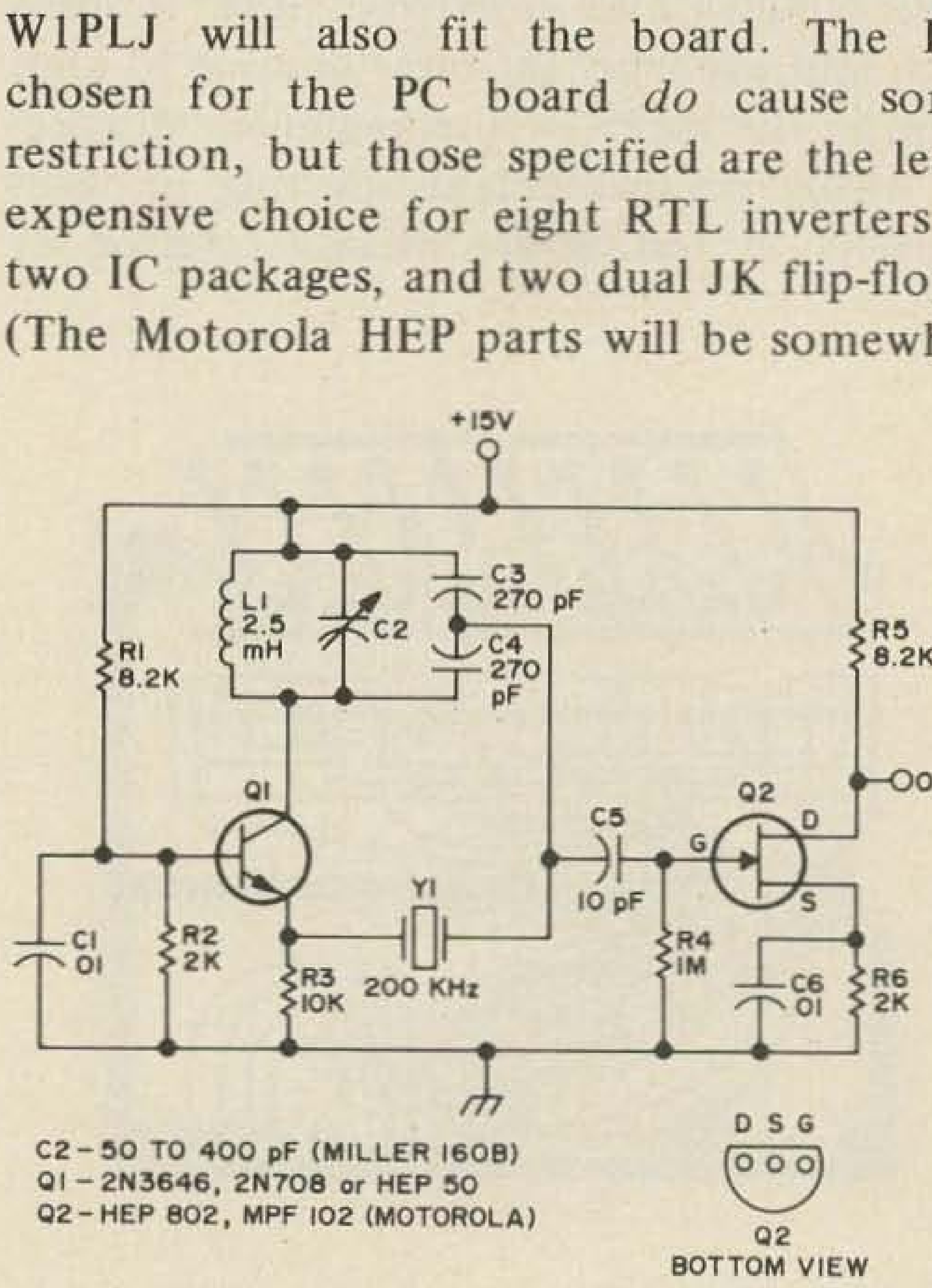
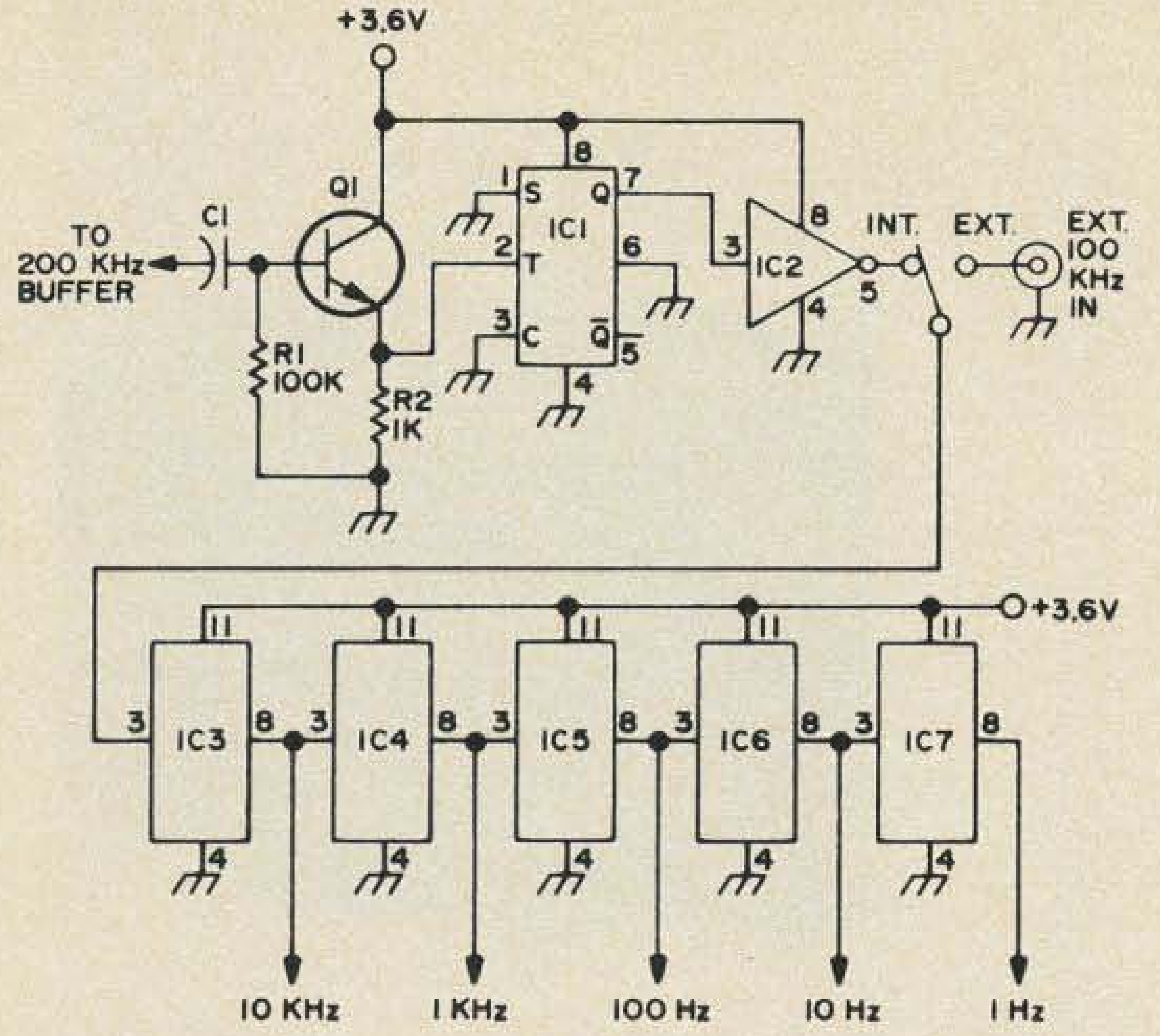


Fig. 4A. 200 kHz crystal standard for counter time base.



C1 – WIRE "GIMMICK"
IC1 – μL 923 or HEP 583
IC2 – μL 900 or MC 800G (MOTOROLA)
IC3 TO IC7 – MC 780P (MOTOROLA)
Q1 – 2N3646, 2N708 or HEP 50

Fig. 3. Divider section.

more expensive than the Fairchild μA and Motorola MC numbers they replace, but the HEP parts are more generally available.)

The other simplifying modification of the counter was the use of MC780P decade counter ICs. These ICs were unavailable when W1PLJ wrote the original article. They make the frequency standard divider section much easier to wire and eliminate any divider adjustments. The MC780P costs about five cents more than two MC790Ps, which were used as the two lowest frequency decades in the original counter, but are well worth it in simplification. The new divider section is then as shown in Fig. 3.

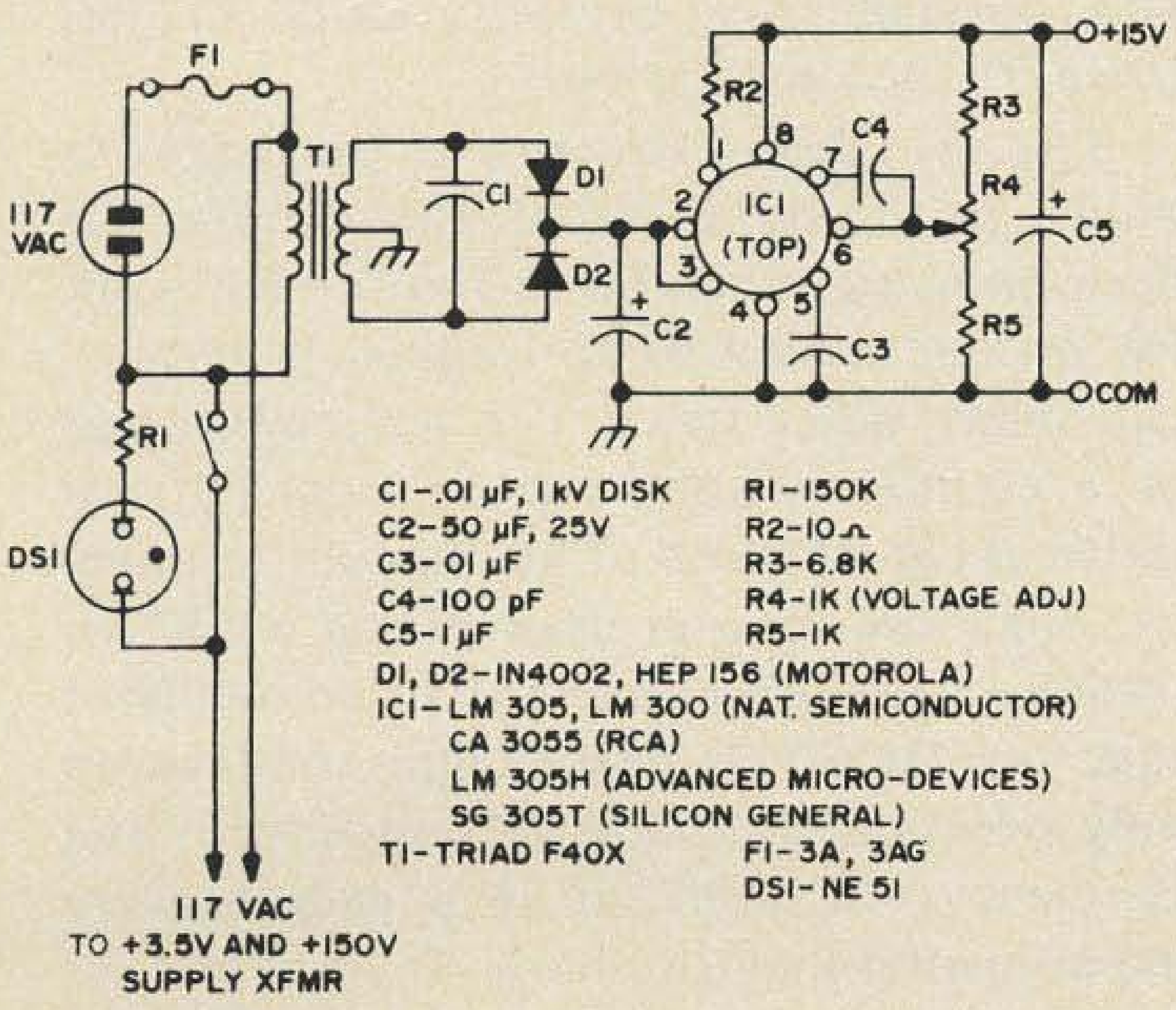
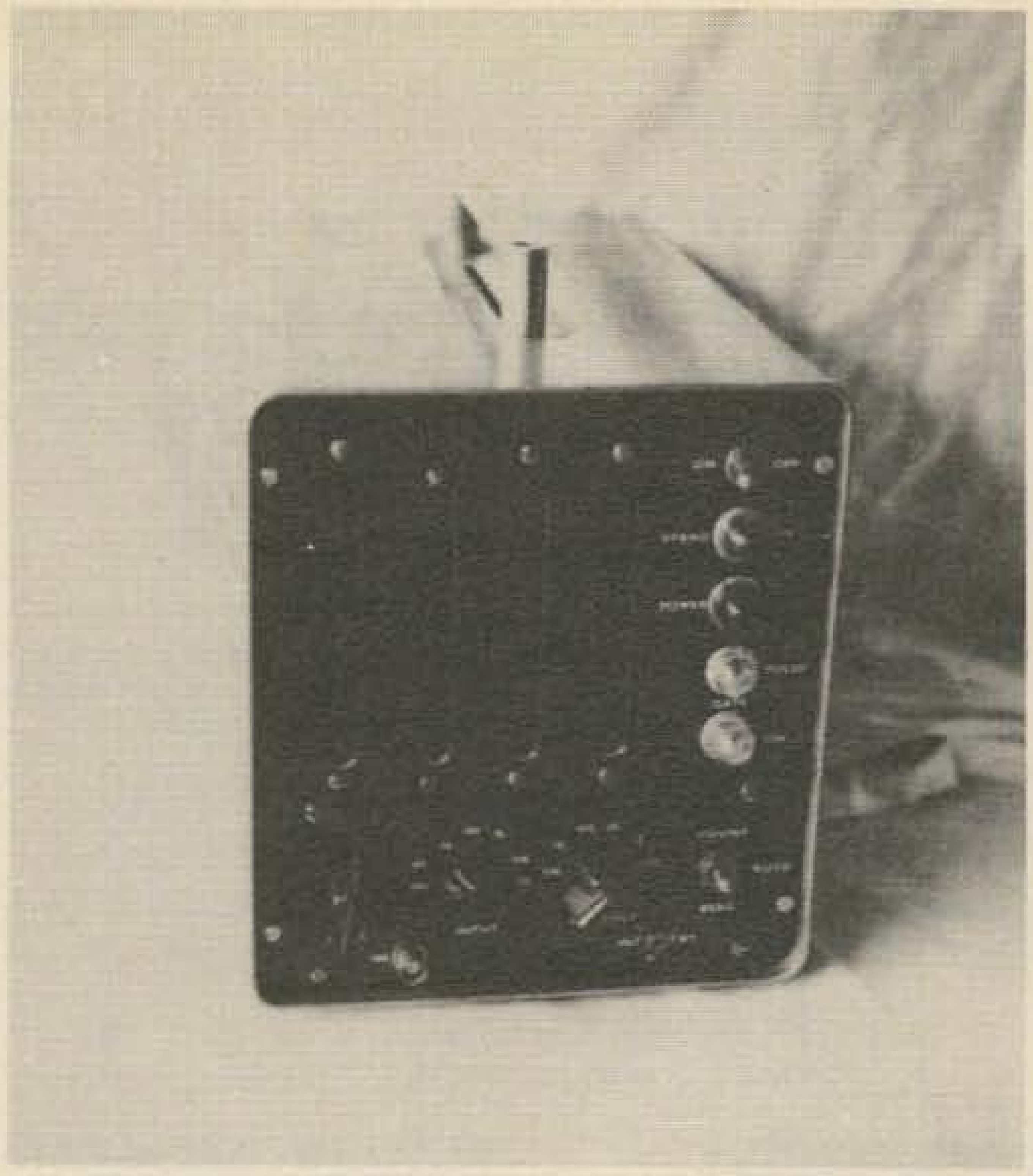


Fig. 4B. Regulated power supply for 200 kHz crystal standard.



Completed counter.

The original counter article did not show a power supply for the crystal standard, and so a new crystal oscillator and regulated supply for it was designed to fit my particular needs. The use of the LM305 IC-regulator very simply accomplishes the job of obtaining a small amount of regulated +15V needed for the crystal oscillator and buffer. Note that a 200 kHz surplus FT241 crystal was used in this version of the counter. While it may be argued that the 1 MHz crystals (being AT cut) are more stable than the crystal used here, the 200 kHz FT241 is quite adequate for the four-place accuracy of *this* counter. These 200 kHz crystals are available from JAN crystals for $1.75 plus 10¢ postage (*Jan Crystals, 2400 Crystal Drive, Ft. Myers FL 33901*).

The finished counter as packaged is shown in the photograph. This counter has been immensely helpful in routine lab work for setting oscillators to frequency *quickly*, and many other tasks. The main advantage of a counter is not its great accuracy, but rather its great *speed* of reading out frequency. Since the counter does all the work, for instance, you can connect it to an oscillator that you are slowly heat-cycling and look up only occasionally to log the temperature and frequency. In short, it is a gadget every experimenter ought to have.

. . .W6GXN

Ken W. Sessions, Jr. K6MVH

Constant-Currant Charger for Ni-Cads

...Lets you charge your batteries the way the manufacturer would want you to.

If you own a hand-held transceiver with a nickel-cadmium battery pack but you don't have a charger, you've probably been going about the recharging task the hard way – connecting a low-voltage dc source to the battery, monitoring the current drain with a milliammeter, and using a pot to increase the applied current to the required rate as the battery gradually becomes charged. That's an effective system, of course, but it requires one heck of a lot of attention if you want the battery up to snuff at the end of the period.

As the battery regains its state of charge, it will tend to draw less and less current, always seeking a state of balance between the applied voltage and the battery potential. When you charge the hard way (as most of us HT owners have), it's very hard to keep track of the time on charge at the right rate, which does make it extremely easy to end up overcharging – and destroying some of the cells in the battery.

Since ni-cads should be charged for 15–16 hours at 10% of their milliampere-hour rating, the monitoring and adjustment process can keep you hopping and be a real drag. The obvious solution is to attack the problem the way Motorola does with its factory-made charging systems – that is, to use a charger whose output current remains constant over the full 16-hour charging period.

Building such a charger is an incredibly simple job. All you need are transformer, small lamp, resistor, and a diode. Since the resistor–lamp combination (and the battery under charge, of course) will determine the current drain, the pair should be selected according to the requirements of your particular battery.

A 28V transformer is right for virtually all Motorola ni-cads, which are themselves typically just over half this value. In most cases (where the battery has a capacity of a quarter of a milliampere-hour or more), the lamp itself should be a 28V type. The charger circuit is shown in Fig. 1.

The resistor should be selected to draw 25–30% of the current drawn by the lamp. You can determine the values experimentally if you have a junkbox that is fairly rich in lamps and resistors. Place a milliammeter across the charging contacts (when the battery is NOT in the circuit) and measure the dead-short current. It should be exactly twice the value of your battery's 16-hour

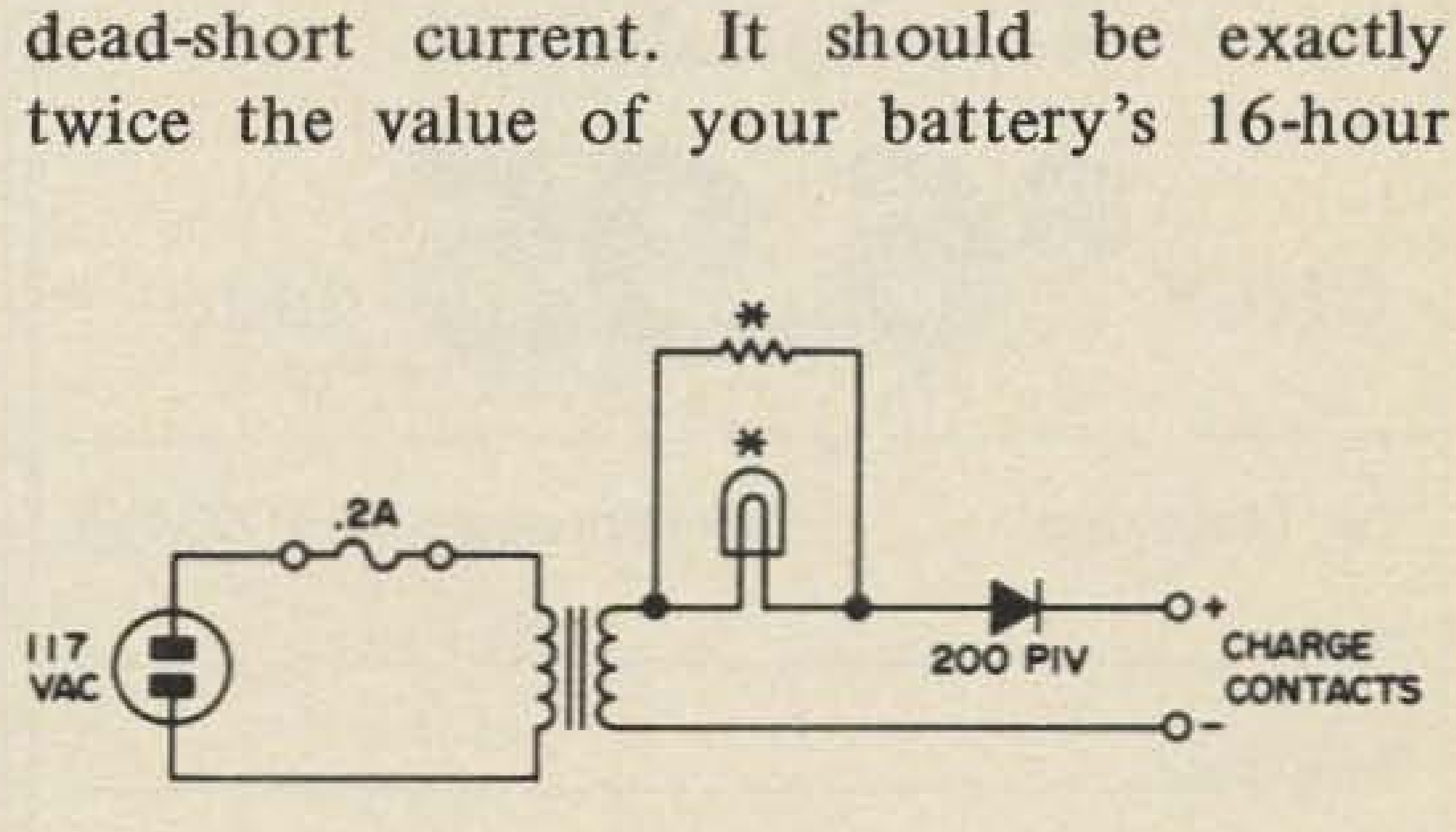


Fig. 1. Constant-current charger circuit for 15V ni-cad batteries. Caution: Don't try to charge mercury batteries with this charger or you'll have battery all over the walls of your shack!

Table I. Lamp and Resistor Values for Popular Motorola Units

Radio	Batt Rating	16-hr Charge Rate	Resistor	Lamp Current
HT-200	500 mA-hr	50 mA	120Ω	70 mA
HT-220	235 mA-hr	25 mA*	270Ω	40 mA
HT-220 OMNI	450 mA-hr	45 mA	180Ω	70 mA
HT-100	70 mA-hr	7 mA	100K	**

*Charge for 15 hours at specified rate.
**Use a GE type B2A neon glow lamp.

charge rate. The approximate values for resistors and lamps suitable for use in chargers for most popular Motorola HTs are shown in Table I. If you use these values, be sure to double check the short-circuit current as indicated above before connecting the battery. It's possible you'll have to make some slight modifications in the resistor values, since those shown were derived by calculation rather than by an empirical process of in-circuit measurement.

When the battery is placed in the circuit (in series with the lamp), the voltage across the lamp drops to approximately half its shorted value, which will also halve the current; thus, if the short-circuit current measures 100 mA, the current will be 50 mA when a 15V battery is connected.

Now that you've got the problem of building the charging circuit licked, you'll have to use some real ingenuity to get the battery charged. The mechanical problems associated with charging Motorola batteries are mind-boggling. There's just no simple way to connect test leads to the batteries. Motorola chargers are form-fitted to the battery so that when the battery is placed in the "pocket," a set of contact pins on the bottom of the charger connect with the battery at the right spot. But if you don't have a form-fitting battery holder, you'll just have to be clever about it. I made up a little wooden box into which the battery fits rather nicely, and installed a couple of screws at the bottom for contact pins. But it would have been easier to simply buy a new Motorola charger. If you have any ideas, I'm sure the rest of 73's readers would like to hear about it.

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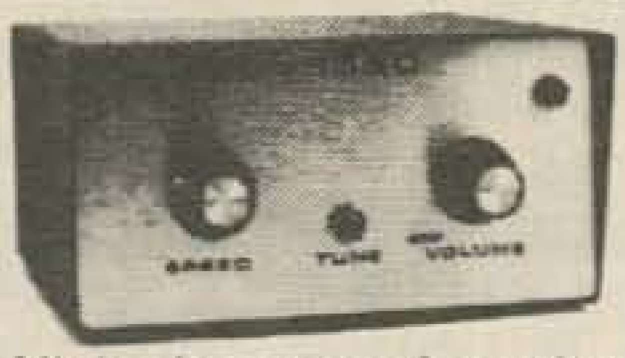

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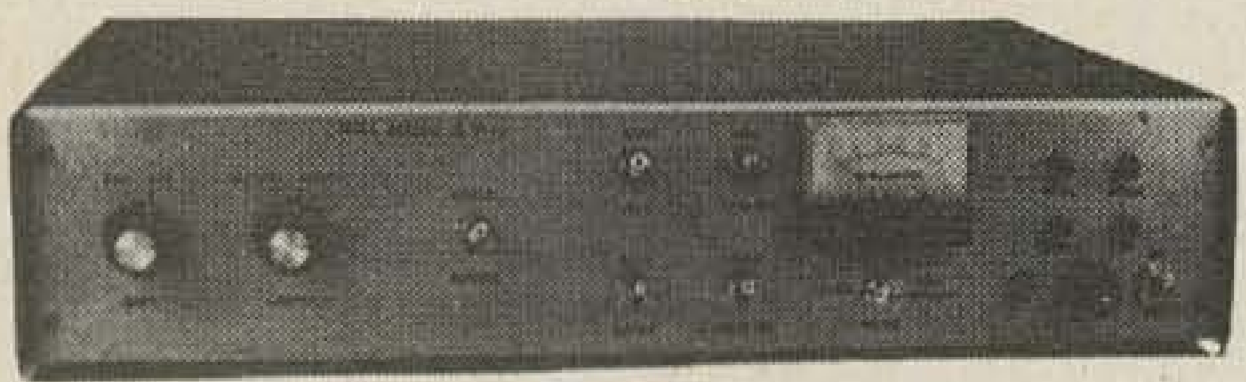

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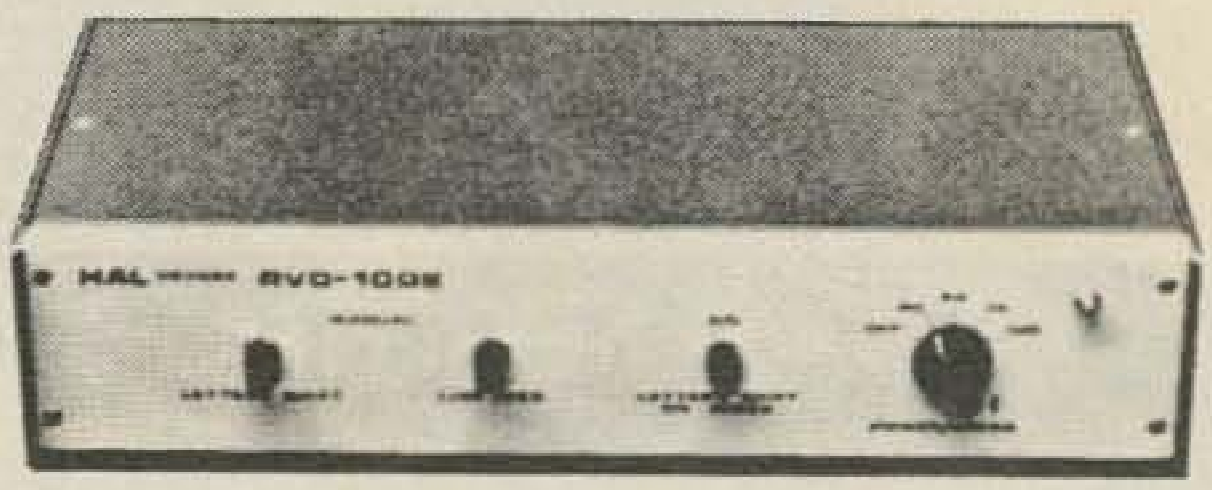

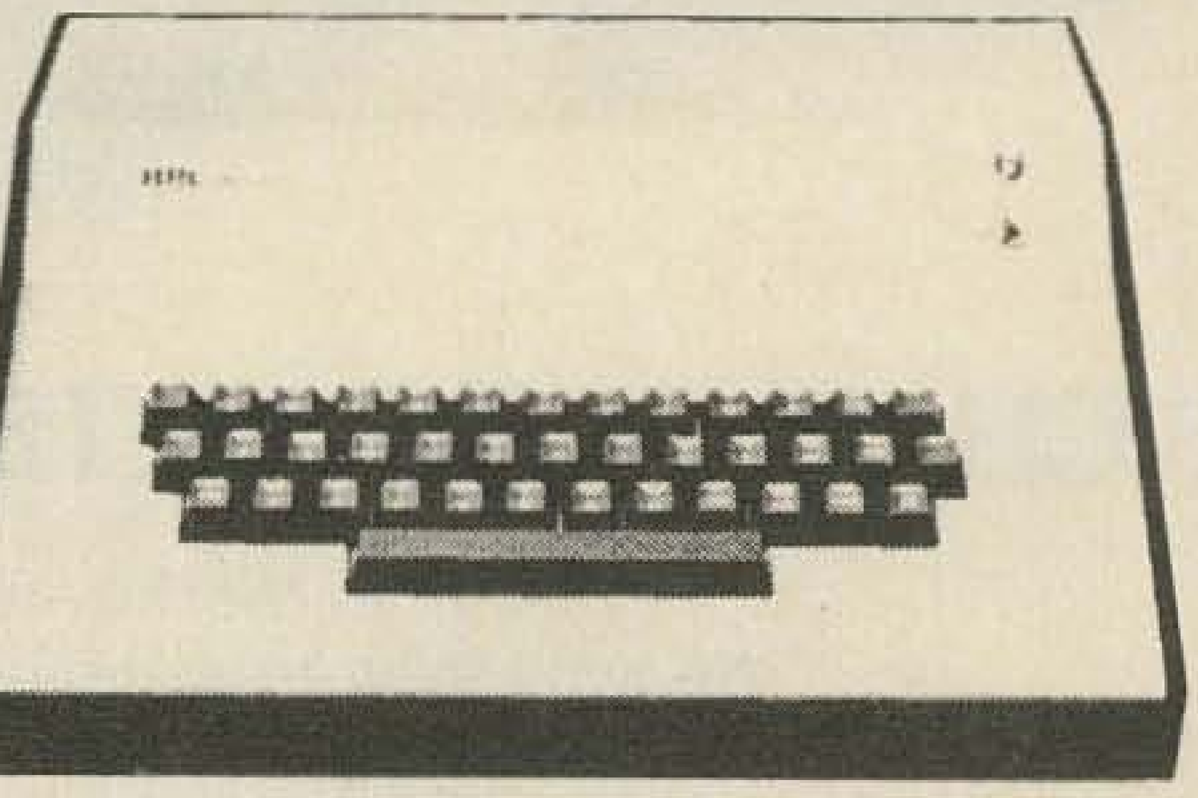

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Theory

At some time or another everyone has probably reflected the light of the sun with a small mirror. However one problem develops if the light is to be directed to a spot a great distance away. Because of the inverse square law and a few other things, the spot of light in the distance usually becomes invisible to the operator and the means of aiming it are lost. The following discussion will explain what has been done to provide a simple and effective means of aiming the spot of light at distances of several miles.

It's easier to show than tell, so take a look at **Fig. 1**. Here we have two intersecting straight lines. The thing to notice is that the two opposite angles marked A and B are identical. This comes from a theorem in

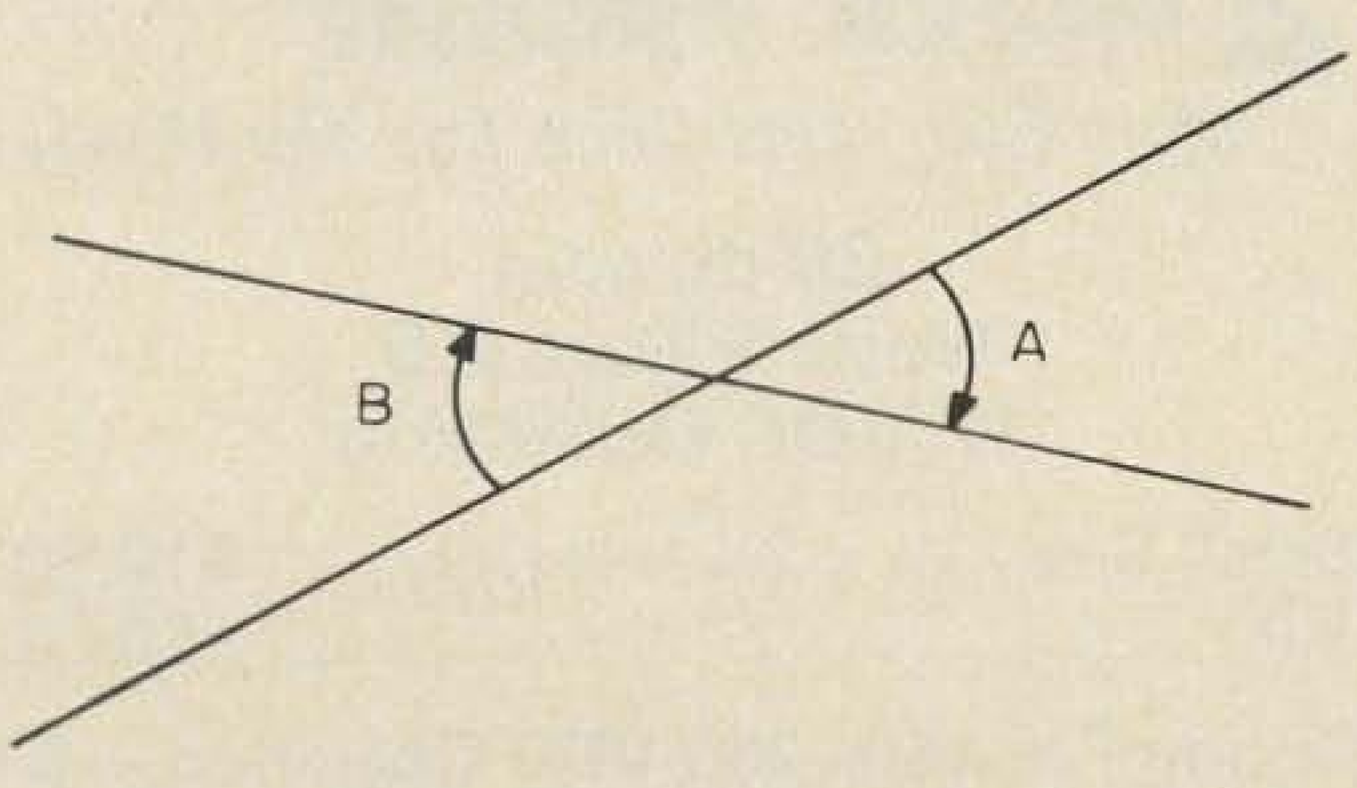
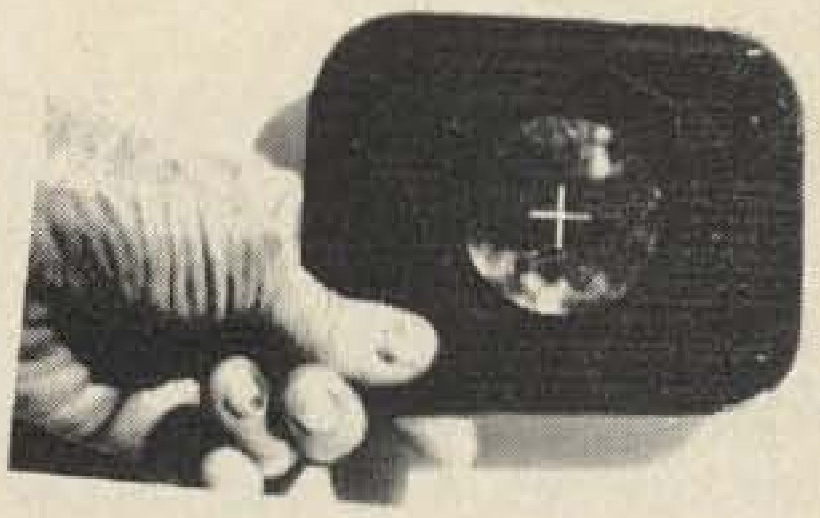


Fig. 1. Equal Opposite Angles. Note that angle A is the same as angle B.



geometry, but can be seen by inspection. For those who are interested in this, a high school geometry text should clear this up.

The mirror consists of a sheet of glass with a reflective surface on one side that reflects from both front and back. This thin reflecting surface has a cross shaped opening in it that allows light to pass through the center.

With these facts established, it is possible to explain the operation of the mirror in **Fig. 2**. Starting at the light source (the sun), the light travels both the dotted and dashed line to the mirror. At the surface of the mirror, most of the light is reflected to the object of interest. However, because of the small opening in the surface, some of the light also travels the dotted line through the mirror and strikes another surface (not a mirror). The light is reflected from this surface in the solid line back to the mirror, much weaker in intensity because of the nature of the surface. Since the back of the mirror is also a silvered surface, the solid line is reflected on to the eye where it is seen as the image of a cross as projected on the surface. In the final leg of the light's travel, we focus our interest on the object. The light that makes up the image of the object travels the solid line to the eye. Since there is an opening in the mirror, the object is seen as it would normally appear, but through the hole in the mirror. It is in this configuration that proper aiming is achieved. If this explanation is not clear, the next section should clear it up.

Operation

At first glance, the instructions on the

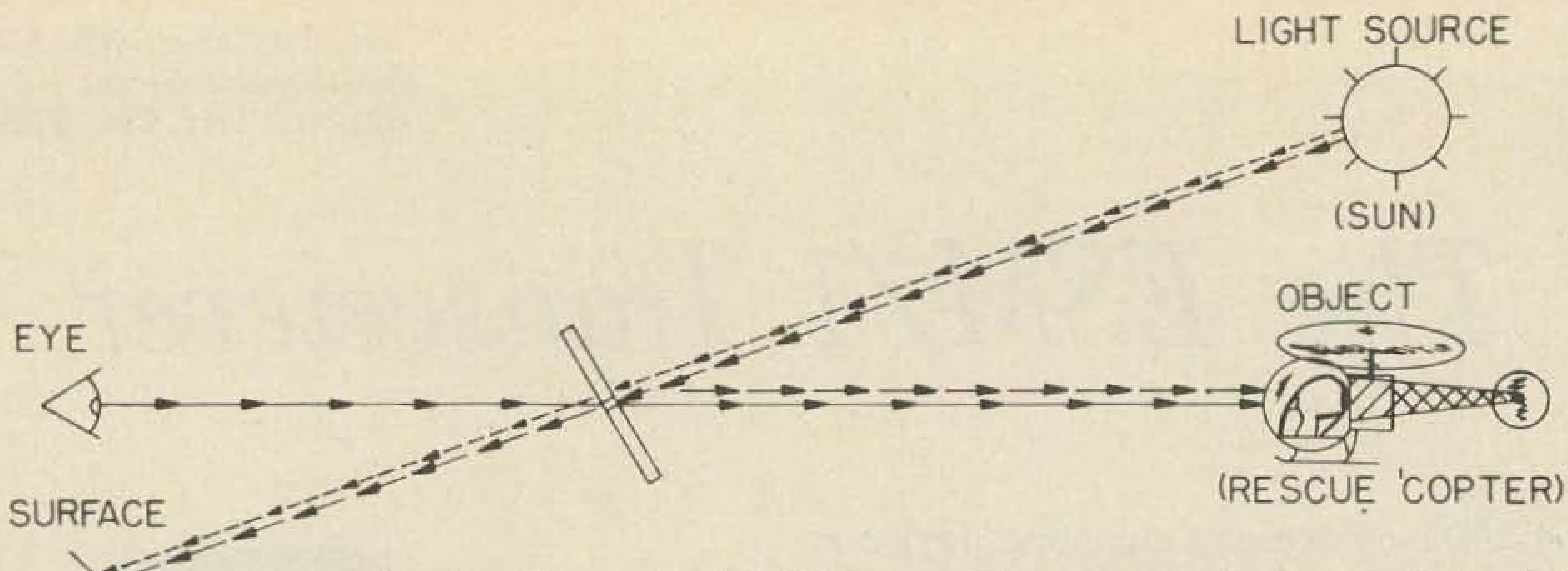


Fig. 2. Mirror Aiming Diagram. The eye sees the image of the hole of the mirror on the hand, the hole in the mirror, and the object, all superimposed on each other.

mirror are not very clear, so some instruction is in order. The first step is to hold the mirror in the sun so that the cross shaped image appears on some surface, usually your hand. Now move your eye around so that the image on your hand is visible in the mirror. Your eye should be about two or three inches from the mirror. As soon as the cross is located, line it up with the cross shaped hole in the center of the mirror. What you see in the distance through the hole in the mirror is where the light is aimed. It is simply a process of lining up the three things; the image of the cross, the cross shaped hole, and the object. Keying can be done by using slow or fast passes over the object to form dashes or dots, respectively. A little practice is required here.

The uses of this device are obvious wherever a highly portable temporary means of communication is required – so long as the sun shines. Microwave or laser paths can be checked for line of sight clearance by this simple method before actual installation of equipment. Since no license is required, anyone can use it. And, if someday you find yourself sitting in one of those little rubber boats with nothing but ocean all around, this mirror may save your life!

. . . WB6BIH

John Kennerdell WA8ZEL
3000 S.O.M. Center Road
Pepper Pike OH 44124

LOW COST TRANSISTOR RF

Semiconductor progress in the past few years has been nothing short of amazing. The transistor has evolved from the 20 milliwatt wonder to a replacement for the 6146. Although basically aimed toward industry, this rapidly advancing technology can be of use to the amateur. One particular field of interest to the ham is that of *rf* power, where often today the transistor proves more economical and practical than the tube. Through proper transistor selection and well-designed circuits, the transistor must no longer take a back seat to the tube for economy.

Transistor Selection

The many merits of the transistor over the tube are well known to every amateur who took part in the great transistor vs. tube disputes a few years ago. But economy was seldom added to the list; "bargain" tubes and cannibalized television sets gave the tube man the edge. The story has changed, though, and today *rf* transistor list prices look a little more appealing. In the $5 and under price range a number of good rf transistors are presently available, as shown in the chart in Table 1. This cross-section of popular types cannot only give you an idea of how much performance to expect for a given amount of money, but it can help with the selection of a type for any desired application.

Two electrical specifications are given on the chart. Both are useful in the selection of transistors, yet often misunderstood. Pt, as might be expected, refers to power. Technically it stands for "the total nonreactive dc power input to all terminals". From this definition it would seem that Pt is the total dc input, and therefore the maximum power input of the transistor. Not so, however, for transistor technology defines power *output* as *negative power input.* In other words, the Pt rating refers to the amount of dc power input *minus* the output power. This corresponds to the plate dissipation of a tube, for it is a rating of the amount of power that can be safely radiated as heat, expressed in watts.

The second rating on the chart, the Ft, concerns the frequency limit of the transistor. "The frequency at which the small-signal foward current transfer ratio extrapolates to unity", the manuals claim. Translated, that's the frequency at which no gain can be realized from the transistor. Of course, we are concerned with frequencies well below this rating, for in the interests of economy a transistor *rf* stage should have reasonable gain, hopefully at least 8 or 9 db. Exactly how far below this frequency the transistor will operate at a moderate efficiency is often difficult to judge.

This "highest practical frequency" depends mainly upon the percentage of efficiency wanted. The 2N2102, for example, has an Ft of 120 MHz, but 50% efficiency cannot be obtained in operation above 10 MHz. Output *is* possible above 10 MHz, but the low efficiency involved makes it impractical from the technical standpoint. At the same time, other transistor types with similar Ft's can operate well above 10 MHz with 50% efficiency. For most HF types a figure of ten percent of the Ft gives a rough estimate of operating frequency. Further specifications of the types listed on the chart, often including practical frequency limits, can be found in manufacturers' guides and manuals. More on obtaining these later.

Assuming that a transistor running class C well below its Ft has a 50% efficiency (which, in most cases, is true), it is obvious that the dc power input of the transistor can safely exceed the Pt. In fact, at 50% efficiency, the dc input can be as much as *twice* the rated Pt. This should be apparent, for if half (50%) of the input is "lost" as output, the remaining half can be safely dissipated.

There is one major disadvantage to increasing a transistor's dc input beyond the rated Pt. If, for some reason, the antenna or load shorts or opens, destruction of the transistor is likely. Having a power input above the Pt and no means of power output, secondary breakdown would take place in the transistor, and failure would be immediate. For the sake of safety most transistor circuits are designed to have the dc power input not exceeding the Pt rating of the transistor. For then, even if the load is interrupted or shorted, the transistor will still be capable of dissipating the entire input.

Another caution concerning maximum power input considers the effect of heat on the transistor. Most Pt ratings are rated at a case temperature of 25° C, or about 77° F. Higher temperatures rapidly reduce the effective Pt. At 30° C, or about 86° F, some types lose as much as 75% of their rated Pt. Although room (ambient) temperatures usually won't be this high, the heat generated by the transistor itself can easily raise the case temperature above 35° C. As the temperature rises the transistor becomes incapable of dissipating the unused input, and thermal runaway takes place.

Destruction of the transistor by thermal runaway can be prevented by the heat sink. With an effective surface area much greater than the transistor's case, the heat sink can radiate enough heat to maintain a safe case temperature. It is important to remember that the heat sink is not meant to *increase* the Pt above its rated value, but only to allow the transistor to dissipate heat and still be capable of its full Pt.

Manufacturers:
MOT: Motorola
GE: General Electric
TI: Texas Instruments

If more than one manufacturer is shown, price indicated is the lowest, and manufacturers are listed in order of increasing price.

Type	Pt W	Ft MHz	Mfg.	Remarks, Features, Similar Types
2N706	1	200	MOT, GE, TI	Very popular HF/VHF osc. and low power amp. TO-18 case. Similar: 2N706A, 2N706B, 2N708
TIS44	1	200	TI	New "Economy Model," plastic case. Similar to 2N706
TIS48	1.2	500	TI	"Economy Model," plastic case. Excellent for VHF. Similar: TIS45, TIS46, TIS47, TIS49, TIS51, TIS52
2N697	2	100	MOT, TI, RCA, GE	One of the earlier rf transistors. Slightly outdated for rf use, but still useful and inexpensive.
2N1491	3	380	RCA	HF/VHF amp. Similar, more power and cost: 2N1492, 2N1493
2N2218	3	250	TI, MOT, GE	Similar, same price: 2N2218A, 2N2219, 2N2219A
2N3118	4	250	RCA	1 W out on 50 MHz.
2N2102	5	120	RCA	HF osc. and amp. Good performance to 10 MHz. High voltage (Vcbo=120V) and tolerant of current surges. Economy version: 2N2270
2N3053	5	100	RCA, MOT	Low cost HF to 10 MHz. Similar: 2N2405
2N3866	5	800	RCA, MOT	One of the best values available for VHF/UHF osc. and amp. 1 W out on 432 MHz.
40392	7	100	RCA	Useful to 12 MHz. Special flanged case
2N3553	7	500	RCA, MOT	Popular HF/VHF power amp. and UHF osc. 3 W out on 144 MHz. Similar: 40280, 40290
2N2631	8.75	200	RCA	An easy 7.5 W out on 50 MHz.

The Circuit

Efficient, clean-sounding transistor *rf* begins in the oscillator. Remember one basic rule: the transistor oscillator is a low power device. Tube tricks, such as 40 watt oscillators, just don't work with transistors. As the power to the oscillator is increased, clean keying and frequency stability are quickly lost.

Shown in Fig. 1. is the typical Pierce transistor crystal oscillator. Two components are of note, base bias resistor R1 and collector tank L1. R1 should be selected for the best keying characteristics. A 5K or

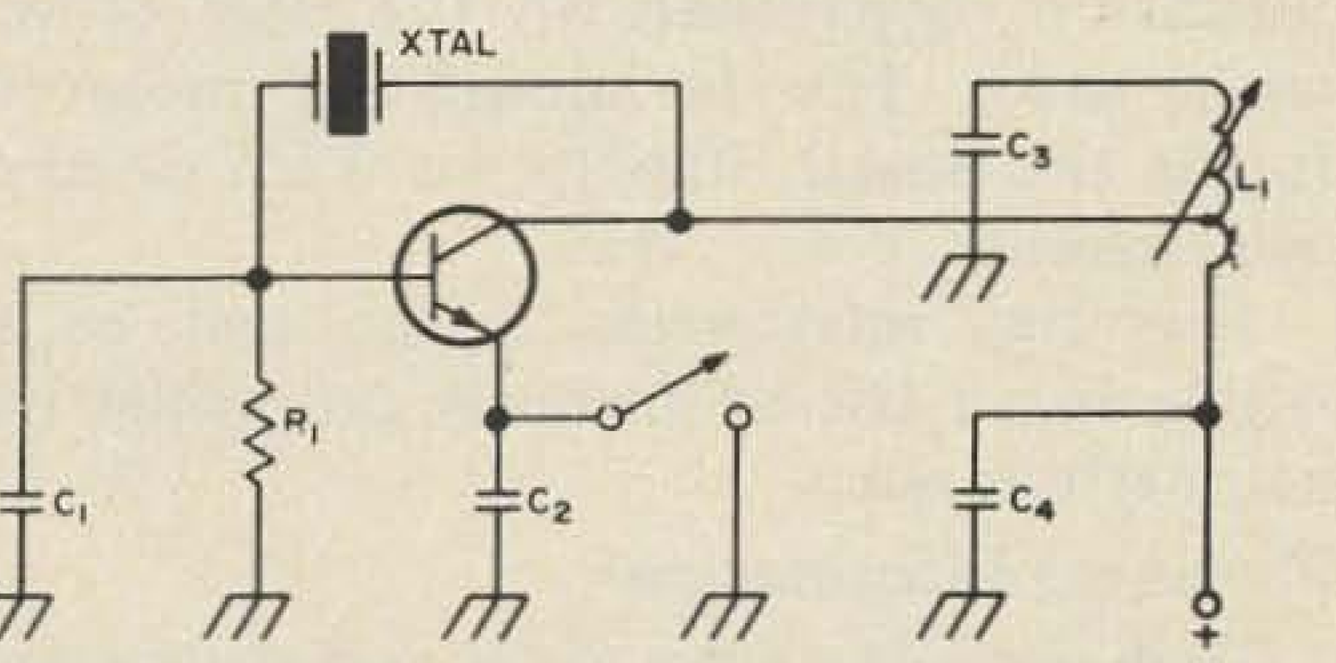


Fig. 1. Typical Pierce crystal oscillator circuit. C_1: feedback capacitor; C_2, C_4: rf bypass capacitors; C_3; output tank capacitor; R_1: base bias resistor (see text); L_1: output tank coil (see text) usually ferrite.

10K pot can be wired in during initial experimentation, adjusted, measured, and then replaced with the nearest fixed-value resistor. The value will usually be in the vicinity of 3K. Values shown in published circuits will seldom require adjustment. L1 should similarly be tuned for the highest output that is consistant with good keying and stability. Even if the oscillator will not be keyed, as in a SSB rig, these adjustments should improve stability.

Stable oscillation in vfo circuits is more difficult than in the simple crystal oscillator. The cost, though, of a simple vfo compares with the price of a few rocks, and the versatility of variable frequency is well worth the extra effort. The Clapp circuit is almost universally used, and for best stability should be well shielded. Many fine vfo designs have appeared recently in 73.

The vxo, or variable frequency crystal oscillator, is a good compromise between the crystal oscillator and the vfo. Shifts up to 25 kHz are possible from a single crystal with rockbound stability.

The simplicity of the typical transistor driver stage is yet another good reason for low oscillator input. Fig. 2 shows all that is actually necessary – an extra tank circuit, transistor, bypass capacitor, and bias resis-

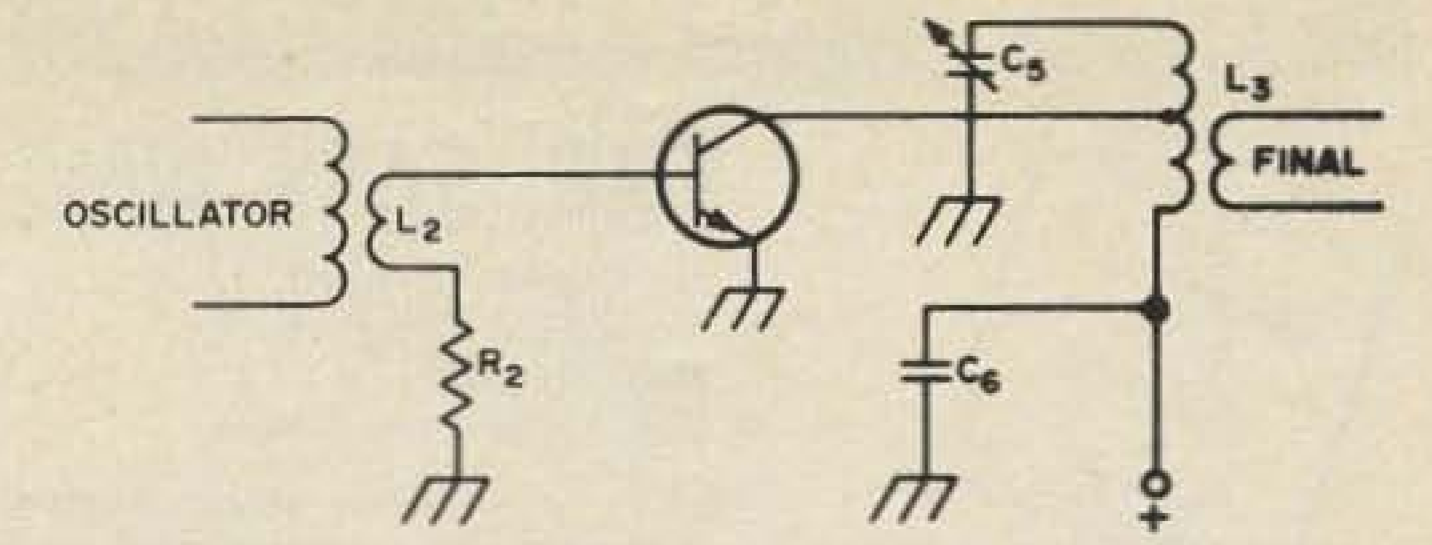


Fig. 2. Typical transistor driver stage. L_2: oscillator link; L_3: output tank coil (see text); R_2: base bias resistor (see text); C_5: output tuning capacitor (see text); C_6: rf bypass capacitor.

tor. In many cases the bias resistor will not be needed, as many transistors are capable of efficient "zero bias" operation. If needed, its value will be very low, and a small (100 ohm) pot can be used to adjust it for maximum power output, as explained above. Unlike the oscillator tank, output coil L3 is usually air-wound for higher efficiency, necessary because of the higher power level found in the driver. Therefore, tank tuning is done by capacitor C5, also tuned for maximum power output.

The selection of the transistor type for the driver is more critical than many builders realize. A type should be chosen that is *incapable of overdriving the final amplifier.* The use of a higher power unit than necessary "cut back" to a low power level is dangerous, and often costly, as meters or lights are usually needed to monitor the drive.

Completing the *rf* line, Fig. 3 is a simple transistor final. Notable here are the paralleled transistors. While some may frown on paralleling in the output stage, it remains an inexpensive method to increase output. An attempt should be made to find two transistors of the same type with similar

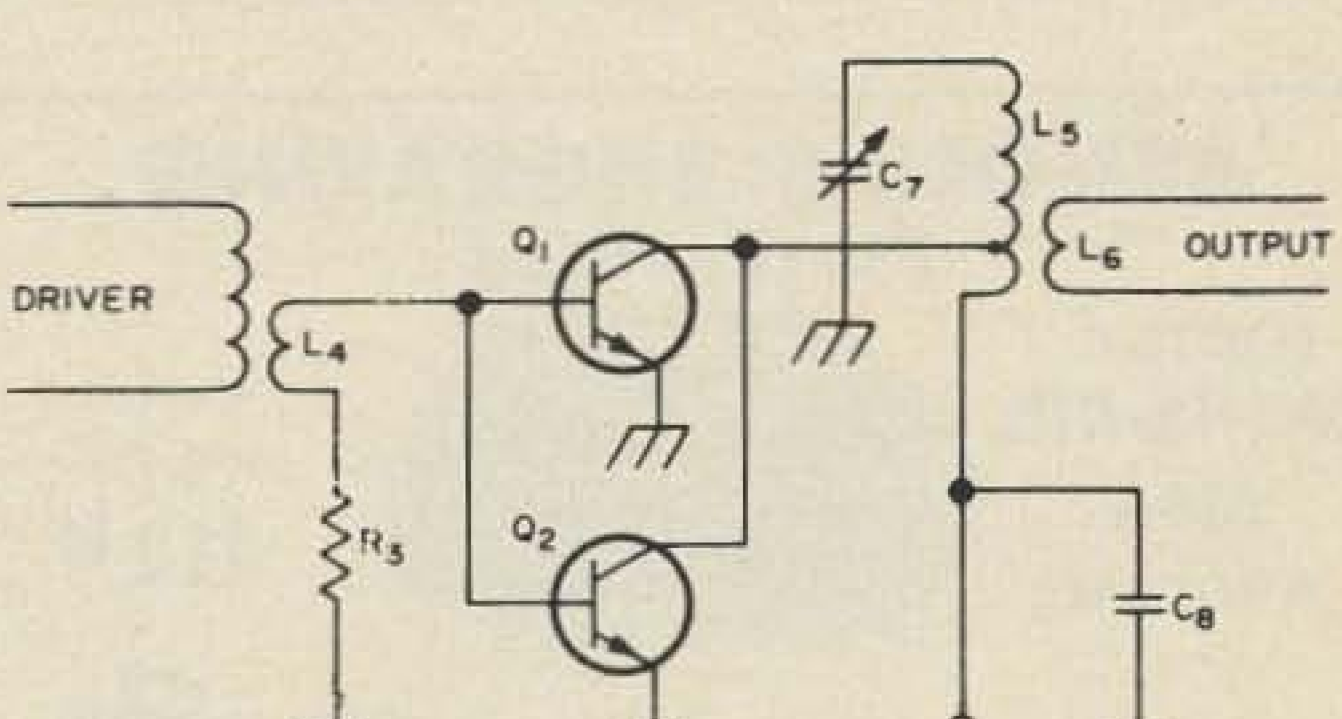


Fig. 3. Transistor output stage. L_4; driver link; L_5: output tank coil; L_6: output link; R_3: base bias resistor (see text); Q_1, Q_2: paralleled output transistors (see text); C_7; output tank tuning capacitor (see text); C_8: rf bypass capacitor.

in-circuit characteristics. Collector current, Ic, is the most important.

Link coupling is shown in the final, as in the other stages, for interstage coupling. Tapped coils can also be used, although with adjustment, links prove more effective.

Bias resistor R3 resembles the driver resistor R2, and all comments apply. This value is not critical, as the resistor serves only to raise slightly the stage's efficiency by creating class C operating conditions.

The final is almost always tuned for maximum output rather than Ic dip. C7 is simply adjusted for maximum meter or light indication, depending on the type of indicator used. The Ic should be monitored during the initial tune-up, to warn of excessive current.

See the references at the end of the article for a list of recently published transistor *rf* circuits.

Obtaining Information

Perhaps one of the most useful all-around guides to semiconductor products is the Allied Electronics Industrial Catalog. Specifications and prices are given for thousands of current types. It can be obtained free on request from Allied Electronics, 100 N. Western Ave., Chicago, Illinois 60680.

Information can also be obtained from the individual companies. Most transistor manufacturers distribute for a few cents product guides or free application notes. For several dollars complete specifications can be found in the large technical manuals.

Transistor *rf* is here to stay. Take advantage of the low cost *rf* available with transistors – today.

. . .WA8ZEL

Selected Articles

W4BRS, "A Toroidal VFO," 73 April, 1967
W1DTY, "An FET VFO for 80 Meters," 73 May 1967
W1DTY, "Designing Transistor Oscillators," 73 August, 1967
W1CER, "A Transistor 5-Watter for 80 and 40," *QST* June, 1967
W1CER, "50 Mc. One Watter," *QST* June, 1967
W1CER, "An Experimental UHF Oscillator,", *QST* August, 1966
K1UBA, "160-Meter 'Solid Status'," *QST* April, 1966
K6RIL, "A Stable VFO for VHF or HF," 73 November, 1966
W1JJL, "The Novice Pair," 73 December, 1966
WØTKX, "Simple R.F. Output Circuitry Design for Transistors," *CQ* January, 1966

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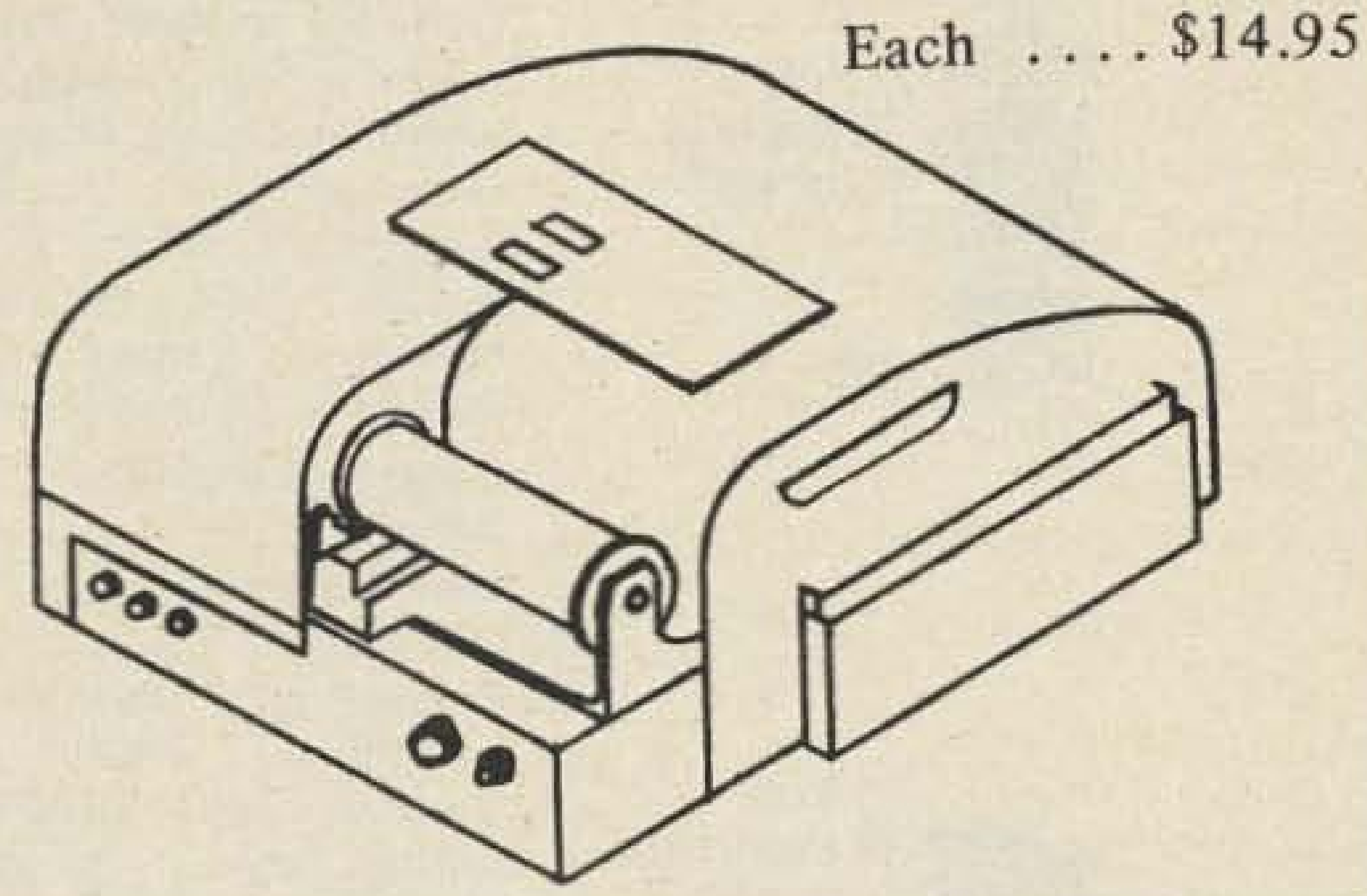

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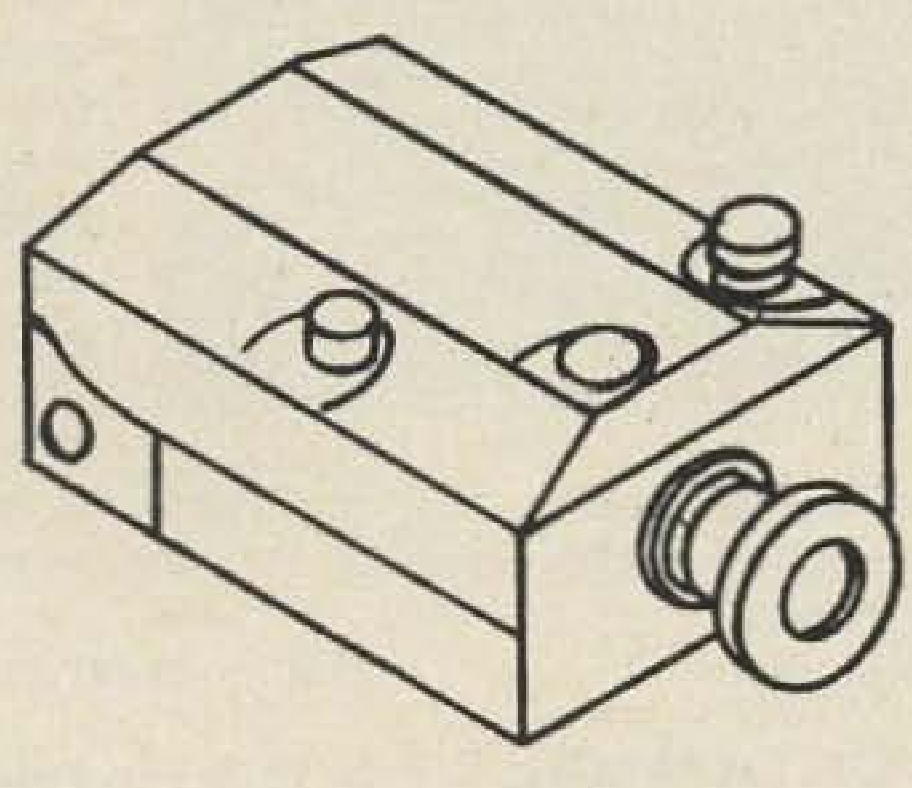

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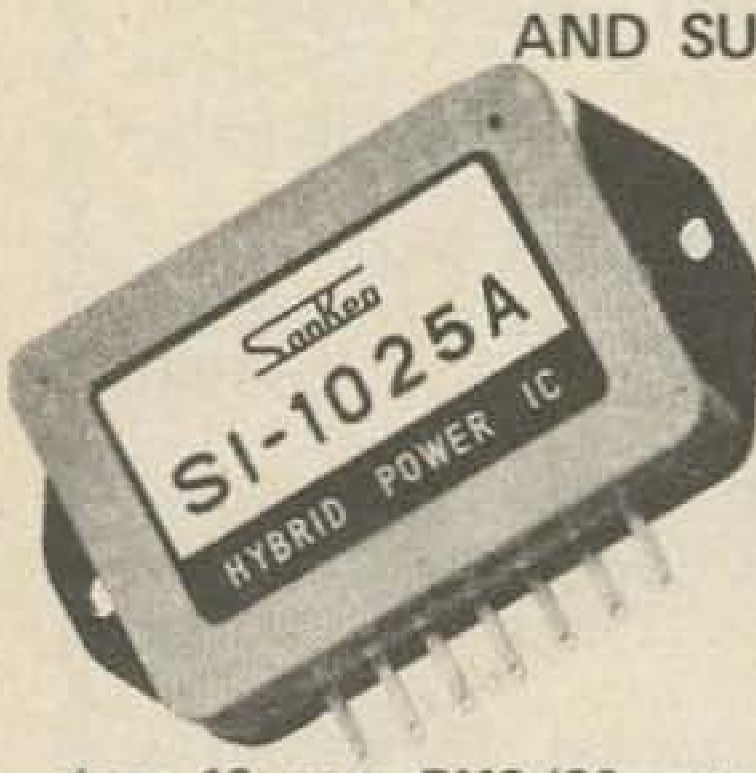

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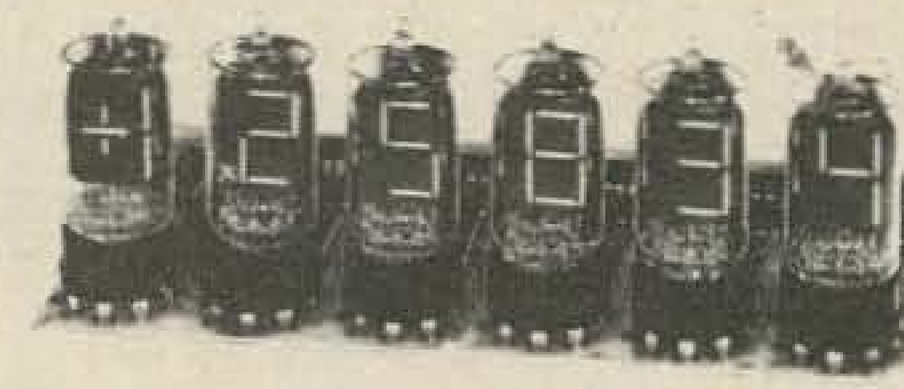

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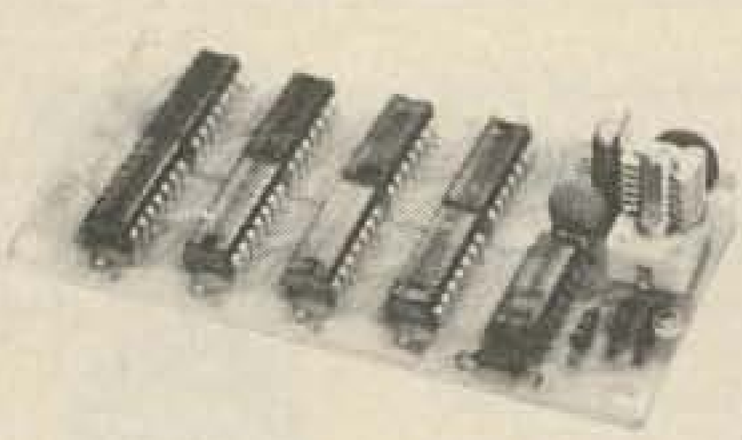

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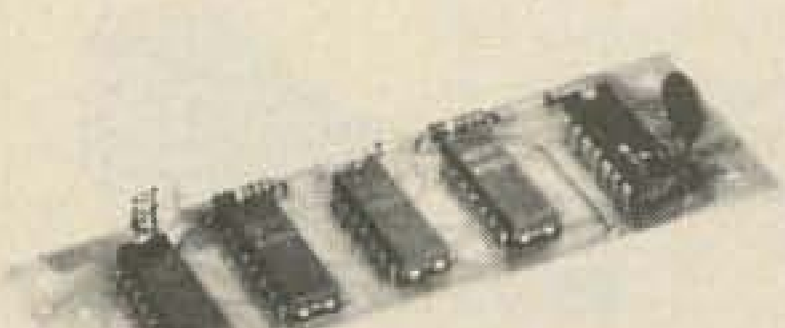

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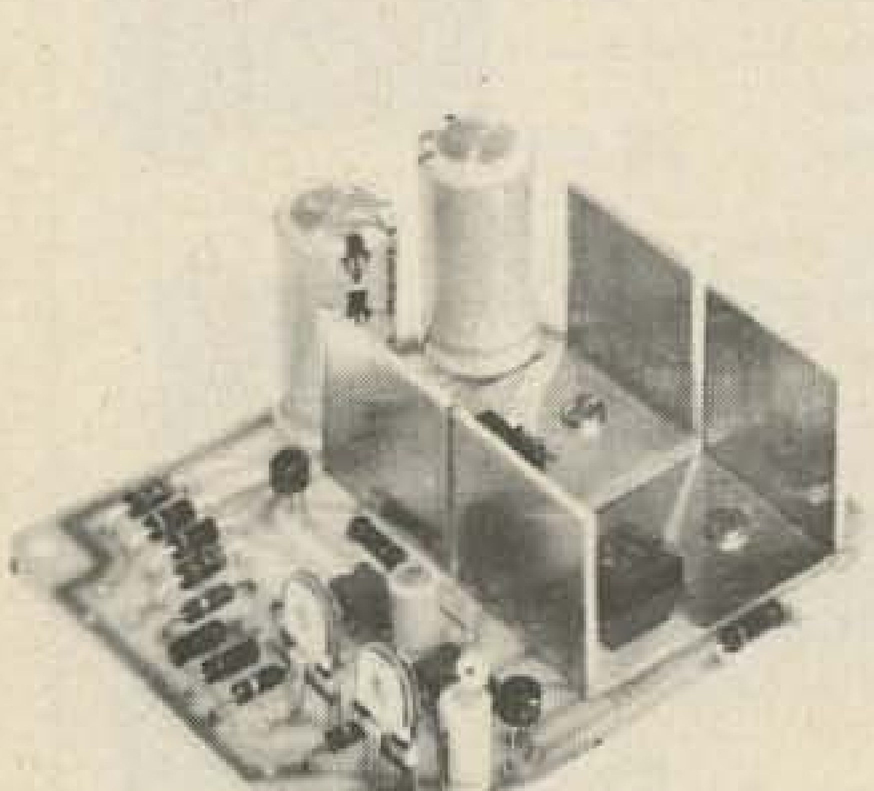

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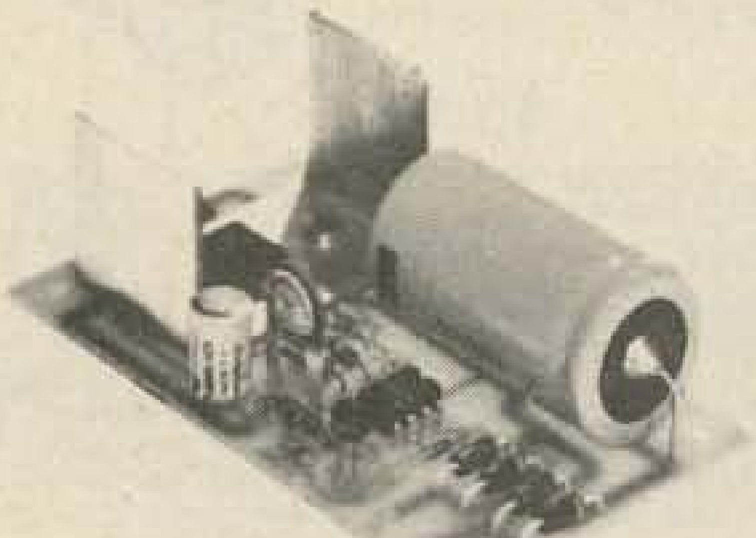

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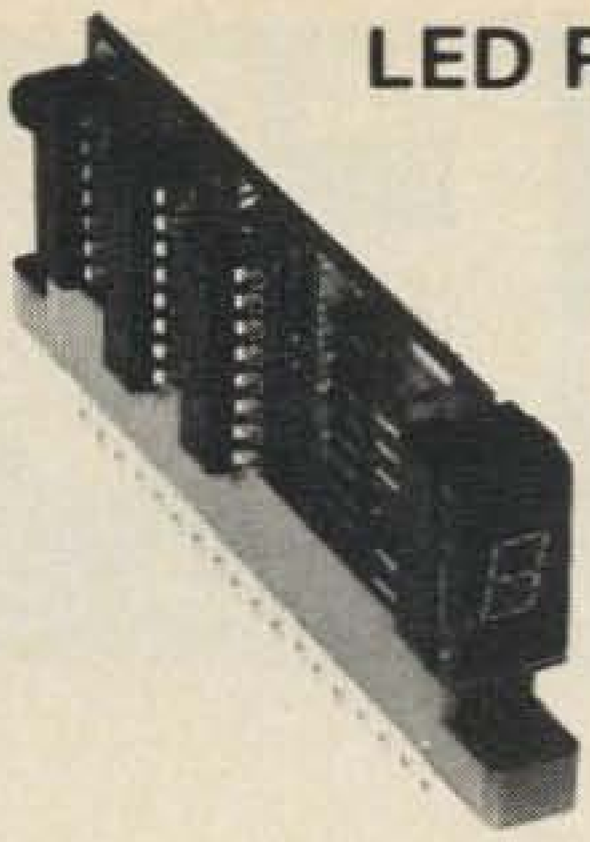

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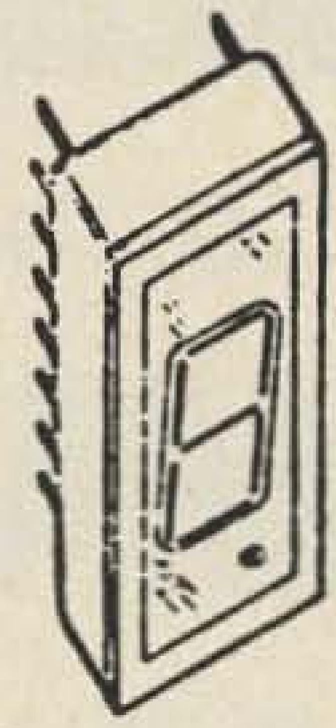


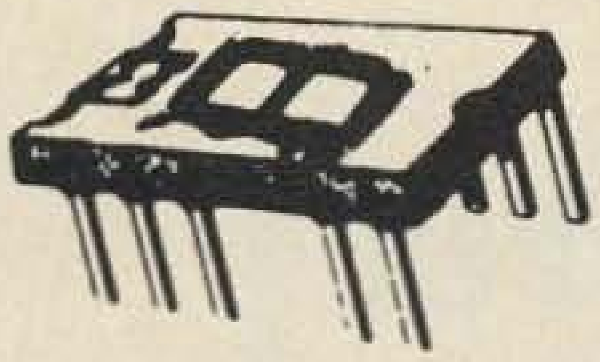
Miniature 7 segment display mounts in 16 pin dual in-line socket. 5V operation at 8mA per segment. 100,000 hr. life. W/decimal pt.

3015 Miniature Display . . .$3.45 . . . . 3/$10.00

LARGER 7 segment display as pictured with the NR-3 series kits. Bright numerals can be seen even in direct sunlight. Mounts in 9 pin miniature socket supplied with the kits.

2010 7 Segment Display . . 0–9 DP $4.45

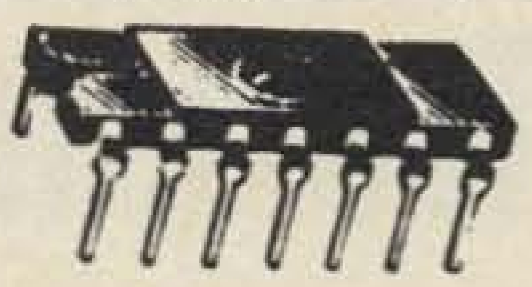
2020 As above except "1" "+" "–" 3.95



LED

Electrically and physically identical to the popular MAN-1. Has higher light output than MAN-1. Includes LH decimal point. W/spec sheet & app information.

LED700 7 Segment LED Display . . . $6.95
[QUANTITY DISCOUNTS AVAILABLE]



RAM

The 1101 Random Access Memory (RAM) will store and readout 256 bits. The chip is TTL compatible and comes with a complete spec sheet w/applications.

1101 256 Bit RAM $8.95

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Build several instruments with this chip and little else. First really useful LSI chip for the experimenter. Contains:

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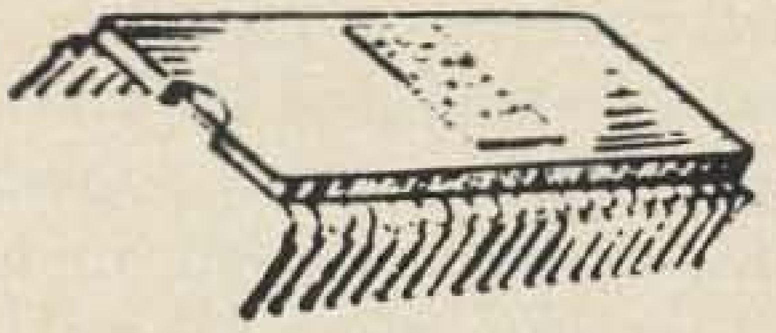
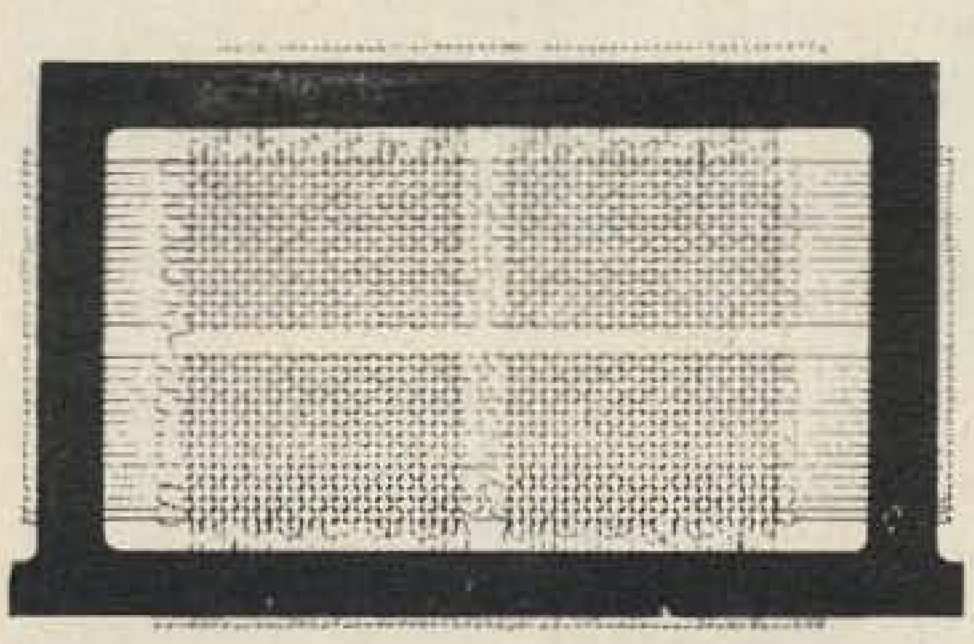


LSI

Comes with 16 p. booklet of specs & app notes. Booklet contains interfacing info on all seven segment displays made.

5002 LSI Chip $24.95

5005 Booklet on 5002 only 1.50



At last! Noncritical memory planes for the experimenter. Made by Ampex for IBM spares. They were removed from NEW core stacks. The large 50 mil cores allow the use of the most inexpensive sense amps. The cores are in an 80x50 array. All the necessary core specs are included with each plane. Available is an 80 page booklet describing an 8 bit x 1000 word memory using the MP-2A. Parts lists, schematics, and app notes are included in the booklet.

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MP-2A 16K Bit Core Stack 47.50

MPB-1 80 Page Core Memory Booklet 10.00

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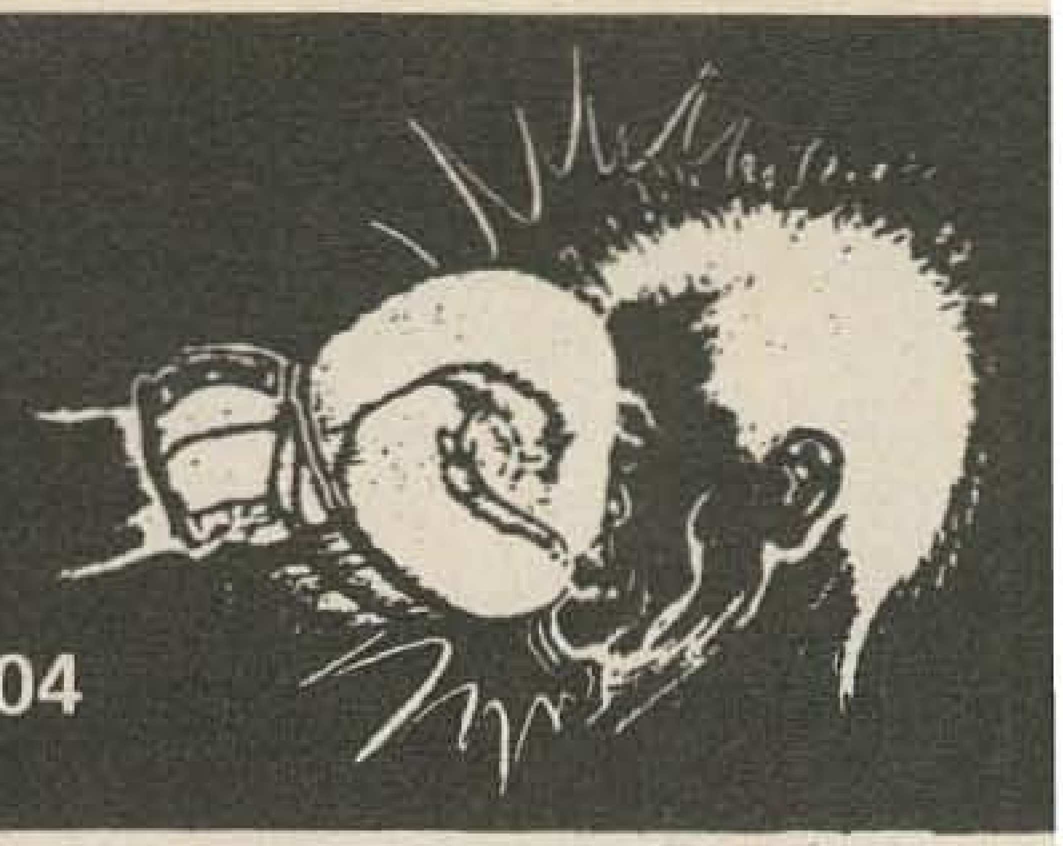

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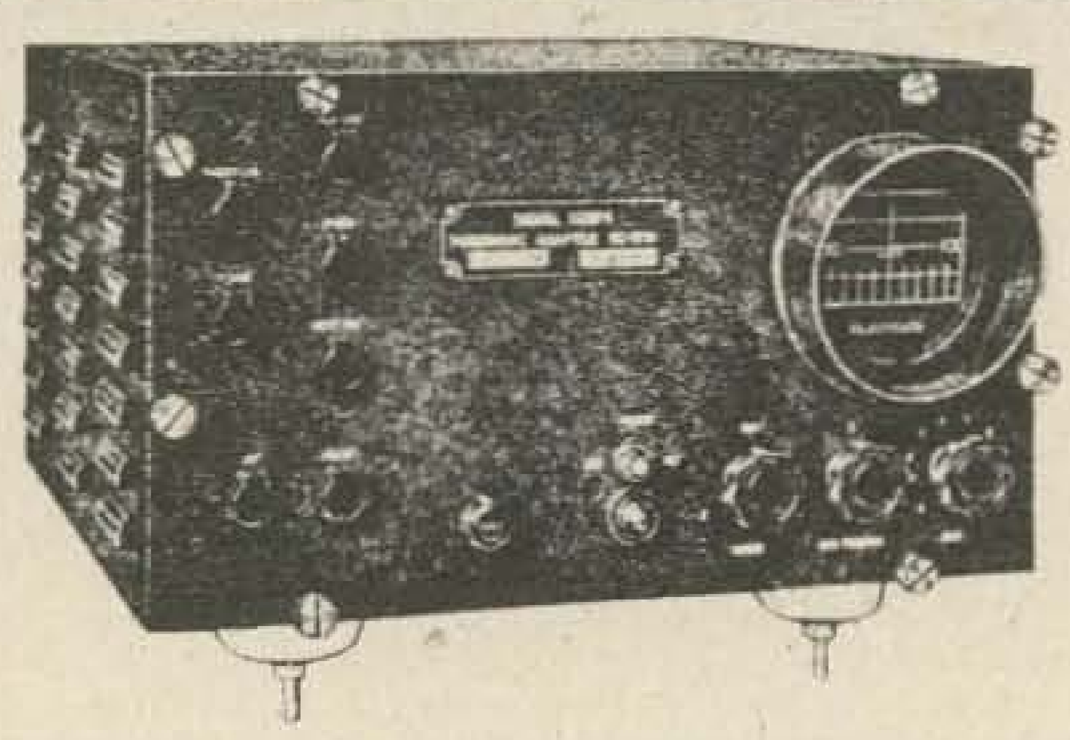

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GR-544B MEGOHM BRIDGE, COMBINATION WHEATSTONE BRIDGE AND VTVM, RANGE 0.1 TO 1M MEGOHMS, FINE FOR LAB $39.00

UPM-6B TRANSPONDER TEST SET, 980-1175MHZ, USE TO MAKE POWER AND SENSITIVITY ON PULSE TYPE EQUIPMENT, FAA APPROVED $175.00

IE-36 TEST SET IN PORTABLE CASE, USED FOR TESTING RECEIVER SENSITIVITY, MODULATION REMOTE SWITCHING, CHANNEL SELECTION CIRCUITS $17.50

ME-11/U TERMALINE RF WATTMETER; MILITARY VERSION OF BIRD 611, 60 WATT DUAL RANGE 0-15/0-60, 30 TO 500MHZ, EXCELLENT FOR AM/FM MEASUREMENT $65.00

SG-299D/U SQUAREWAVE GENERATOR, A WIDE RANGE 1HZ TO 1MHZ CONTINUOUS COVERAGE, USE WITH ANY OSCILLOSCOPE TO DETERMINE FREQUENCY RESPONSE AND PHASE SHIFT CHARACTERISTICS OF VIDEO AND AUDIO AMPLIFIERS, MILITARY VERSION OF HP 211A $39.50

STODDART R.F.I. RECEIVER NM-40A FREQUENCY 30HZ TO 15KHZ, COMPLETE WITH POWER SUPPLY, LESS ANTENNAS $125.00

STODDART URM-6 RECEIVER, SAME AS NM-10A 10-250KHZ, COMPLETE WITH POWER SUPPLY, ANTENNAS AND CABLES, TRIPOD $175.00

BALLANTINE 300 VTVM; 10HZ TO 150KHZ RANGE, 1MV TO 100 VOLTS IN 5 RANGES, LOG ARITHMIC SCALE 1-10DB, ACCURACY 2% $29.50

TS-382/U AUDIO OSCILLATOR, 0 TO 200KHZ, WITH 60 AND 400 CYCLES REED FREQUENCY METER CHECK POINT. A FINE LAB INSTRUMENT $79.50

HP 218A DIGITAL DELAY GENERATOR WITH 219B DUAL PULSE UNIT. HAS VARIABLE GATE GENERATOR FOR WORK WITH DIGITAL COMPUTERS AND COUNTERS, A TIME INTERVAL GENERATOR FOR CALIBRATING TIME BASES, DELAY LINES, RADAR RANGES, AND PRECISION SWEEP DELAYS $750.00

TRACOR CARDIOID UNIT MODEL 612, USED TO MEASURE VLF ENERGY BEING RECEIVED ALONG SHORT GREAT CIRCLE PATH AND LONG GREAT CIRCLE PATH BETWEEN TRANSMITTER AND RECEIVER. AFTER PATH IS SELECTED NORMAL PHASE TRACKING OF VLF ENERGY CAN BE MAINTAINED. FREQUENCY RANGE 10 TO 39KHZ AND 60KHZ, 50 OHMS. ALL SOLID STATE. TAKES 10VDC REGULATED POWER SUPPLY, NOT SUPPLIED. A VERY INTERESTING UNIT FOR VLF EXPERIMENTS. THE OUTPUT OF THE CARDIOID UNIT IS CONNECTED TO THE ANTENNA INPUT CONNECTOR OF ANY VLF RECEIVER $32.50

TS-330/TSM CRYSTAL IMPEDANCE METER FREQ RANGE 1-15MHZ, RESISTANCE RANGE 0-9900 OHMS, CAPACITANCE RANGE 12 TO 110MMF $65.00

TS-592/UPM-15 PULSE GENERATOR PRF 50 TO 10,000PPS, OUTPUT .002 TO 200 VOLTS .25 TO 2500 OHM IMPEDANCE $49.00

TS-148/UPM-33 SPECTRUM ANALYZER - RANGE 8470 - 9630MHZ, SWEEP WIDTH 10-30MHZ VARIABLE, FREQUENCY SWEEP 40-50MHZ IF BANDWIDTH 50KHZ. PERFECT FOR ANY RADAR WORK $95.00

TS-505/U VTVM: 0-250VAC, 0-1000VDC, 0-1000M OHM RESISTANCE MEASUREMENT, AC FREQUENCY RESPONSE 30HZ - 500MHZ, HIGH INPUT IMPEDANCE, PORTABLE RUGGEDIZED CONSTRUCTION COMPLETE WITH PROBE $65.00

TS-723/U DISTORTION ANALYZER, 20HZ TO 20KHZ FREQUENCY RANGE, MEASURES DISTORTION DOWN TO .1%. BUILT-IN VTVM WITH FULL SCALE READING OF .03 - 300V RMS. DB: −30 to +50. MILITARY VERSION OF HP330B $175.00

HP524D BASE FREQ 10HZ TO 10MHZ 8 DIGIT VERTICAL READ-OUT, 525 SERIES PLUG-INS EXTEND RANGE TO 510MHZ $295.00
FREQUENCY CONVERTER PLUG-INS FOR HP524 B, C, D, USM-26, FR-38, AND NORTHEASTERN:
- HP-525A 10-100 MHZ $69.50
- HP-525B 100-220MHZ $85.00
- HP-525C 100-510MHZ $195.00
- HP-526A VIDEO AMPLIFIER $85.00
- HP-526B TIME INTERVAL PLUG-IN $65.00
- HP-526C PERIOD PLUG-IN $65.00

HP540B TRANSFER OSCILLATOR 10MHZ TO 12.4GHZ, EXTENDS FREQUENCY MEASUREMENTS WHEN USED WITH COUNTERS COVERING 100-200MHZ $245.00
GERTSCH FM-3, RANGE 20-1000MHZ, .001% ACCURACY. WILL ALSO GENERATE SIGNALS OVER THIS RANGE $165.00
GMQ-20 WIND SPEED AND DIRECTION RECORDER, RECORDS WIND SPEED 0-120 KNOTS AND DIRECTION THROUGH 360 DEGREES, ON CHART, 115V/60CY $27.50

STRIPPER SPECIALS

FOR THOSE WHO LIKE TO STRIP OUT EQUIPMENT FOR RESISTORS, CAPACITORS, TUBES SOCKETS, TRANSISTORS, CHOKES, HARDWARE, WIRE, CHASSIS, CIRCUIT BOARDS, WE HAVE SELECTED A GOOD ASSORTMENT OF MILITARY SURPLUS EQUIPMENT LOADED WITH COMPONENTS FOR STRIPPING. YOU WILL HAVE MANY HOURS OF ENJOYMENT; GUARANTEED TO SATISFY YOU. ORIGINAL COST IN THE THOUSANDS. 100 LB. ASSORTMENT SHIPPED PRE-PAID MOTOR FREIGHT FOR .... $32.50. GOOD IN USA ONLY.

SIGNAL GENERATORS

TS-413/U 75KHZ TO 40MHZ IN 6 BANDS, PRECISE CALIBRATION FROM 1MHZ CRYSTAL OSCILLATOR HAS % MODULATION METER, CW OR AM 400/1000CPS VARIABLE 0-50% AND RF LEVEL METER 0 TO 1.0V. IDEAL FOR AMATEUR, MARINE, AIRCRAFT AND HOBBYIST FOR IF AND RECEIVER-TRANSMITTER ALIGNMENT, OR DEVELOPMENT WORK $89.50
SG-557/URM-52B 3800 THRU 7500MHZ, 115V/60CY MILITARY VERSION OF HP618B $245.00
TS-418/U 400 TO 1000MHZ, AM, CW, PM, POWER OUTPUT 1MW. A POPULAR SET WITH THE FM SHOPS FOR UHF WORK $225.00
TS-497/URR, 6 RANGES 2 TO 400MHZ, MILITARY VERSION OF MEASUREMENTS MODEL 80, 0.1 TO 100,000MV $175.00
SG-12/U, FM, 20 to 100MHZ, USED BY MILITARY FOR ALIGNMENT OF GRC FM EQUIPMENT. PERFECT FOR LOW BAND FM WORK $275.00
SG-1A/ARN WITH PP-348, MILITARY VERSION OF THE BOONTON 211A, COVERS 88 TO 140MHZ, A POPULAR UNIT IN ALL AIRCRAFT RADIO SHOPS $650.00
TS-403/U 1800-4000MHZ ±1%, CW, FM, PM, PRR 40 TO 40,000 PPS, POWER OUTPUT 1MW, 0 TO −127DBM, VARIABLE VOLTAGE OUTPUT .1 TO 224,000MV, MILITARY VERSION OF HP 616A $245.00
SG-47/URM-16 10MHZ TO 440MHZ in 12 BANDS. CALIBRATE OUTPUT 0.5MV TO 10,000MV, 50 OHMS, INTERNAL MODULATION AM/FM 400 TO 1000CY, EXTERNAL 20 TO 20,000CY. 0.5% ACCURACY, .002% WITH INTERNAL CRYSTAL CALIBRATOR $345.00
AN/URM-25, 10KHZ TO 50MHZ IN 9 BANDS INTERNAL MODULATION 0-50%, 100-15,000CY; OUTPUT VOLTAGE 0.1MV-0.1 VOLT, 50 OHM LOAD, AM/CW ACCURACY .5%, 12 POSITION ATTENUATION SELECTOR $225.00
TS-419/URM-64, 900 TO 2100MHZ, CW/PM OUTPUT 0 TO −120 DBM, .2MV INTO 500 OHMS, PRR 40 TO 4,000 PPS. DELAY TIME 3 TO 300 USEC. SIMILAR TO HP 614A AND ARC H-12, IDEAL FOR RADIO, RADAR, AND TRANSPONDER WORK $225.00
AN/URM-35, 4,450 TO 8,000MHZ, CW/PM USED TO CHECK BROAD BAND RADAR RECEIVERS, ANTENNA TRANSMISSION LINES AND INDICATORS $37.50
AN/URM-26, 4MHZ TO 405MHZ IN 6 BANDS, AM/CW/MCW/PM, MODULATION 0 TO 50%, INTERNAL 400 TO 1,000CY, EXTERNAL 100 TO 20,000CY, RF OUTPUT .1 TO 100,000MV INTO 50 OHMS, ACCURACY .5% $225.00

ATTENTION: LINEAR AMPLIFIER BUILDERS

B & W 850A PI-NET INDUCTOR, DESIGNED FOR 80-10 METER AMATEUR BANDS, PLATE LOAD IMPEDANCE 2500-5000 OHMS, USED FOR SINGLE AND PARALLEL FED TUBES, SERIES FED CIRCUITS, 813, 4-125, 4-400, 4-1000 - RATED 1000 WATTS, NEW FACTORY BOXED $59.50
B & W 852 PI-NET INDUCTOR, DESIGNED FOR 80-10 METER AMATEUR BANDS, PLATE LOAD IMPEDANCE 2000-4000 OHMS, USED FOR SINGLE OR PARALLEL TUBES, SERIES OR SHUNT FED CIRCUITS. 3-400Z, 3-500Z, 3-1000Z, 4CX1000A ETC., RATED 1000 WATTS, NEW FACTORY BOXED $59.50
30 AMP GROUNDED GRID FILAMENT CHOKE, BIFILAR TYPE 1/2" x 7 1/2" LONG, USE WITH PAIR OF 4-250A, 4-400A, 3-400Z, 3-500Z, 813's, OR SINGLE 4-1000A, 3-1000Z $8.50
JENNINGS UCS 10-300MMFD VACUUM VARIABLE CAPACITOR 7.5KV WITH GEAR DRIVE TRAIN AND MOUNTING BRACKET. POPULAR FOR LINEAR BUILDING $29.50
NEW FACTORY EIMAC YELLOW BOXED TUBES, FACTORY GUARANTEED:
- EIMAC 3-400Z $36.00
- EIMAC 3-500Z $36.00
- EIMAC 3-1000Z $85.00
- EIMAC 4-400A $49.00
- EIMAC 4-400C $58.00
- EIMAC 4-1000A $130.00
- EIMAC 4CX-1000A $195.00
- EIMAC 4CX1500A $200.00

EIMAC SK-510 SOCKET 3-1000Z, 4-1000A $10.50
EIMAC SK-410 SOCKET 3-400Z, 3-500Z $10.50
EIMAC SK-650 SOCKET 4X150A, 4CX250B, NO SCREEN BY-PASS $12.00
EIMAC SK-620 SOCKET 4X150A, 4CX250B, HAS SCREEN BY-PASS $14.00
EIMAC SK-516 CHIMENY FOR 3-1000Z $12.00
EIMAC SK-416 CHIMNEY FOR 3-400Z, 3-500Z $7.00
EIMAC SK-626 CHIMNEY FOR SK-650, SK-620, 4X150A, 4CX250B $2.00
EIMAC HR-6 HEAT DISSIPATING PLATE CAP FOR 4-65A, 4-125, 4-400 ETC. $2.20
EIMAC HR-8 HEAT DISSIPATING PLATE CAP FOR 3-1000Z, 4-1000A $2.85
SEND NEEDS FOR OTHER EIMAC TUBES AND SOCKETS.

572B/T160L TUBES BY CETRON, NEW FACTORY BOXED AND GUARANTEED $16.50

MISCELLANEOUS EQUIPMENT

AN/PRS-3 MINE DETECTING SET IN SHIPPING CASE, A POPULAR UNIT USED FOR LOCATING RELICS AND LOST ITEMS. CAN BE USED AROUND SALT WATER AND IRON SOIL, GIVES METER READING AND TONE. TAKES STANDARD BATTERIES, NOT SUPPLIED, ORIGINAL COST OVER $800.00. HAVE FUN WITH THIS; SPECIAL AT $59.50
PANORAMIC INDICATOR IP-259/U, MILITARY VERSION OF SB-8A TYPE T-200, 400-600KHZ IF INPUT, 5 INCH CRT, COMPLETE WITH PS-8 115V/60CY POWER SUPPLY $119.00
CV-89/URA-8 RTTY AUDIO TYPE CONVERTER, A POPULAR UNIT WITH BUILT-IN SCOPE. WORKS WITH ANY MACHINE $125.00
TT-4A/TG ARMY TELETYPEWRITER, KSR, 60WPM. 115V/60CY. A GOOD MACHINE, TABLE TOP SIZE PAGE PRINTER AND KEYBOARD $49.00
PP-840/TRA-19 POWER SUPPLY $16.50

ORDER TODAY, OR REFER TO THIS ADVERTISEMENT DURING 1972. ALL EQUIPMENT EXCELLENT CONDITION F.O.B. ELLENTON, FLORIDA. SATISFACTION GUARANTEED OR MONEY REFUNDED! IMMEDIATE SHIPMENT. WRITE OR PHONE 813-722-1843, BILL SLEP.

Slep Electronics Company

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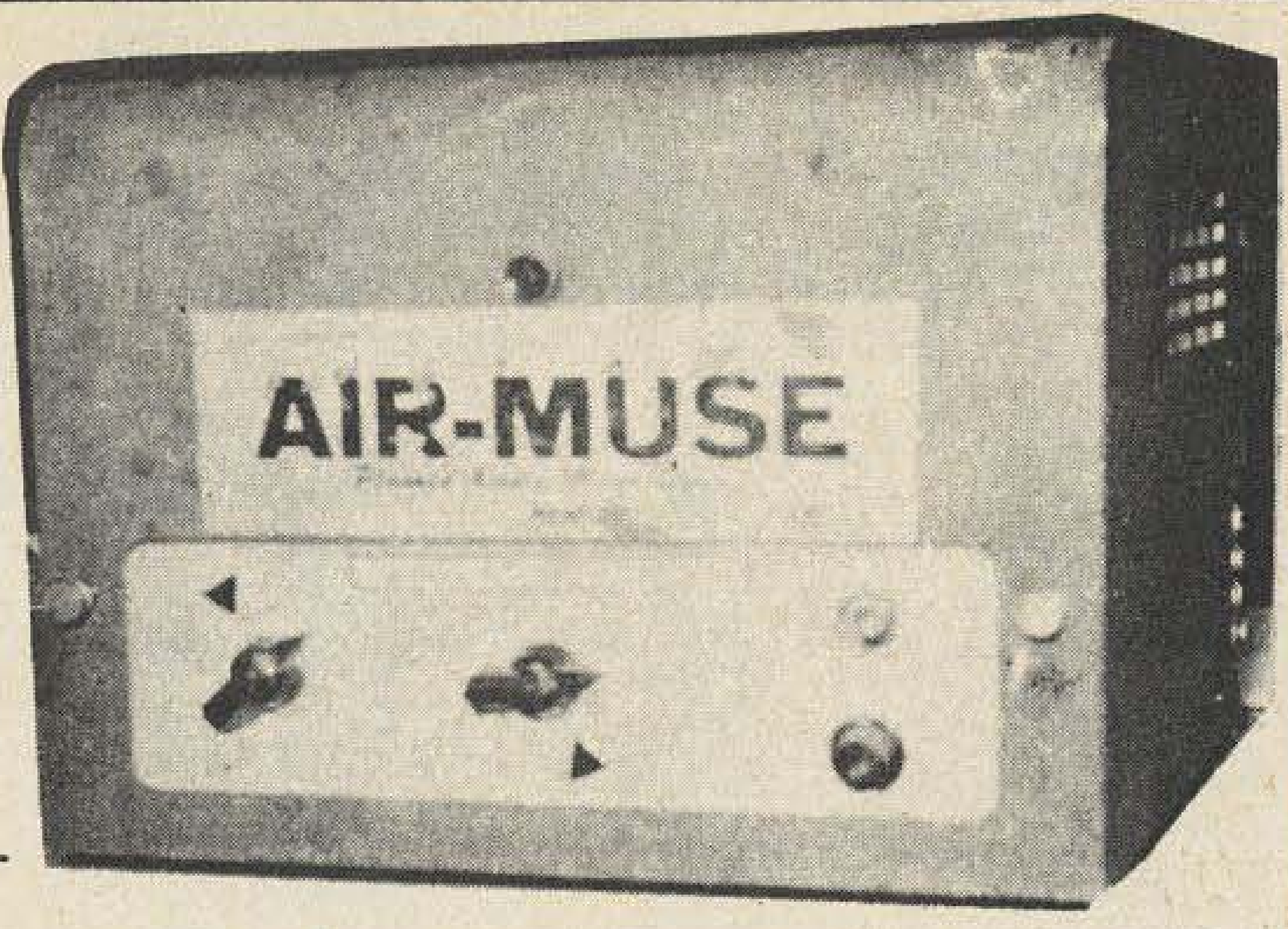
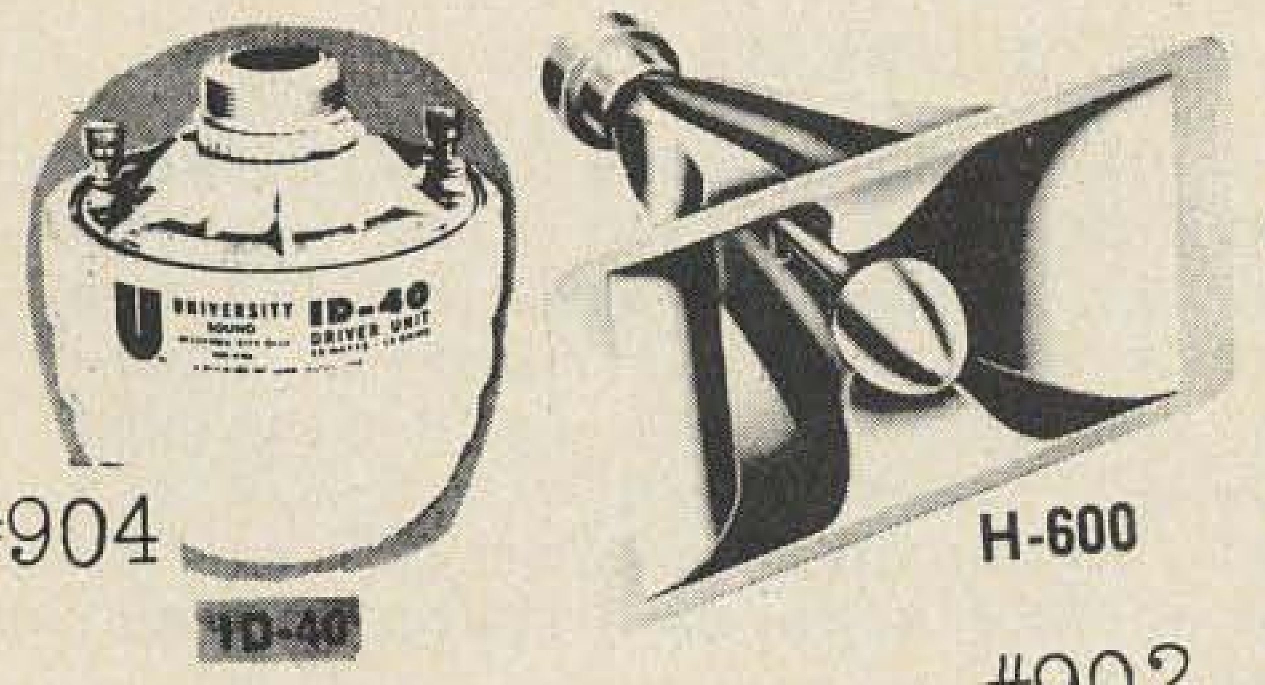


971 D3

Only $24.50 for these background music FM Receivers & Audio Amplifiers.



#904 H-600 #902

971 D4 UNIVERSITY Sound

Speakers, Trumpets & Drivers at bargain prices.

SURPLUS CATALOG

CONRAC 971 N1

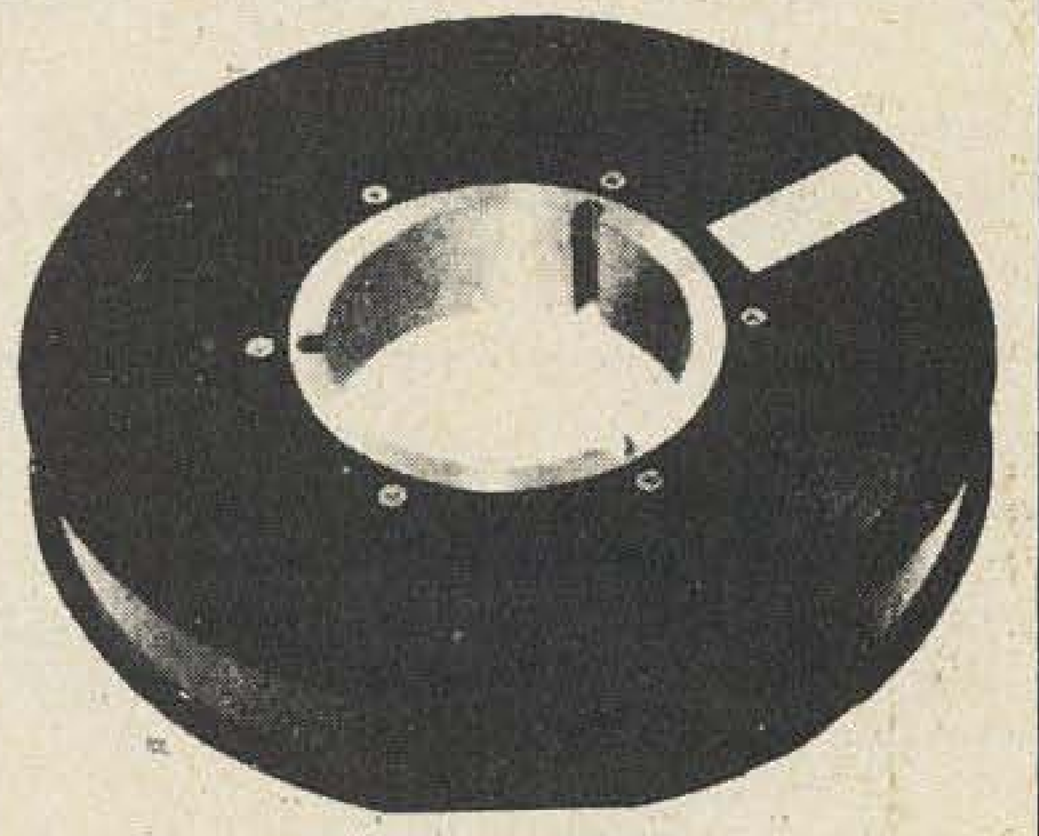
Special on Conrac 17" & 25" high resolution monitors.

971 M3 mti

INDUSTRIAL TYPE MONITORS

PROFESSIONAL TRANSISTORIZED VIDEO MONITOR at close-out prices.

971 S1



New Video Tape for helical scan recorders 1" 1 hr. $34.95.
1/2" 1 hr. $24.95
1/2" 3/4 hr. $19.95
Plus bargains in zoom lenses, etc.
Video Distribution Amplifiers for 5 channels - new Only $89.95.

All of those who are interested in amateur TV as well as commercial video systems should be on our mailing list. A copy of above flyers will be mailed free upon request until stock is exhausted.

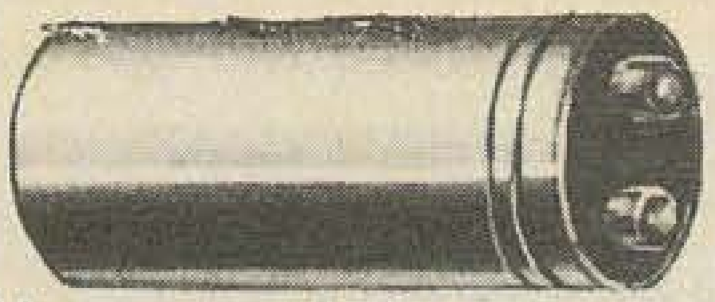
WAREHOUSE SALE May 6&7, 1972 - details flyer 972 #2

THE DENSON ELECTRONICS CORPORATION

P.O. Box 85 (Longview Street), Rockville, Conn. 06066 Tel (203) 875-5198

SURPLUS CATALOG

COMPUTER GRADE ELECTROLYTIC CAPACITORS



MFD, BY SPRAGUE, MALLORY & SANGAMO

MFD.	VOLT	SIZE
25,000	6	2x4-1/2
66,000	6	2-9/16x4-3/4
40,000	7	2x5
15,000	10	2x4-1/2
15,500	10	2x4-1/2
74,000	10	3-1/16x5
15,000	12	2x4-1/2
11,500	18	2x4-1/2
2,300	33	2x4-1/8
3,500	52.8	2x4-1/8
3,500	55	2x4-1/2
6,000	55	2x4-1/2
3,100	75	2x4-1/2
3,750	75	2x4-1/2
800	99	2x4-1/8
750	165	2x4-1/8
1,250	175	2x4-1/2
500	200	2x4-1/2
300	275	2x4-1/8
250	330	2x4-1/8

PRICE $.75 EA

OIL FILLED CAPACITORS

MFD	VOLT	H	W	D	PRICE
2	1000	4	1-3/4	1	$1.25
4	2500	4-1/4	4-1/2	3-3/4	3.95
.25	3000	2-1/2	2-1/2	1-3/16	2.35
1	4000	5-1/8	3-3/4	2-1/4	4.75
.5	5000	4-1/2	3-3/4	2-1/4	2.95

PLASTIC FILM CAPACITORS

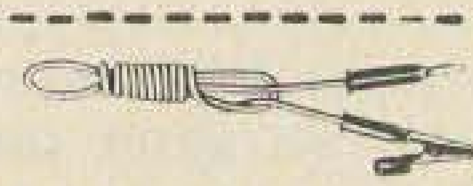
GLASSMIKE ASG-503-2M. .05 UF - 2000 VDC. 3/4" DIA x 1-3/4. AXIAL STUD $.35

GUDEMAN GC-246R202K. .002 UF - 7500 VDC. 3/4" DIA x 2". AXIAL LEADS $.70

AIR VARIABLE CAPACITOR
MFR. HAMMARLUND

5 PF TO 50 PF. GEAR REDUCTION ON SHAFT FOR THAT FINE TUNING OF YOUR VFO ETC. $.75

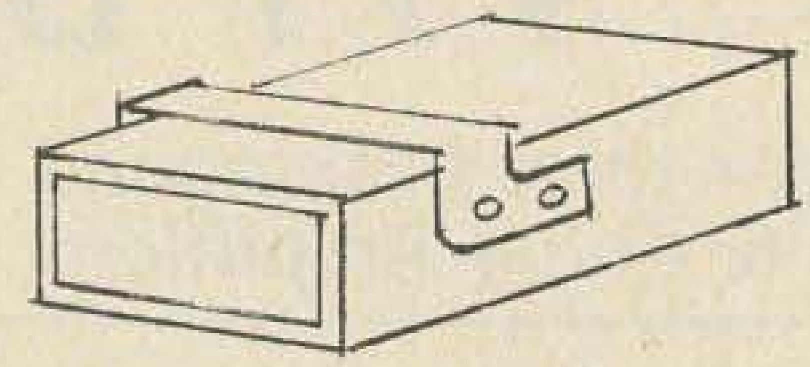
TEST LEADS



4 FT LONG, RED TEST PROD WIRE. WORKING VOLTAGE 10,000 INSULATED BANANA PLUG ONE END, MUELLER TEST CLIP OTHER $.45

ULTRA MINIATURE 2 GANG VARIABLE CAPACITOR
MFD. MONARCH

#CV-200. MAXIMUM CAPACITY, ANTENNA-148.1 UUF. OSCILLATOR-65.2 UUF. TRIMMER CAPACITOR EFFECTIVE VARIABLE CAPACITANCE-6 UUF. $.35



CB CASE & CHASSIS

22 GAUGE STEEL CASES WITH SLIDE IN CHASSIS. ORIGINALLY MADE FOR CB RADIOS. FRONT OPENING ROLLED FOR NEATER APPEARANCE. SLOTTED VENTILATION OPENINGS ON EACH SIDE (NOT SHOWN). SIZE 3-3/4"H x 8-3/4"D x 7"W. PANEL OPENING 6-1/4" x 3". MAY BE HAD WITH OR WITHOUT MOUNTING BRACKET.

WITH BRACKET $3.25
WITHOUT BRACKET $2.45

COILED CORD (MICROPHONE)
MFR. BELDEN

#8497. 3 CONDUCTOR WITH 1 CONDUCTOR SHIELDED. AWG STRANDING 23(21x36). O. D. 1/4". EXTENDS FROM 11-1/2" TO 6'. NEOPRENE JACKET. $.95

UNETCHED PRINTED CIRCUIT BOARD

THICK	SIZE	COPPER CLAD	PRICE
.0055	8x8-1/2	1 SIDE	$.32 EA
.006	8x8-1/2	2 SIDE	.32 EA
.007	10x14	2 SIDE	.80 EA
.010	11x16	2 SIDE	.88 EA
.017	12x17	2 SIDE	.99 EA
1/32	8x10	1 SIDE	.52 EA
1/8	8x10	1 SIDE	.95 EA
1/8	8x10	2 SIDE	$1.10 EA

TUNING METER
MFR. GENERAL ELECTRIC
TYPE DW-33

DIAL CALIBRATED IN 7 DIVISIONS, WHITE ON BLACK FACE. METER READS TUNE FOR MAXIMUM. MOVEMENT - 0 TO 4.2 MA. BUILT IN SOCKET FOR DIAL LIGHT. FLUSH MOUNT. 2-1/8" DIA. $.95 EA

GERMANIUM DIODE: PRV 20, FWD 50 MA 25/$1.00

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Minimum Order $5.00
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BONUS SALE! NEW LOW, LOW PRICES!

free 810 operational amplifier (dual) DIP w/data for all prepaid orders of $10. or more. .... **$1.25 value**

FREE 810 op-amp and one LM309K 5 volt 1 amp. power supply module (TO-3) with prepaid orders of $25. or more .... **$3.75 value**

With prepaid orders for $50. or more you get the $25. bonus plus ten per cent discount on all items purchased.

EPOXY TRANSISTORS

Popular numbers, all factory-marked with 2N-type numbers. Guaranteed minimum of 40 pieces of TO-5 and TO-18 mixed. Untested, but sampling indicates over 85% good.

approximately 1-ounce—40+ transistors **for only $1.89**

DIGITAL SPECIAL

Ten brand new (on carriers) dual-in-line JK flip-flops—LU321 with data sheet and two pages of application notes describing hookups for—divide by three through ten, and twelve. Also self correcting ring counter hookups, etc.

10 LU321 W/data $5.00

TTL dual-in-line

7400, 7401, 7402, 7404, 7405, 7410,
7420, 7430, 7440,
7450, 7451, 7453 .... ea.$. 30
7441 BCD decoder driver 1.40
7442 BCD decoder 1.40
7473 dual JK flip-flop .... .65
7474 dual type D FF .... .50
7475 quad latch 1.40
7476 dual JK FF .... .65
7480 gated full adder .... .80
7483 4 bit full adder 1.60
7486 quad exclusive or gate .... .65
7489 64 bit RAM 4.00
7490 decade counter 1.40
7491 8 bit shift register 1.40
7492 divide by 12 counter 1.40
7493 4 bit binary counter 1.40
74154 one of 16 decoder 3.00
74192 up/down decade counter 2.25
74193 up/down binary counter 2.00
74195 unv. 4 bit SR 1.40
8220 parity gen/checker 1.00
8242 4 bit comparator .... .90
8280 preset decade counter 1.40
8281 preset binary counter 1.40
8520 25 MC divide by "N"
2 to 15 .... 2.00
7495 4 bit SHIFT REGISTER 1.40
8590 8 bit shift register 2.00
8270 4 bit shift register 2.00

LINEAR SPECIAL

Ten (10) Teledyne TO-5 741 operational amplifiers with a two-page sheet of application notes covering the basic circuits using op-amps .... $.75 each

Op-amp package 10-741's, data sheet and application notes .... only $7.00

DIGITAL COUNTER MODULE 30MC

unit includes board, SN7490, SN7475 quad latch, SN7447 7-segment driver and RCA "numitron" display tube W/decimal. 1" x 4.5" module will mount on 1" centers.

kit $12 — wired and tested $15

LED Red Emitting Lamp .... .60

LINEAR IC's (dual-in-line)

709 operational amplifier .... .50
710 voltage comparator .... .75
LM309K 5V-1A
power supply module 2.50
LM100 positive voltage reg. .... .80
747 dual 741 op amp DIP 1.25
LM302 voltage follower op-amp 1.25

All IC's are new and fully tested — leads are plated with gold or solder. Orders for $5 or more will be shipped prepaid. Add 35¢ handling and postage for smaller orders. California residents add sales tax. IC orders are shipped within two workdays of receipt of order — kits are shipped within ten days of receipt of order. Money back guarantee on all goods sold.

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P. O. Box 242 Jacksonville Fla.

TECH MANUALS

This is a sample listing of our stock. Some are one of a kind, many we have in stock in large quantity. We also have hundreds of others not listed.

All manuals listed are originals, not copies, and 99% are brand new, unused.

ALA-2	HSI	6.00
ALR-5	HSI	9.00
ALR-8	HSI	13.00
APA-5a	HSI	8.00
APA-6	HSI	8.00
APA-11	HSI	7.50
APA-16	HSI	8.00
APA-17	HSI	9.00
APA-17a	HSI	9.00
APA-56	HSI	15.00
APA-81	HSI	7.00
APA-89	HSI	7.00
APA-125	IPB	7.50
APG-30	HSI	
APM-74		
APQ-2a		
APR-1		
APR-2		
APR-4		
APR-5		
APR-6x		
APR-9		
APR-12		
APR-13		
APS-2		
APS-3a		
APS-4		
APS-19a		
APS-20a,c		20.00
APS-20e	IPB	20.00
APS-31+	HMI	25.00
APS-33+	HMI	25.00
APS-42b	HMI	30.00
APS-44	HMI	40.00
APS-45+	HMI	30.00
APS-88+	HMI	30.00
APT-2	HMI	7.00
APT-5	HMI	
APX-1		
ARB		
ARC-5		
ARC-5		
RT58		
ARC-12 (R-11)		
ARC-19		
ARC-27		
ARC-27		12.00
ARC-28	HMI	7.00
ARC-30	HMI	8.00
ARC-38	HMI	10.00
ARC-38	IPB	10.00
ARC-39	HMI	10.00
ARC-48	HMI	16.00

ARC-51	HMI	10.00
ARC-52	HMI	10.00
ARC-52	IPB	10.00
ARC-55	HMI	9.00
ARC-94	HMI	9.00
ARC-119	HMI	9.00
ARC-120	HMI	9.00
ARM-5	HMI	7.00
ARM-10	HMI	
ARM-19		
	IPB	10.00
	HMI	9.00
ARW-56	HMI	9.00
ASA-13	HSI	19.00
ASA-13	IPB	20.00
ASB-3	HMI	7.50•
ASQ-8	HMI	15.00
ASQ-10	HMI	15.00
ASQ-17	HMI	
ATA/ARA		
ATB		
		8.00
	IB	9.00
	IB	8.00
GP-6,7	IB	8.50
LAE-1	IB	8.00
LAF-2	IV	8.00
LM-2	IB	8.00
LM-7	IB	8.00
LM-13	IB	8.00
LM-14	IB	10.00
LM-16	IB	10.00

LM-17	IB	8.00
LM-18	IB	10.00
LP-3	IB	10.00
LR	IB	
LR-1		
LR-2		
		10.00
	IB	10.00
RDG	IB	8.00
RDR	IB	8.00
RDR-1	IB	12.00
RDZ	IB	12.00
REJ	IB	7.50
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S U R P L U S C A T A L O G

NONLINEAR RESISTORS

Hank Olson W6GXN
P. O. Box 339
Menlo Park CA 94025

E=IR, or so Ohm's Law says, and we generally accept Herr Ohm's word for it. But there is a fairly large class of resistors for which Ohm's Law doesn't hold true: that is, for which a given voltage change *does not* cause a proportional current change. Such resistors are called nonlinear resistors.

"What, resistors that don't obey E=IR? It sounds like an enemy plot to upset our electronics defense industry," bellows the angry citrus county ham. Well, no; there's no plot; in fact, read on, old patriot. We'll see that nonlinear resistors are very useful to our electronics industry.

In a minor way, nearly every resistor is a nonlinear one. That is, every resistor has *some* variation of resistance with temperature. If current is passed through it, power (I^2R) is dissipated in the resistor, which changes the temperature of the resistor and thus its resistance. However, most resistors used in electronic circuits are designed to minimize resistance change with current, so that the assumption that each one has a constant resistance is a good approximation. The newer metal-film resistors bring the concept of a noninductive, linear resistor very close to realization.

The types of nonlinear resistors we'll be concerned with here are light bulbs, thermistors, Thyrite varistors, and similar devices. The light bulb is often called a barretter, a category which also includes small electrical fuses when used as circuit elements.

Let's take the light bulb first, since it is the most familiar to most of us. If we plot a curve of voltage versus current as was done in Fig. 1 (for a small 120V Christmas tree lamp), one immediately can see the nonlinearity of the device. The E-I plot of Fig. 1 is typical for light bulbs, and several important facts can be observed about it. The light bulb has a positive resistance coefficient; that is, as current increases, the resistance *increases*. Also, one will notice that (for normal temperature environments, where humans and electronics operate together) the greatest nonlinearity occurs at only a few percent of the normal operating voltage of the lamp.

Several other facts can be learned by more careful measurement. First, the lamp

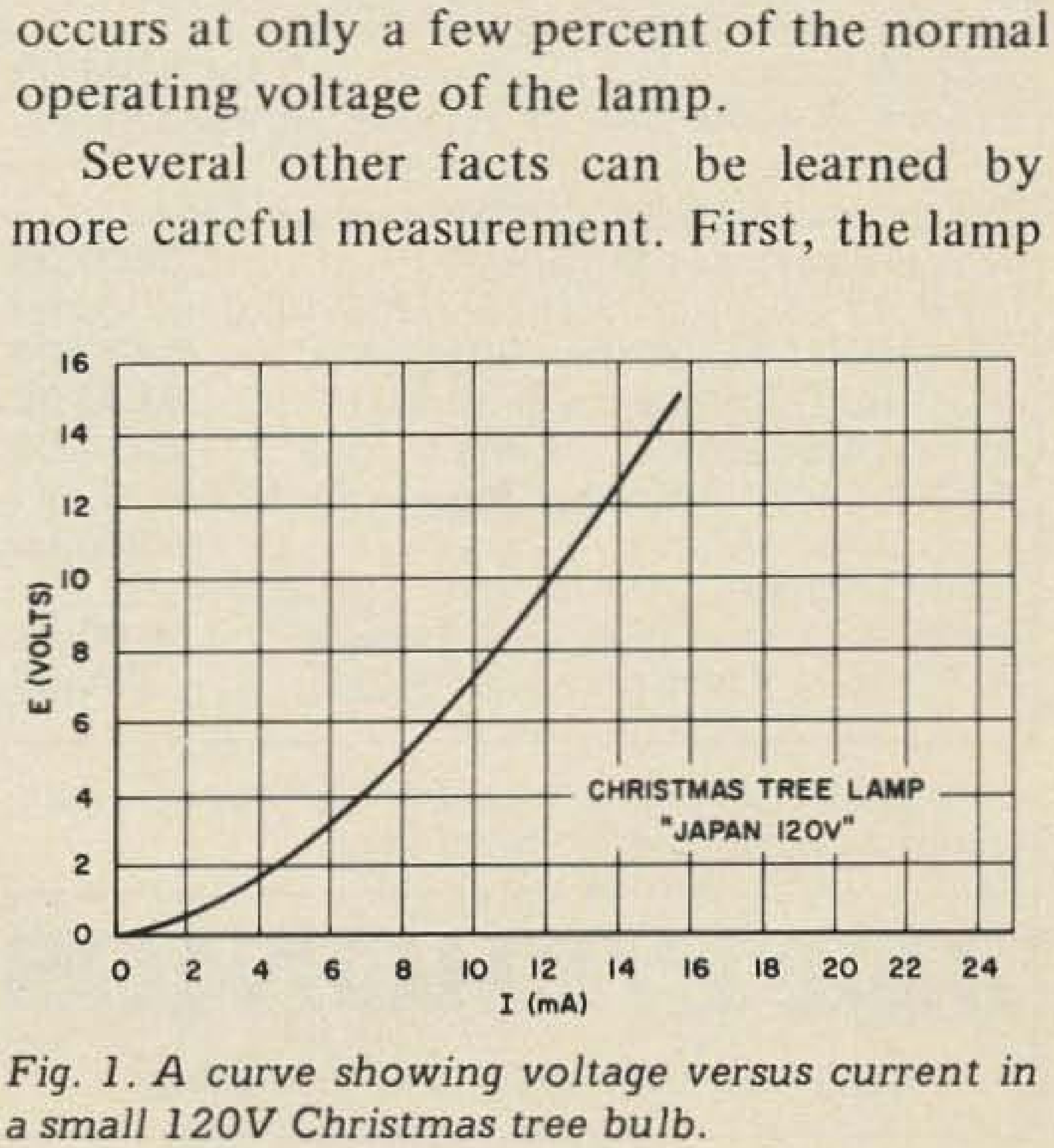


Fig. 1. A curve showing voltage versus current in a small 120V Christmas tree bulb.

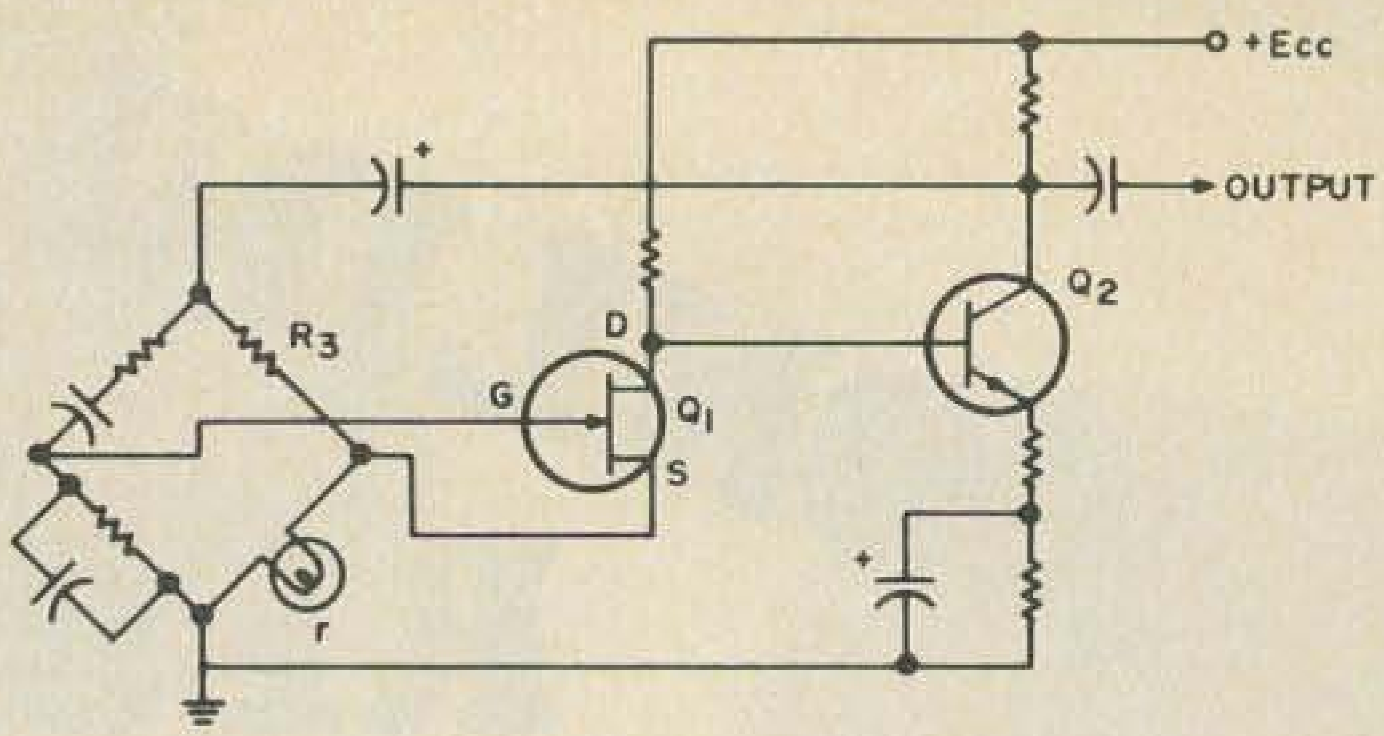


Fig. 2. The light bulb as a nonlinear amplifier as used in the Wien bridge oscillator.

has a time constant; that is, it will follow only slow changes in current. For our 120V bulb of Fig. 1, this time constant is of the order of one-half second. Secondly, at any point on the curve, if we shine a second incandescent lamp (operating at its nominal 120V) directly on the lamp under measurement, the measured current will decrease.

Perhaps the best known application of the light bulb as a nonlinear resistor is its use in the popular Wien bridge audio oscillator, as shown in Fig. 2. The left side of the bridge provides *positive* feedback to the gate of Q1, allowing oscillation to occur around this two-stage circuit. The right side of the bridge provides *negative* feedback to keep the amplitude of oscillation constant.

If the audio oscillator is initially operating satisfactorily (in class A), a change of operating conditions which increases output will increase the audio voltage across R3 and r. The increase in voltage across r increases the resistance of this nonlinear resistor, which decreases the gain of the Q1 stage, restoring our original operating condition.

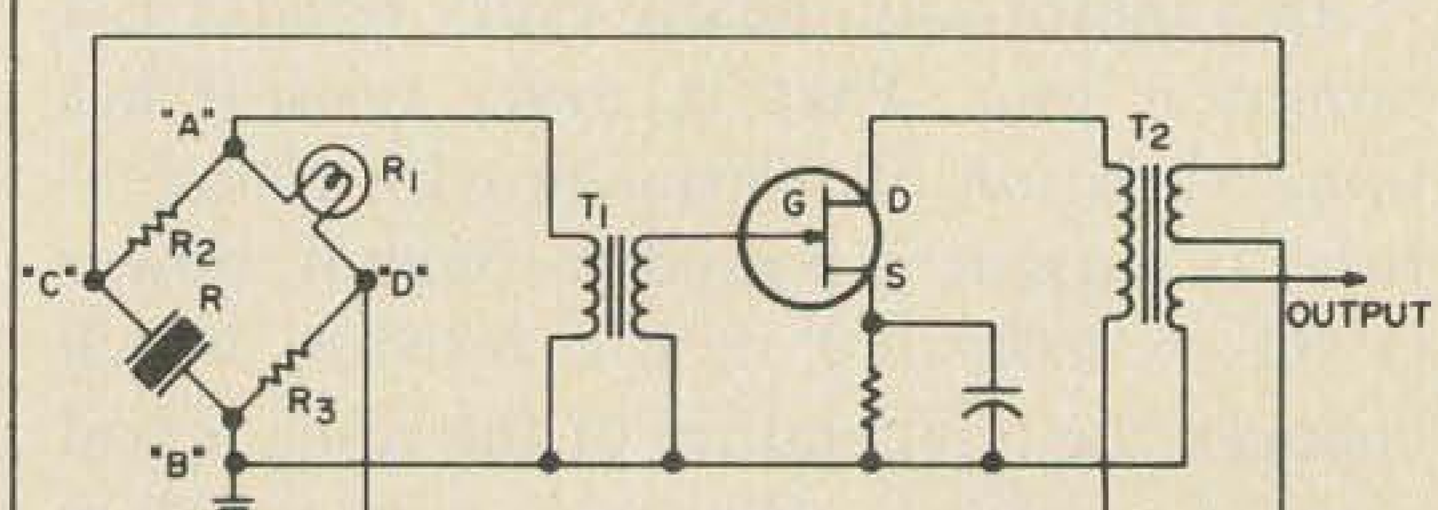


Fig. 3. A lamp as a stabilizer in the Meacham bridge crystal oscillator.

There is one consideration in Wien bridge design, however, that sometimes isn't appreciated: The time constant of r must by large compared to the period of the lowest frequency of oscillation. This is necessary so that the resistance of r is only dependent on the rms value of output voltage, and does not vary at the audio

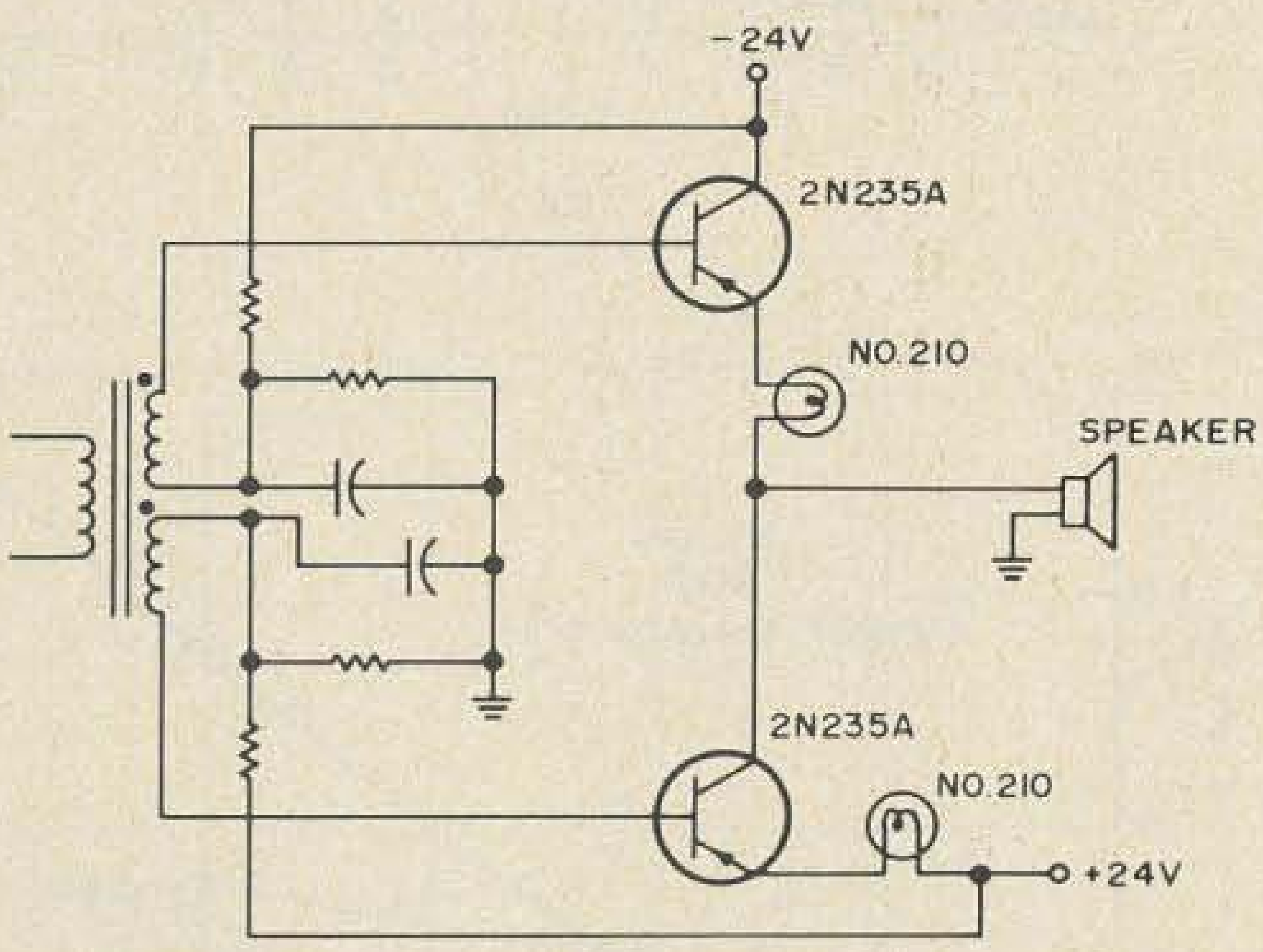


Fig. 4. Two lamps in a pseudo-complementary output stage.

frequency rate. Bulb time constant can be a problem at 10 Hz, the lower range of some audio oscillators; this is one of the reasons that (large) 120V 6W bulbs are used in many audio oscillators.

Another oscillator which uses a lamp as a stabilization device is the Meacham bridge crystal oscillator. The elementary form of the Meacham bridge is shown in Fig. 3. Since this oscillator is a narrowband device, transformers can be used for matching and phase inversion.

The bridge is balanced when the point-to-point ac voltage is zero. In perfect balance, the Meacham bridge will not oscillate. But when a slight unbalance is present, typically 1%, oscillation occurs. The lamp is positioned in the bridge in such a way that an increase in its resistance will adjust the bridge *toward* balance.

The best choice of bridge values occurs when $R=R_1 = R_2=R_3$. Since R (the series resistance of the crystal) is determined by the crystal supplier, we have very little control of this parameter. Starting with R, we must then find a lamp which offers the same resistance (R_1). The resistance R_1 must equal R at a point on the E-I curve of the lamp where resistance is changing rapidly and this value of E x I should also be approximately the value of power we expect to dissipate in the crystal in operation.

Since, in the previous two examples, the light bulb was used as a measuring device (measuring rms voltage or current), why couldn't it be used as an rf monitor? Lamps *can* be used as barretter elements at frequencies where their inductance is small compared to their resistance. The resistance of the element is then measured with an audio frequency bridge, the rf circuit (including the barretter leg) being decoupled by rf chokes and capacitors.

Because of the "loop" construction of most lamps, the inductance of a lamp is a severe limitation on usefulness at higher frequencies. The instrument fuse, however, because of its size and axial construction, is much more easily used as a barretter element. The 3AG or 8AG fuse is easily placed in a coaxial system for measurement of power. For years, standard 1/200 amp and 1/100 amp Littlefuses have served as barretter elements in power measurements up to 4000 MHz.

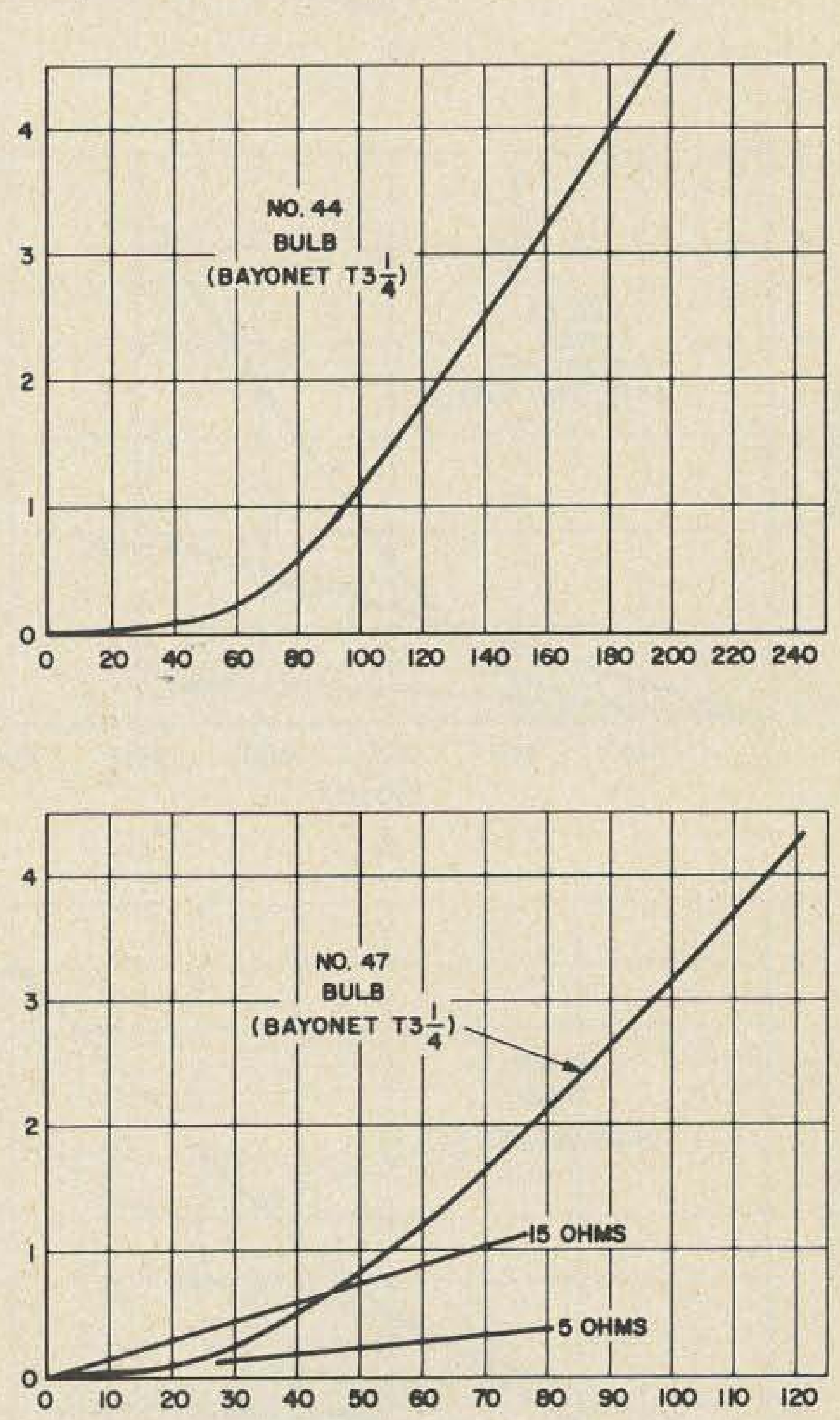
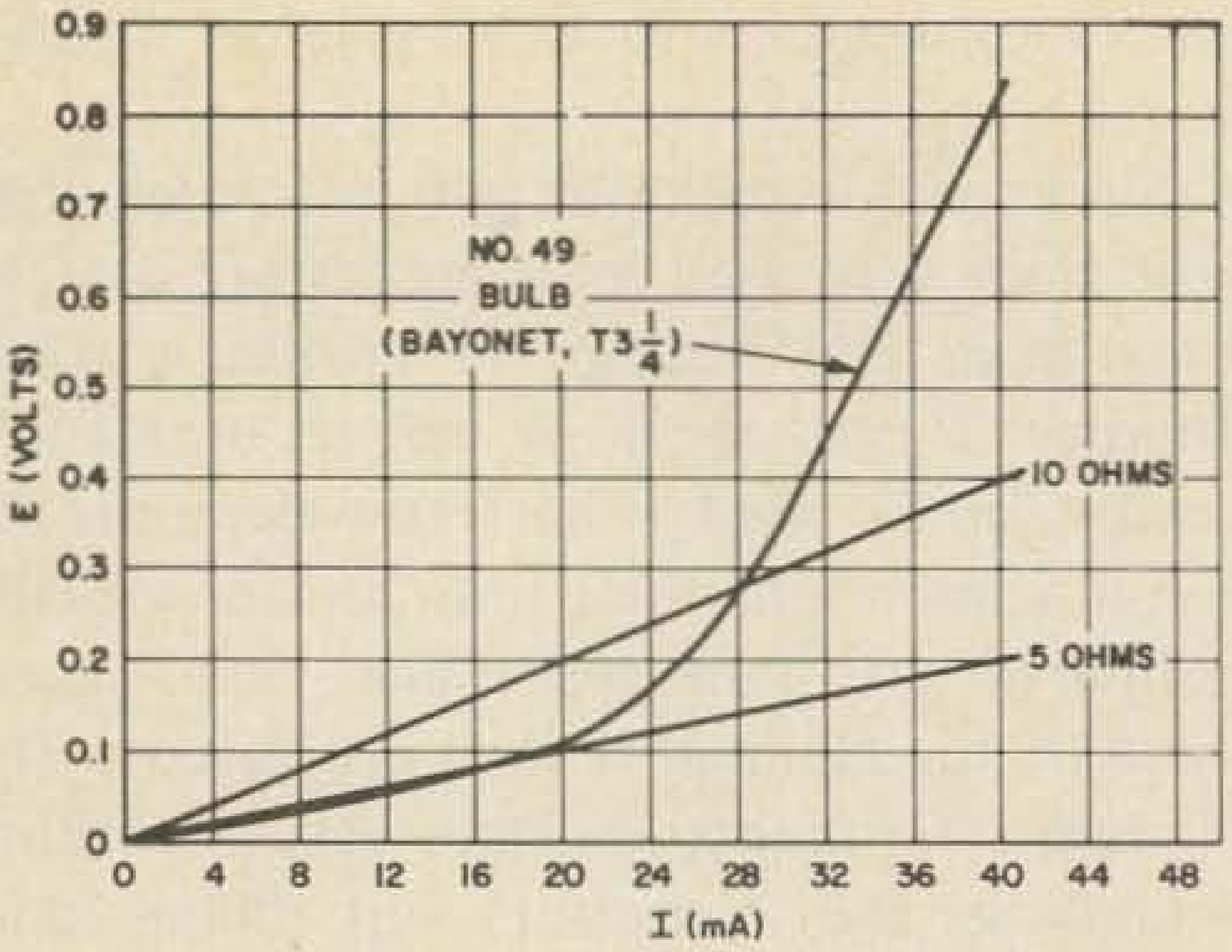


Fig. 5. A selection of E-1 plots (continued on the following page).



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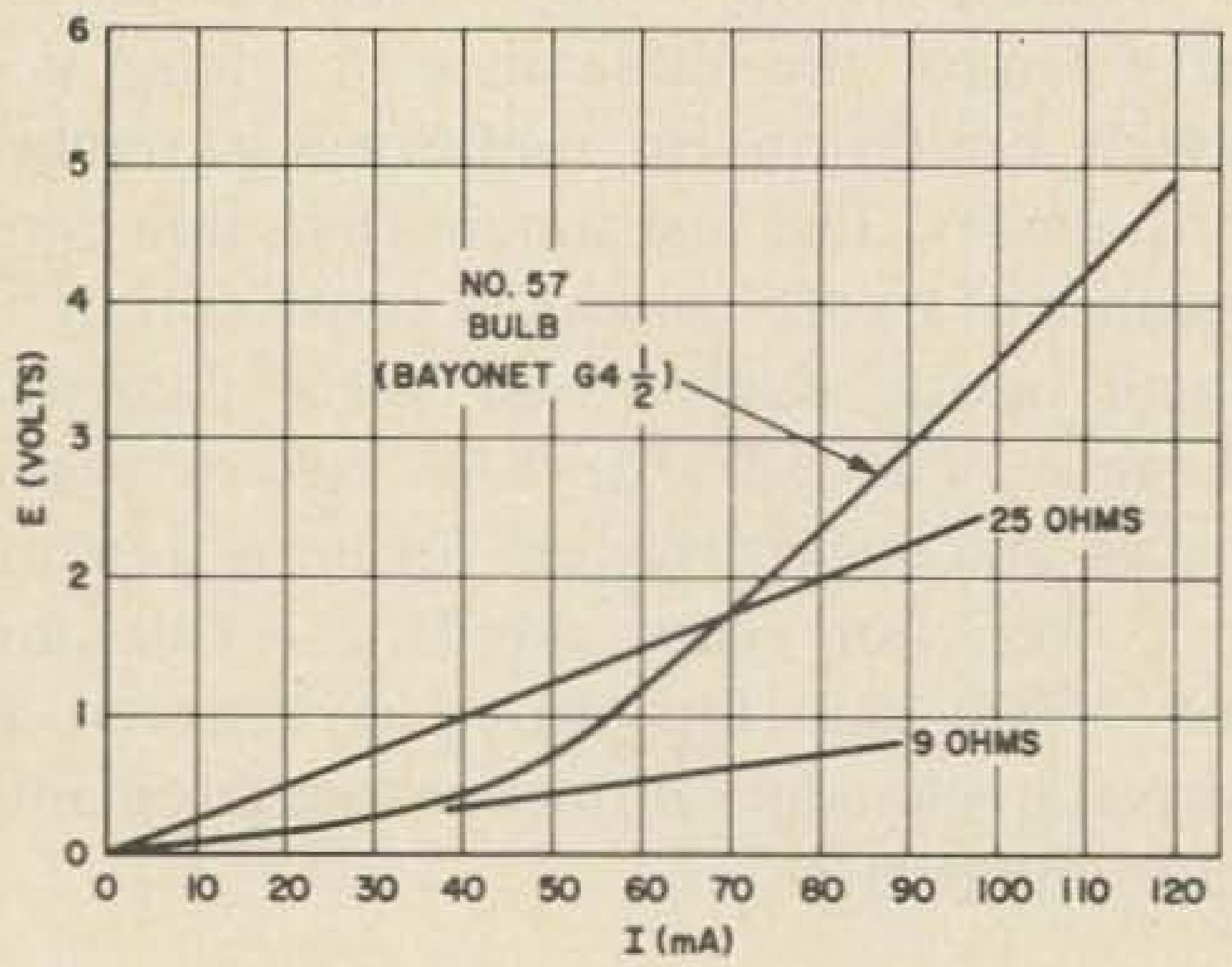

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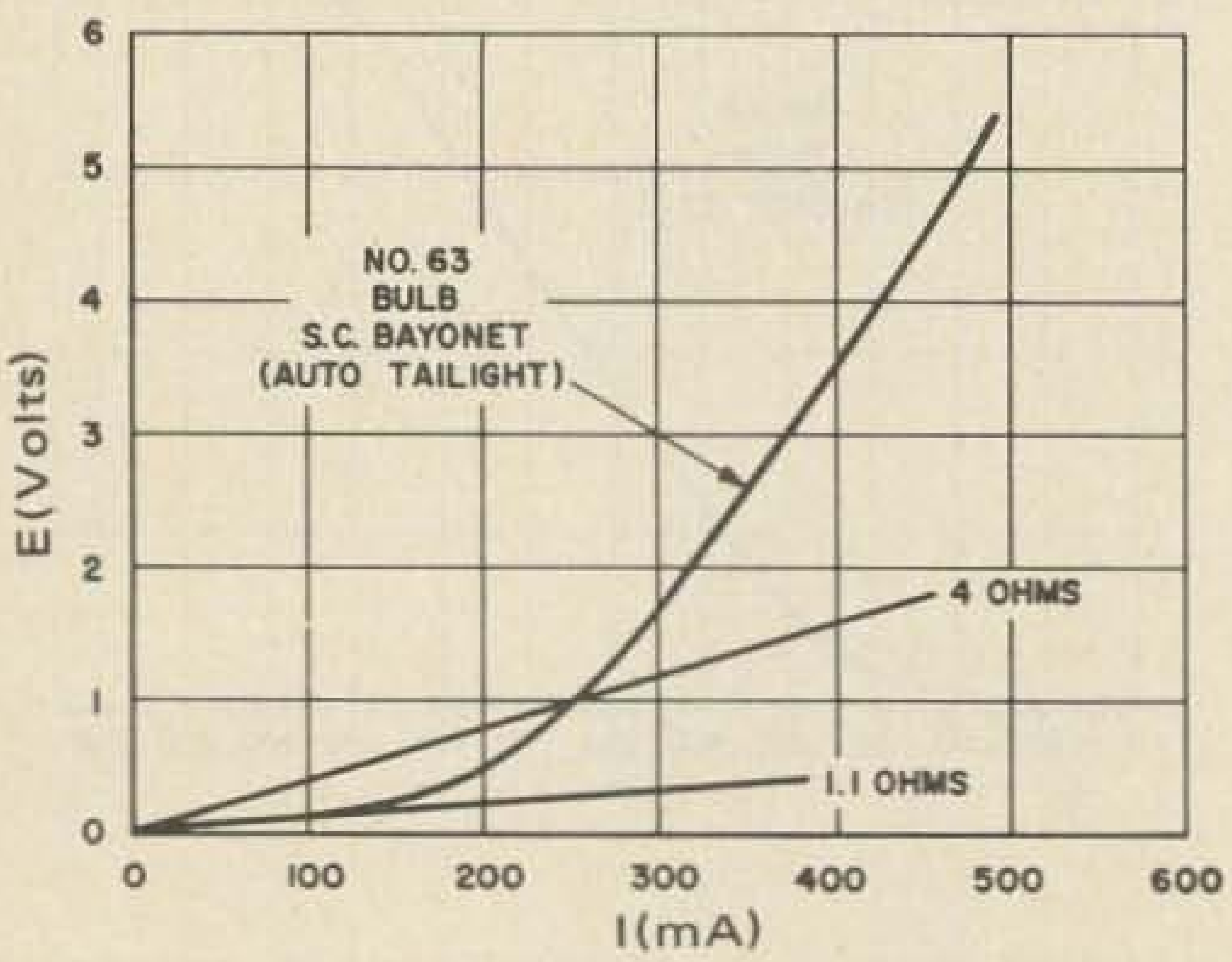

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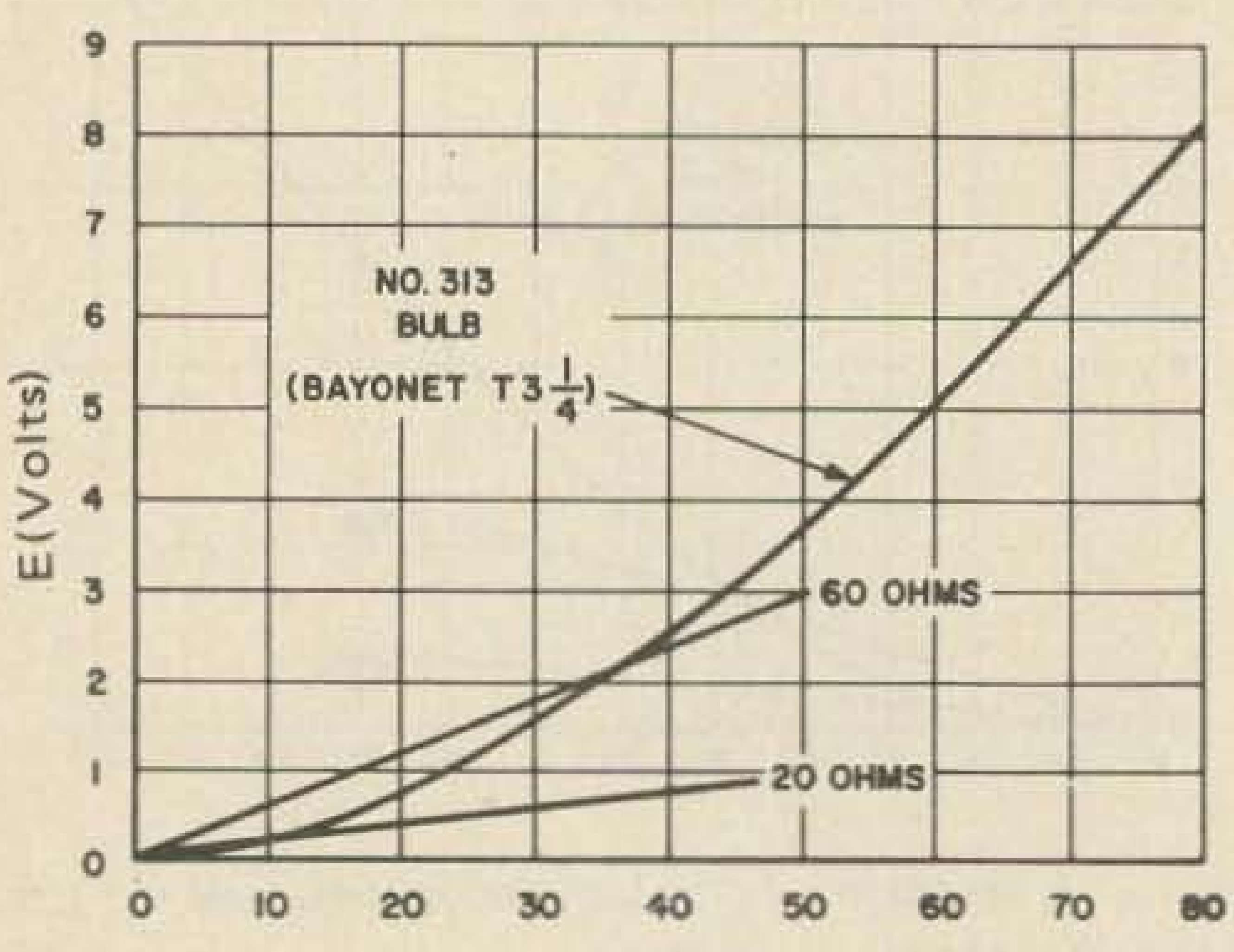

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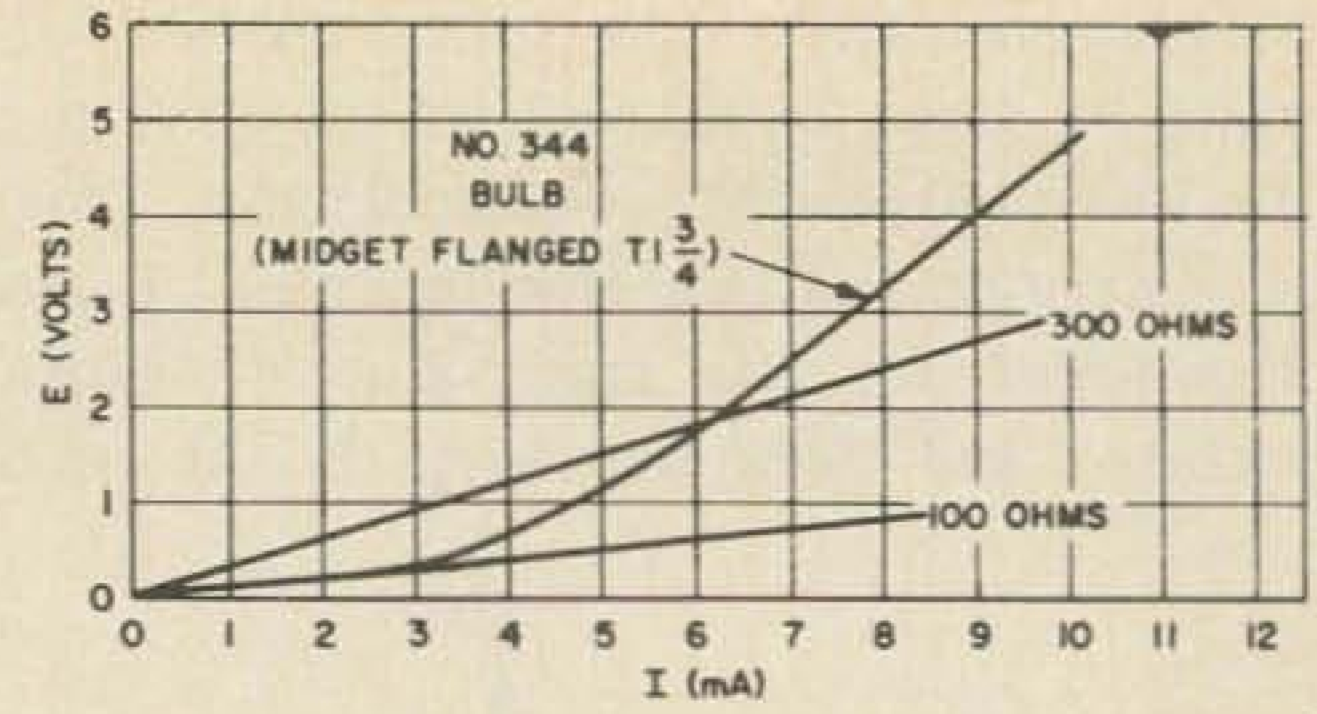

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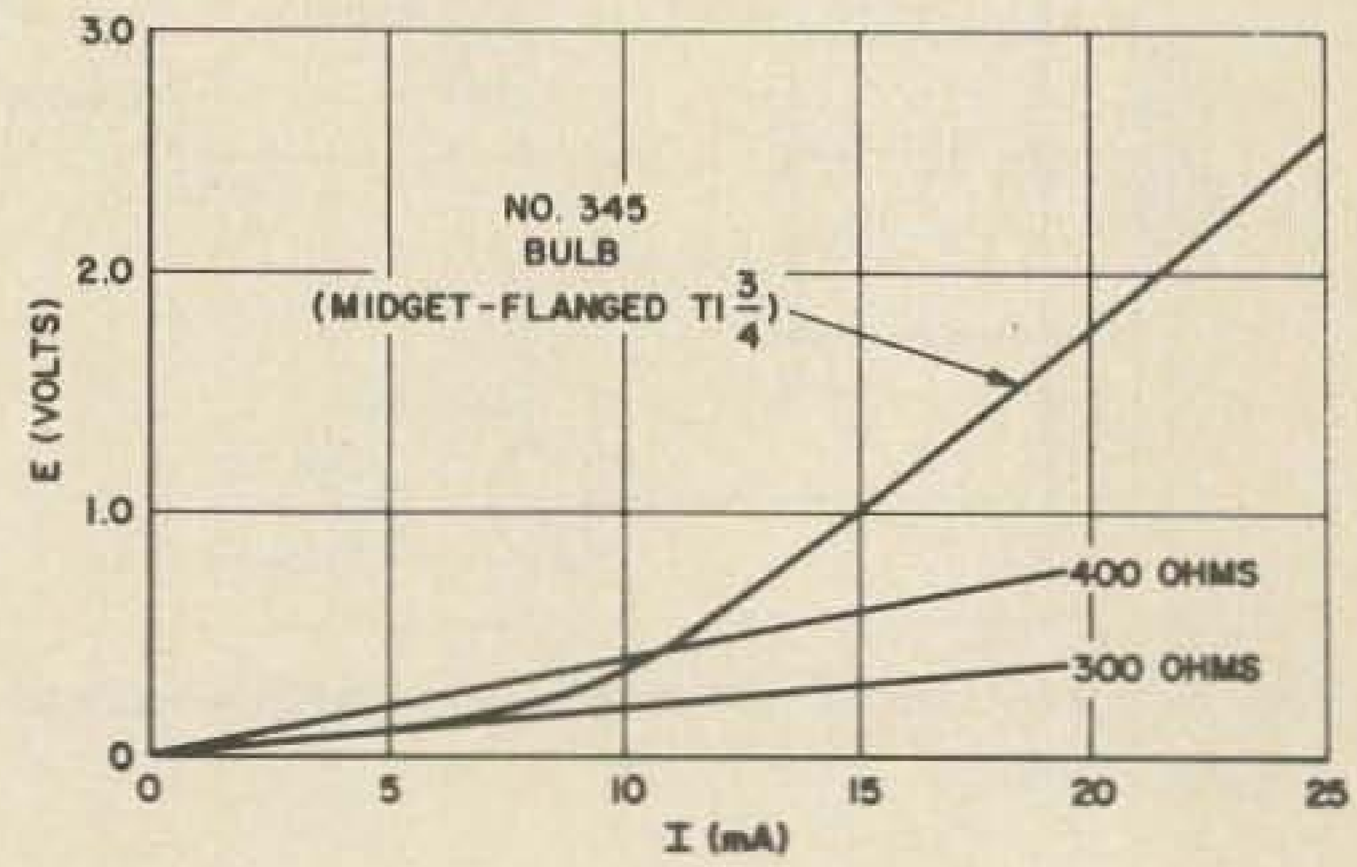

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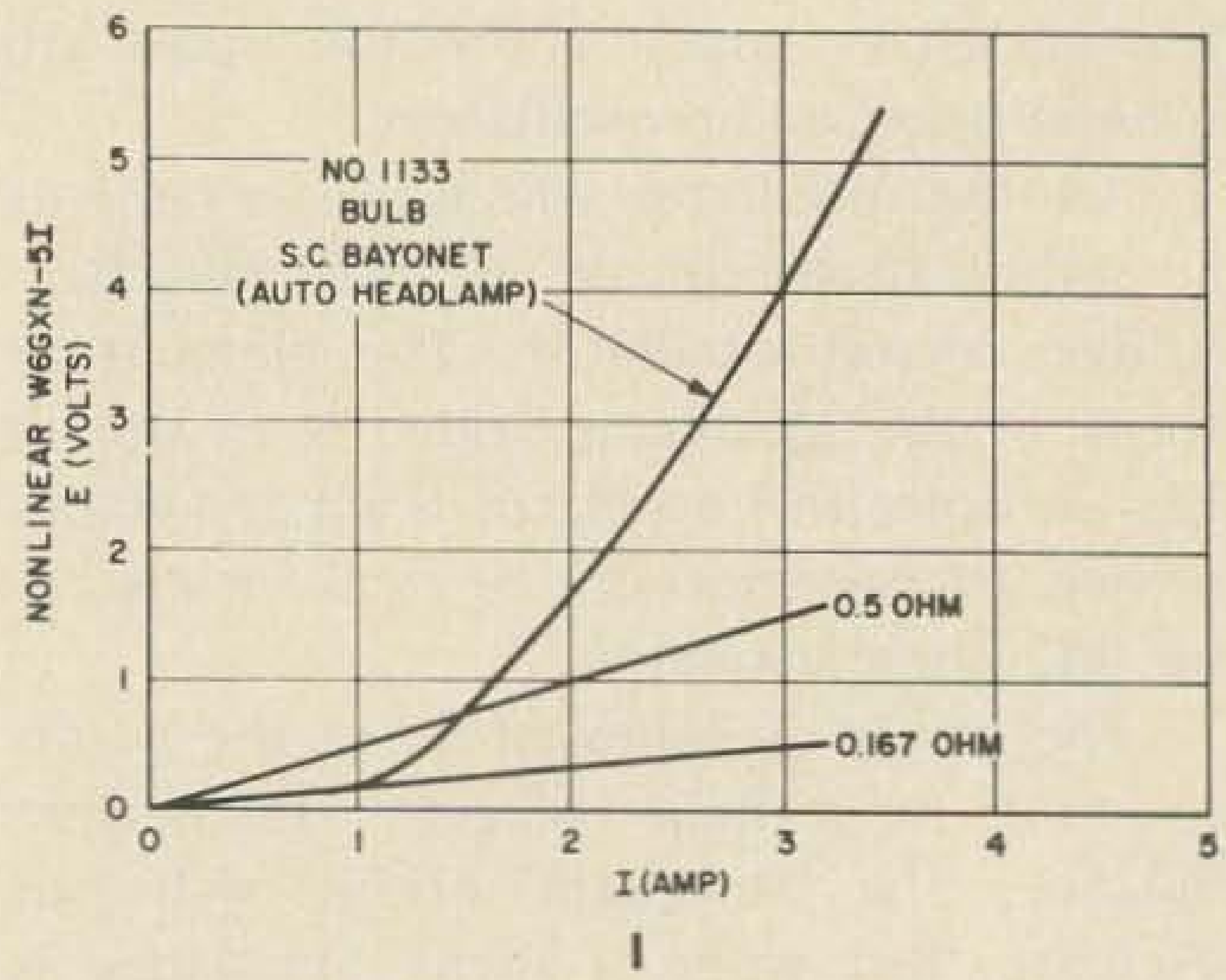

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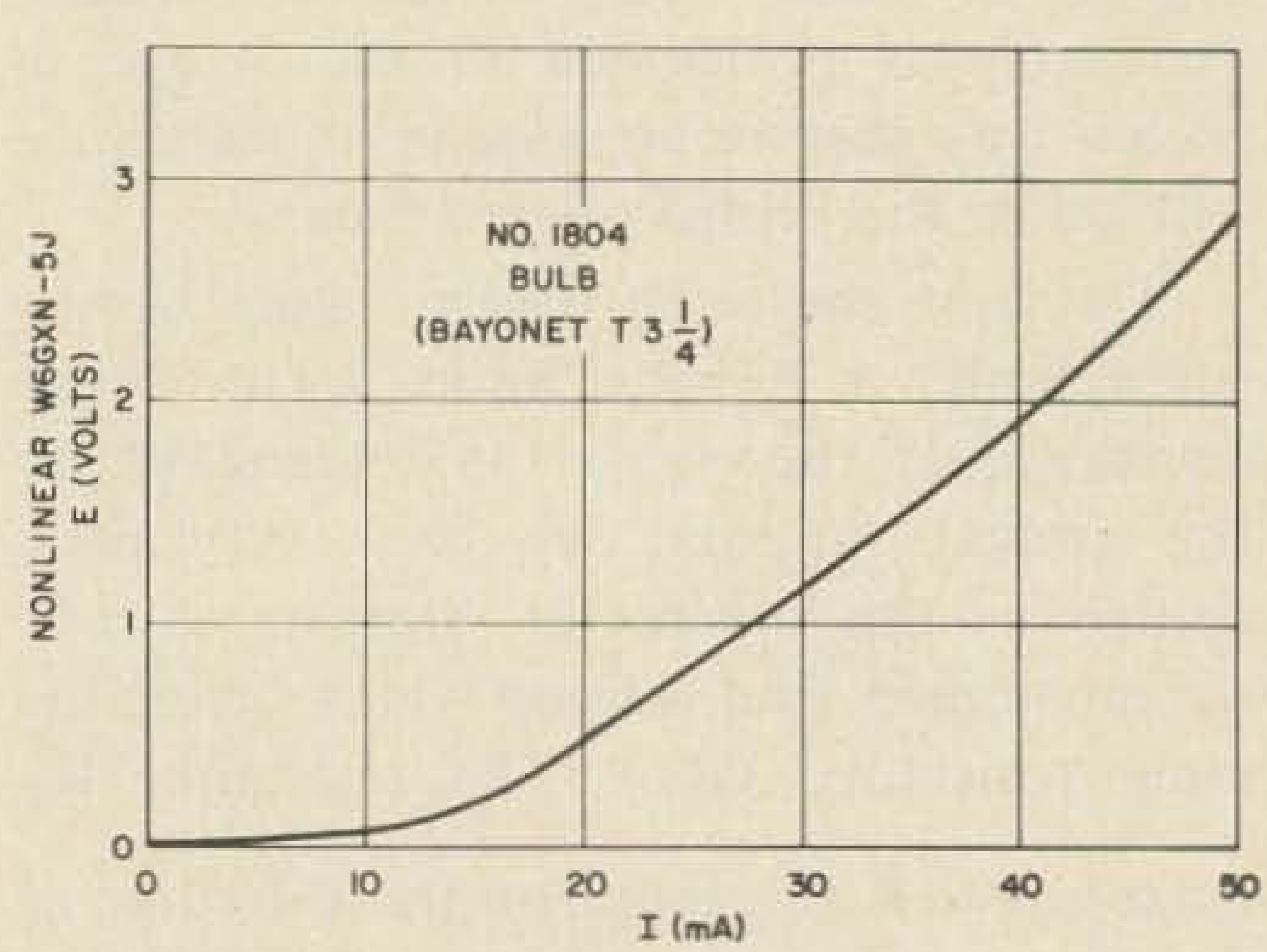

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Fig. 5. A selection of E-I plots (cont.)

So far, we have seen lamps used as stabilizing elements in oscillators and as elements in bolometers for power measurement. A similar use of lamps is in the application of current limiters or fuses. In many circuits which may be subject to expensive failures, lamps may be used to slow down destructive runaway currents, and then "open," fuse-like, if the runaway continues uncontrolled. One such application is in push-pull or pseudo-push-pull transistor output amplifiers; Fig. 4 shows two lamps in a pseudo-complementary output stage. In this particular design, separate positive and negative supplies are used, and the speaker is direct-coupled. In case of a failure of one output transistor, the speaker is protected, as one of the bulbs will open in about 0.1 second.

In order to be able to use lamps as nonlinear circuit elements, one must know, in fair detail, their E-I characteristics. E-I plots on common lamps are not generally available, and so must be plotted by the user. A selection of E-I plots is presented in Fig. 5, as measured by the author. The curves in Fig. 5a through 5j all show somewhat similar shape. The fact that some seem to display a sharper "break" in slope is apparently due to details in the form and mounting of the lamp filament.

A (rare?) exception to normal lamp behavior was found in one old telephone-style bulb. The E-I plot of this unit is shown in Fig. 6. This unit is apparently an old carbon filament type, and its response came as quite a surprise.

The curves presented in Figs. 5 and 6 should be taken as "typical" for their particular types; individual units can vary somewhat.

The second nonlinear resistor that we shall examine is the thermistor, a device not so familiar to most hams as the light bulb. Actually, there are many thermistors in use by hundreds of amateurs across the country, but they probably don't think of them as such. The thermistors generally used by hams are those which were designed for TV sets with series heater strings, but which are used in high power final amplifiers as plate parasitic suppres-

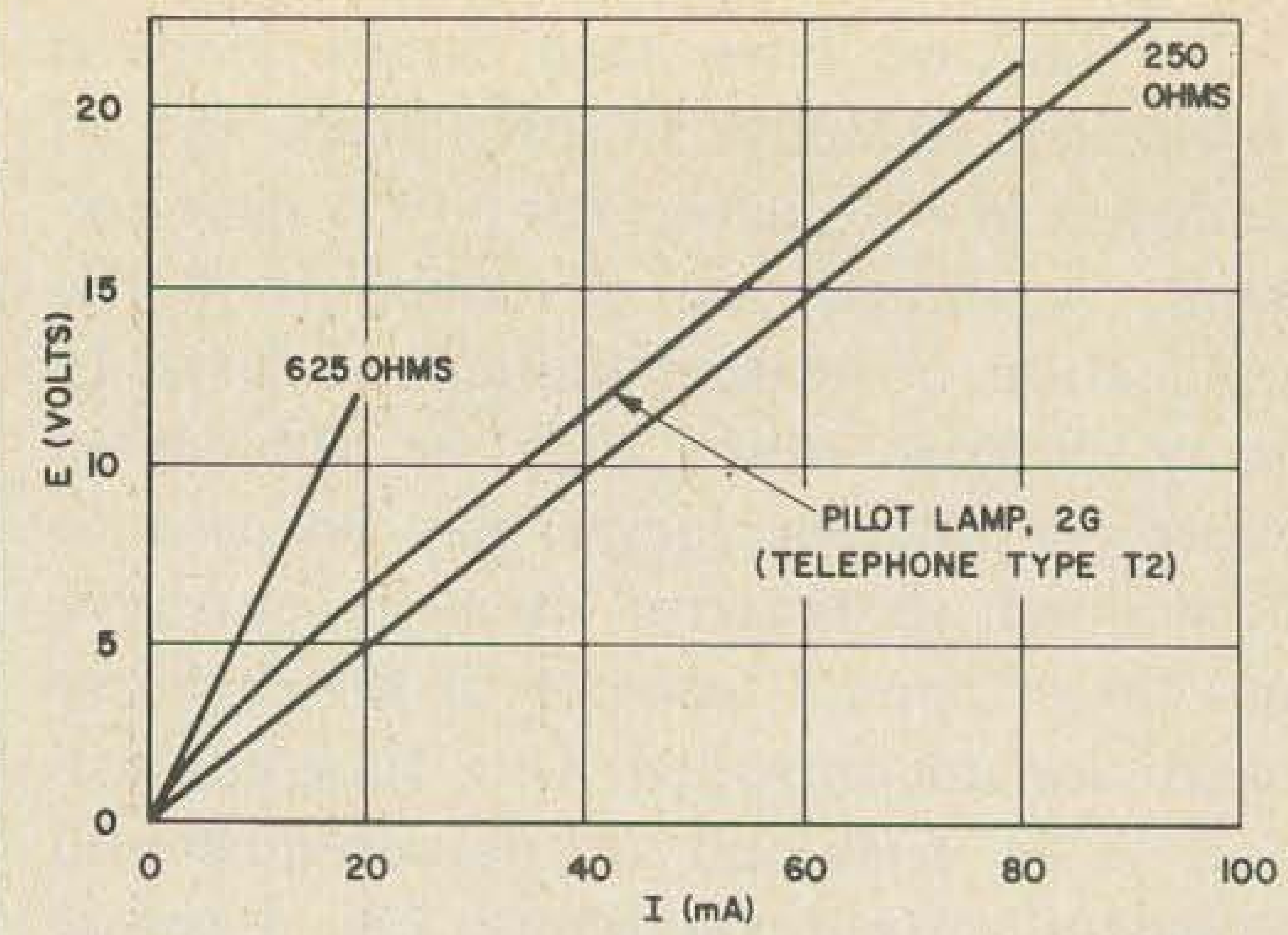

Fig. 6. The E-I plot of an old telephone style bulb.

sors. The General Cement Glo-bar type 25-912 is typical for this use, having a resistance of 20Ω hot and 250Ω cold. The variation of resistance with temperature (not with dc, since there is a coil in parallel in parasitic suppressor service) makes little difference in this application.

Thermistors – that is, thermally sensitive resistors – are made of metallic oxides of manganese, cobalt, and nickel which have been sintered at high temperature. They are ceramic-like in their physical characteristics, and they are very stable electrically. If one uses a thermistor with very small current passing through it (not enough current to dissipate a significant amount of power in the device) we find that it has a temperature versus resistance plot like that in Fig. 7. From this plot, the obvious use for a thermistor is in the measurement of temperature; and many *are* used for that purpose. The thermistor once calibrated, measures temperature by itself; unlike the thermocouple, which needs a temperature reference.

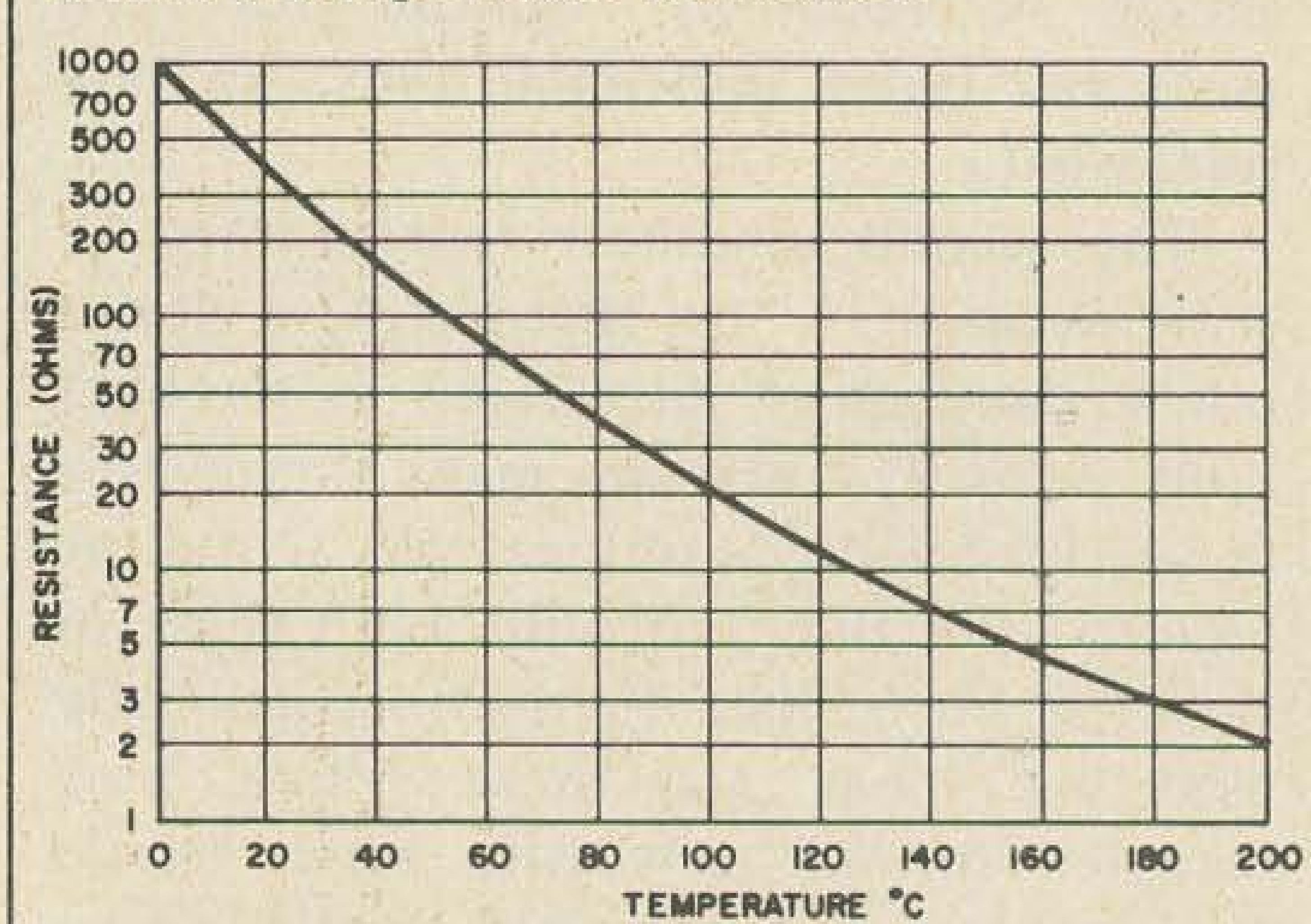

Fig. 7. The temperature versus resistance plot of a thermistor.

Temperature compensation is another use for thermistors. This can be as simple as using a low resistance thermistor in series with a relay coil to prevent its drawing too much coil current when very cold. An example of temperature compensation of a phase shift oscillator is shown in Fig. 8. Of course, the oscillator in Fig. 8 could also have been frequency-compensated with negative-temperature-coefficient ceramic capacitors.

If larger currents are used in the thermistor, so that power is dissipated in it faster than heat can be conducted or radiated away, a different situation exists. In this case an E-I plot similar to Fig. 9 applies. To the right of Vm, in Fig. 9, the thermistor has a negative resistance coefficient, due to the heating effect of current. In this negative slope region, thermistors may be used in circuits as nonlinear resistors having the opposite slope as lamps.

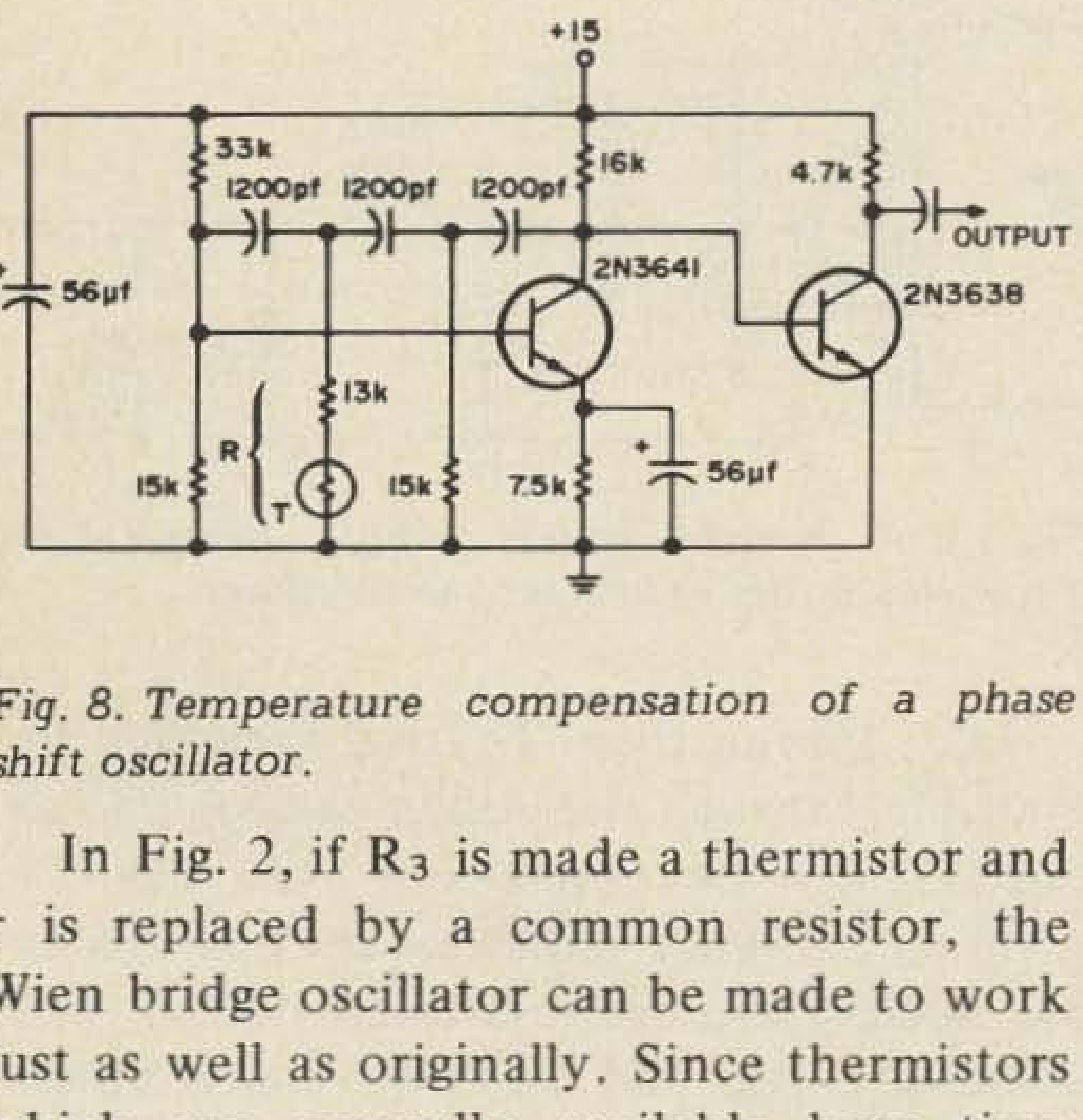

Fig. 8. Temperature compensation of a phase shift oscillator.

In Fig. 2, if R_3 is made a thermistor and r is replaced by a common resistor, the Wien bridge oscillator can be made to work just as well as originally. Since thermistors which are generally available have time constants of one second up to several minutes, the requirement that the nonlinear element in the Wien bridge respond only to the rms value of audio oscillation is easily met.

The Meacham bridge crystal oscillator (Fig. 3) is also operable using a thermistor in the lamp leg of the bridge (R_1), if one also reverses the sense of either transformer in the circuit.

Like lamps and fuses, thermistors are used as barretters for the bolometer method of measurement of radio frequency power. The thermistors used are very tiny, so have little inductance and fit conveniently into transmission lines.

Vacuum tubes have heaters or filaments that behave similarly to lamps as to their E-I characteristics. That is, until a tube heater or filament comes up to a visable red or orange color, its resistance may be only a fraction of its nominal value. This means that when we plug in our tube-type receiver, the initial current drawn from the line may be several times the normal operating value. Since the thermistor has the opposite (E-I) coefficient to the tube, one is often put in series with the line to limit initial inrush current. This is especially true in series-heater TV sets, where the previously mentioned General Cement 25-912 is used. Not only is inrush current limited by such a thermistor; but since the tubes warm up much more slowly, the tube heaters are subjected to far less thermal stress, resulting in better tube life.

Thermistors are not *special* or *rare* devices; being made by GE, Veco, Fenwal, Ferroxcube, and others. Several manufacturers' types of thermistors are obtainable from Allied Radio's mail order service, making them available easily anywhere in the U.S.

The last type of nonlinear resistor we will cover is the Thyrite varistor. This element is rather an old one as electronic devices go, having been introduced about 1930. The Thyrite varistor was first developed for use as a lightning arrestor, and is a relative of the coherer – that ancient detector of waves in the ether.

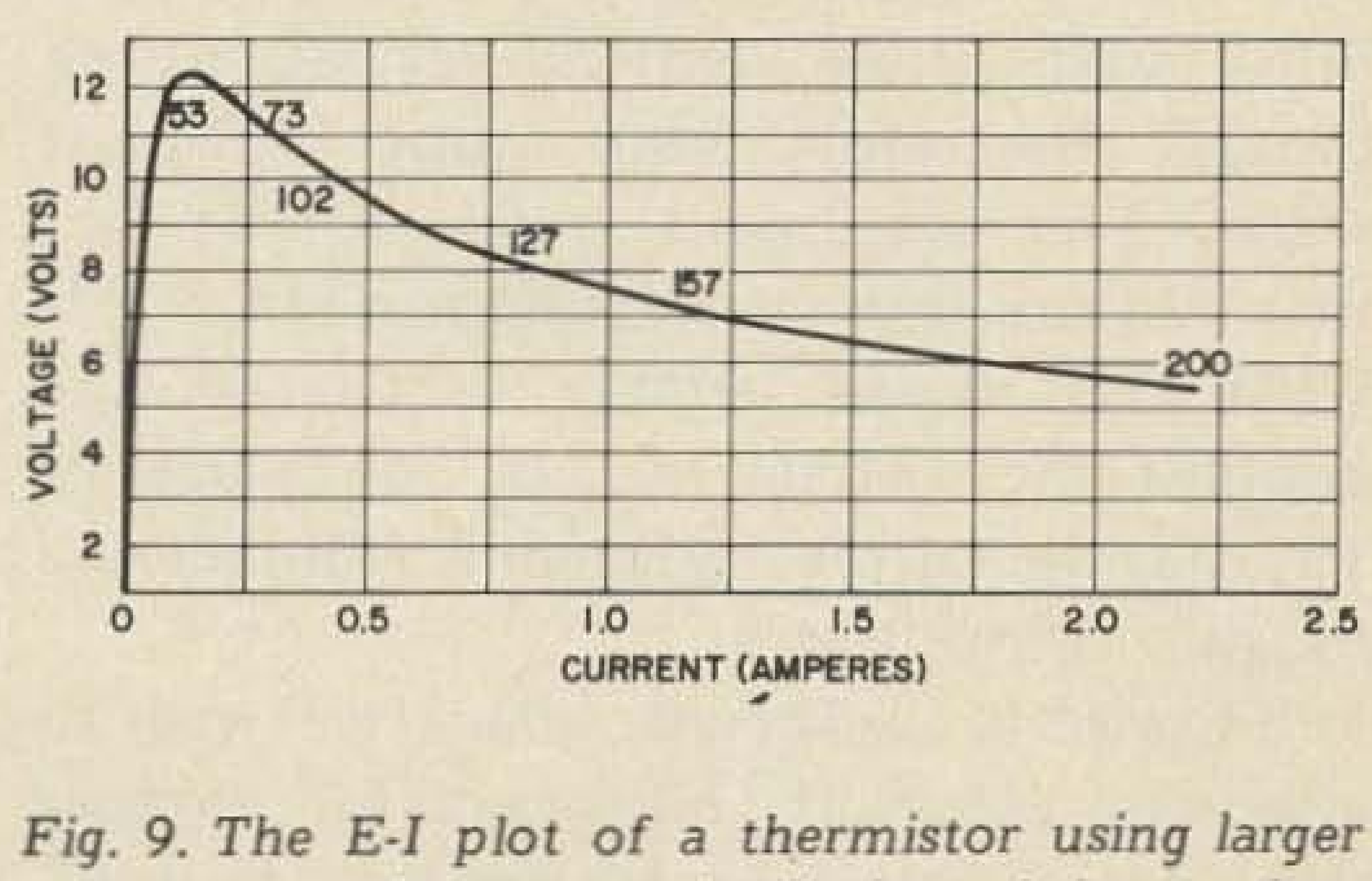

Fig. 9. The E-I plot of a thermistor using larger currents so the power is dissipated faster than heat can be conducted away.

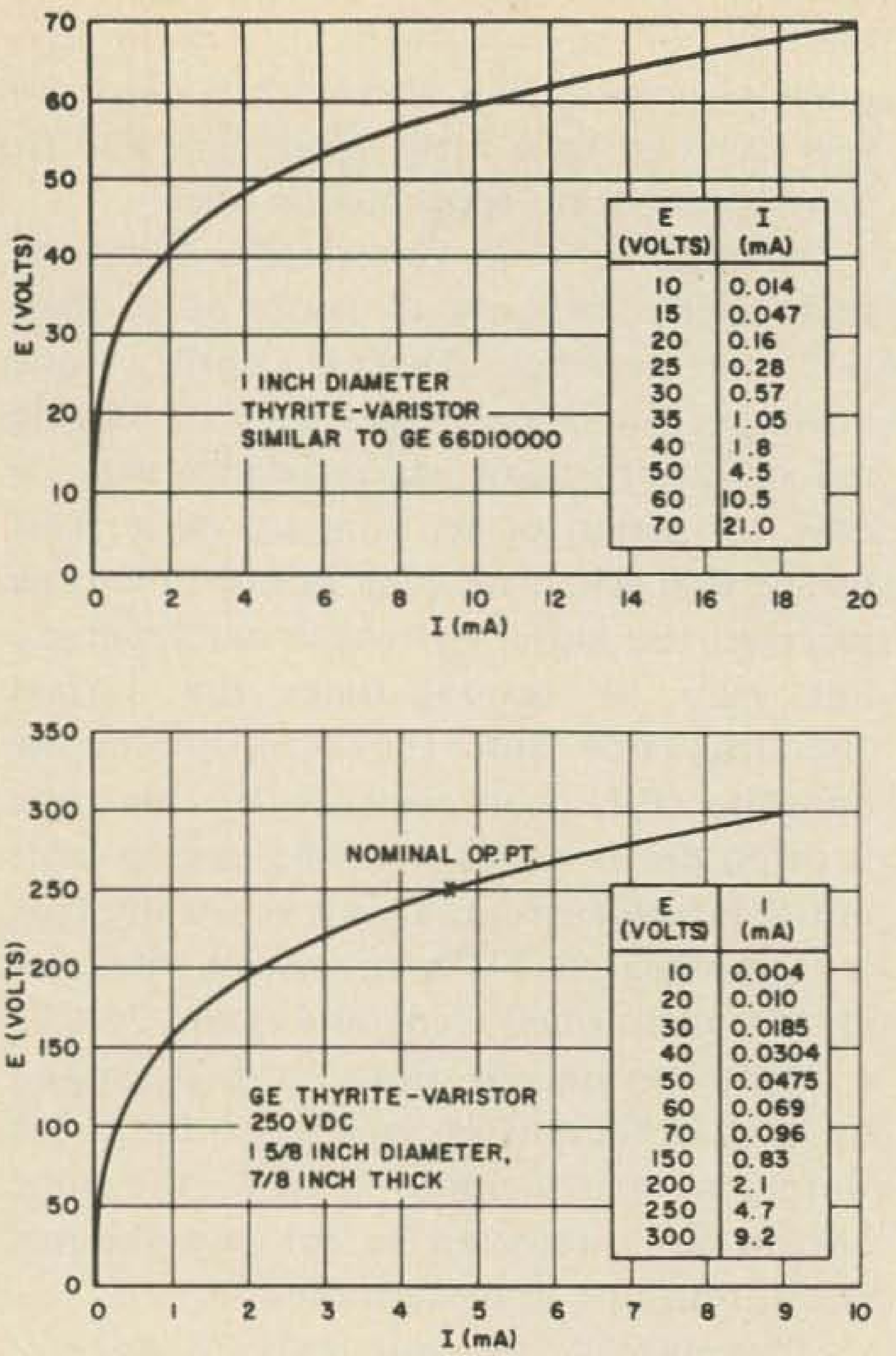

Fig. 10. The E-I plot of a Thyrite varistor.

Thyrite displays a negative coefficient of resistance versus voltage, like a thermistor, but differs in a very important way. The resistance value of the Thyrite varistor does not take seconds or minutes to be established, after application of voltage. This means that the Thyrite varistor fills the need for a "fast" limiter, one which will respond at the ac rate. This fast response shouldn't come as any surprise, since the stuff *was* designed for lightning!

Figure 10a shows an E-I plot of a representative Thyrite varistor, and Fig. 10b shows another higher-voltage type. Both curves show identical curvature even though the plots have quite different scales. This agreement is due to the fact that Thyrite follows the relation $i=Ae^{3.54}$. What this means, simply, is that if one doubles the voltage across *any* piece of Thyrite, the current through it will increase roughly twelve times.

Thyrite is useful any place we wish to attenuate transient voltage spikes, whether they come from the ac line or are internally generated by circuit components. For example, Thyrite varistors are widely used across relay coils to control the inductive spike that occurs when the relay is deenergized.

Figure 11 shows a simple power supply that uses three of the Thyrite varistors of Fig. 10a to protect the rectifiers. The two varistors across the transformer secondary are to protect against transients that are coupled from the ac line. The third varistor is to damp the inductive spike which occurs when the supply is turned off and the choke field collapses. These particular Thyrite varistors have been used extensively by the author because of their convenient size, voltage rating, and *low price*. They are available for 49 cents from Red Johnson Electronics, 3311 Park Boulevard, Palo Alto, California (who also sells the 16 VA transformer shown in Fig. 11 for $1.89). The fully protected supply can thus be built for about $10.

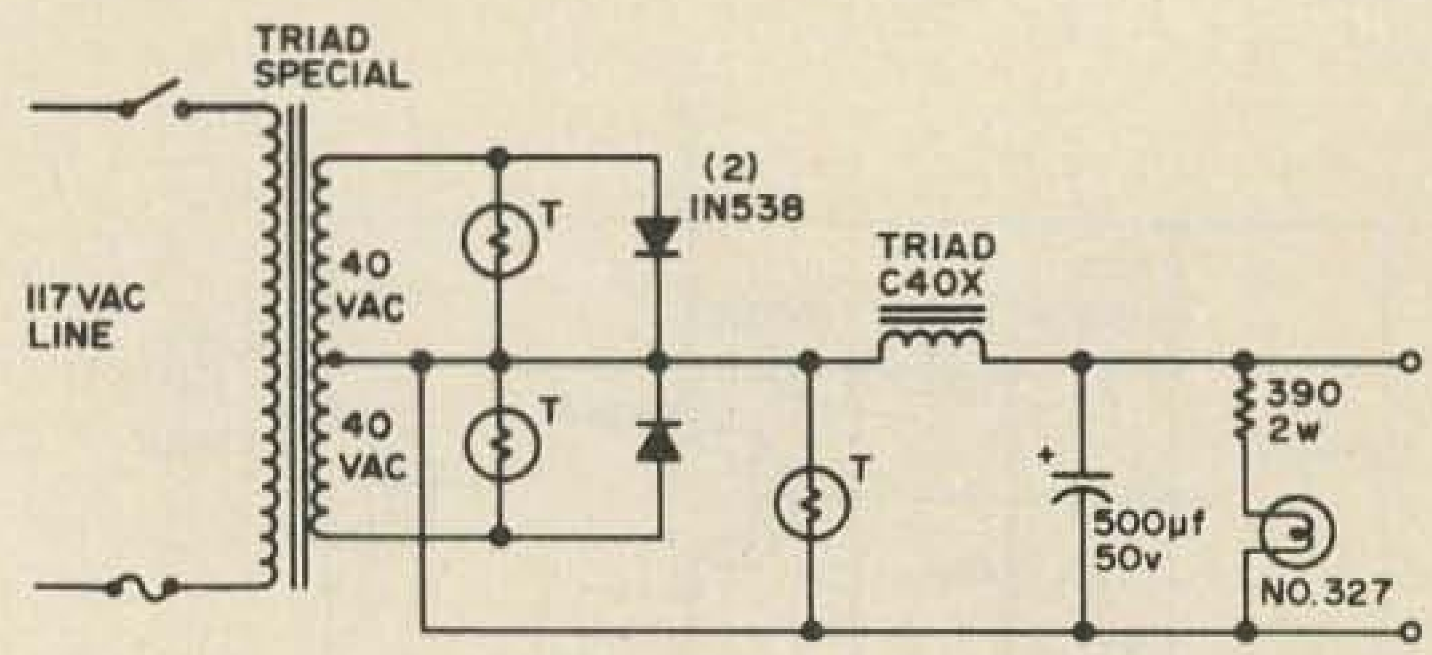

Fig. 11. A simple power supply using three Thyrite varistors to protect the rectifiers.

Like thermistors, Thyrite varistors are available through the Allied catalog and so can't really be considered *odd* devices. Although Thyrite varistors are historically old devices and are somewhat bulky, their use costs little and can save many dollars worth of expensive semiconductors.

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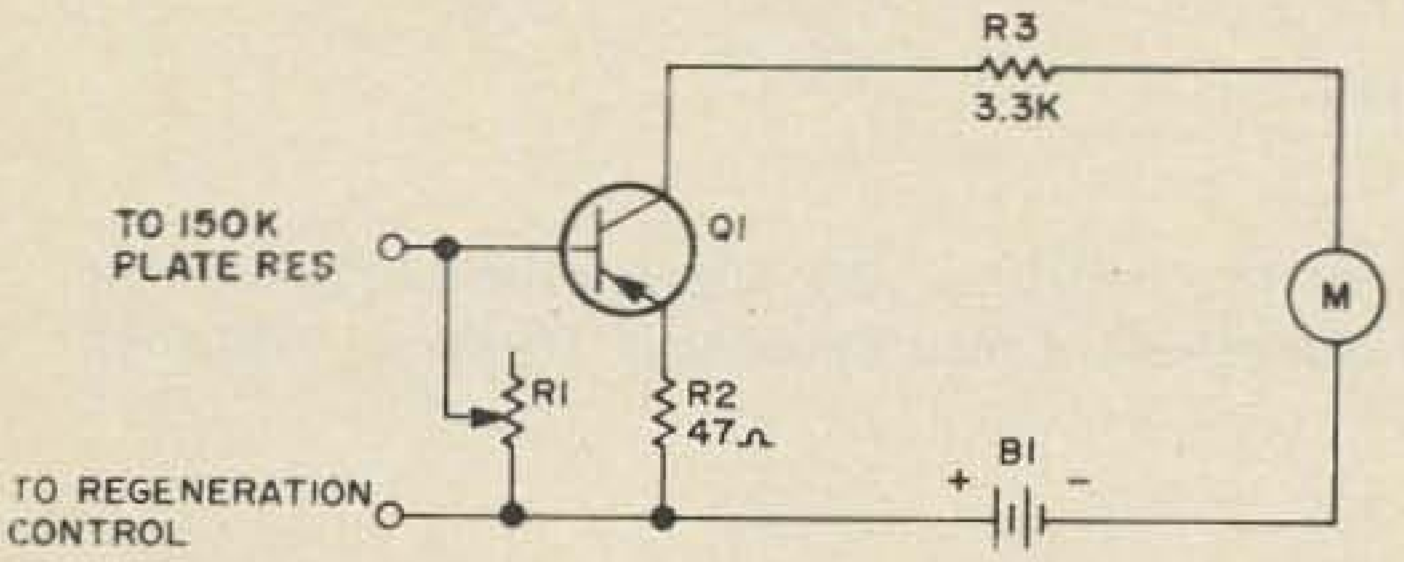
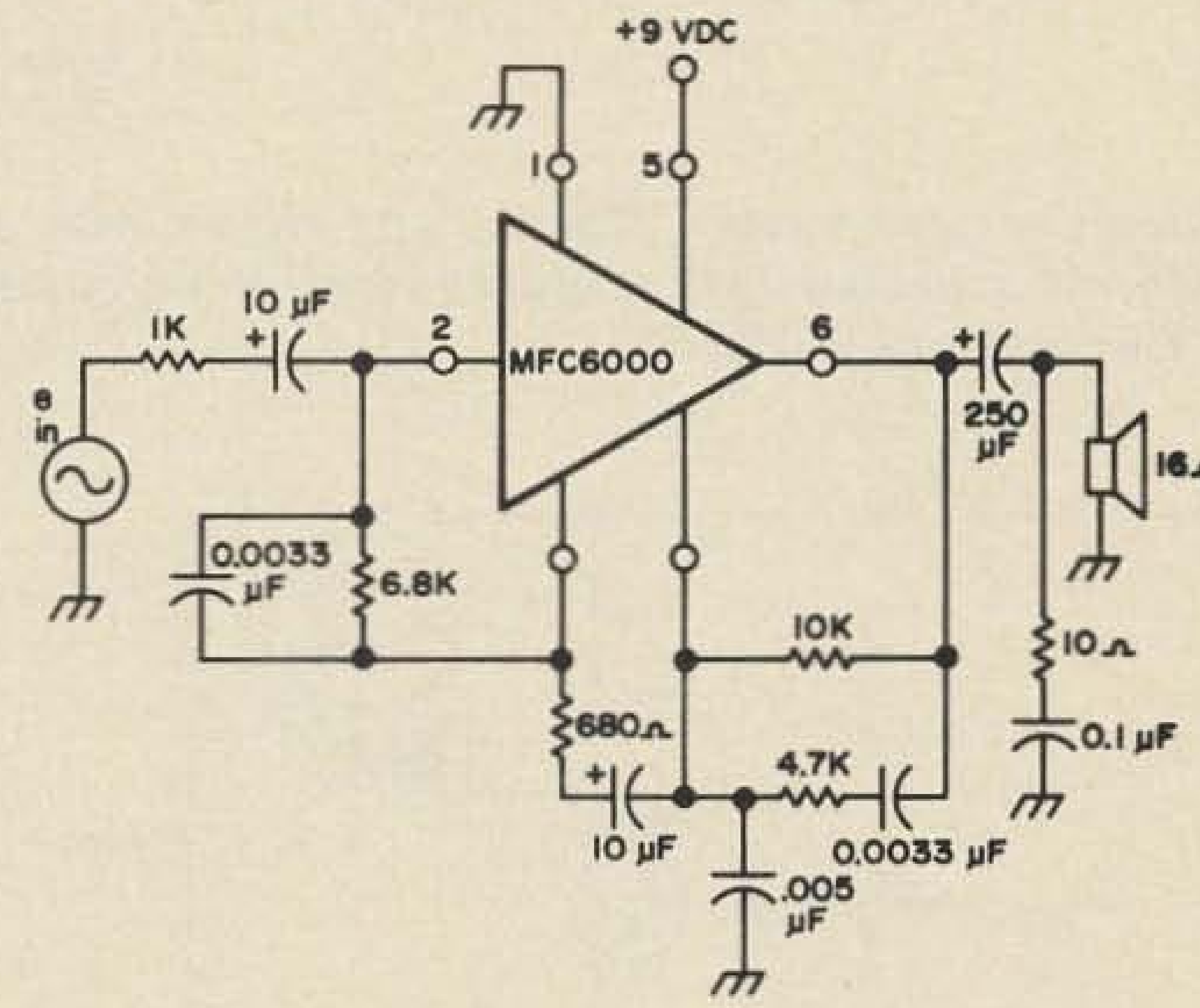
CIRCUITS, CIRCUITS, CIRCUITS...

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.

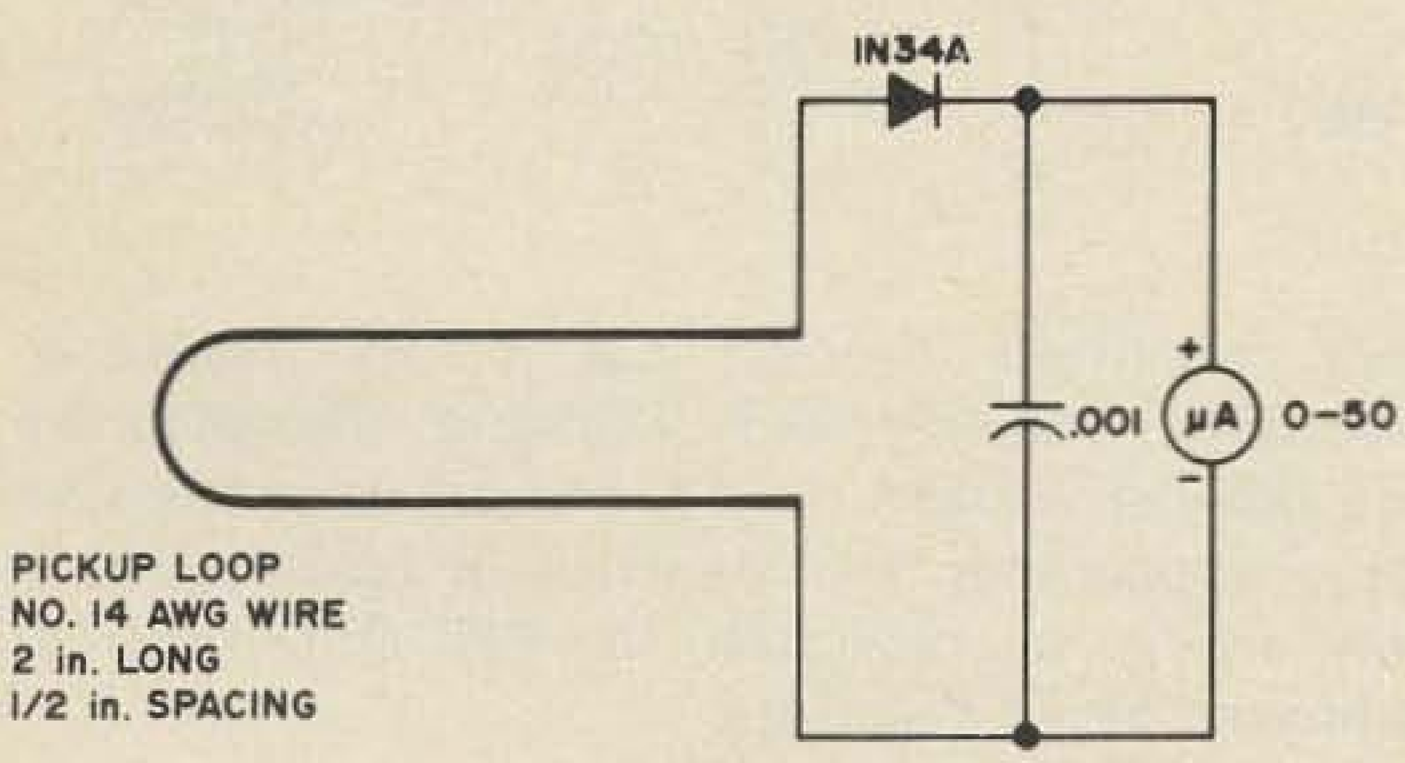
Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation 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.



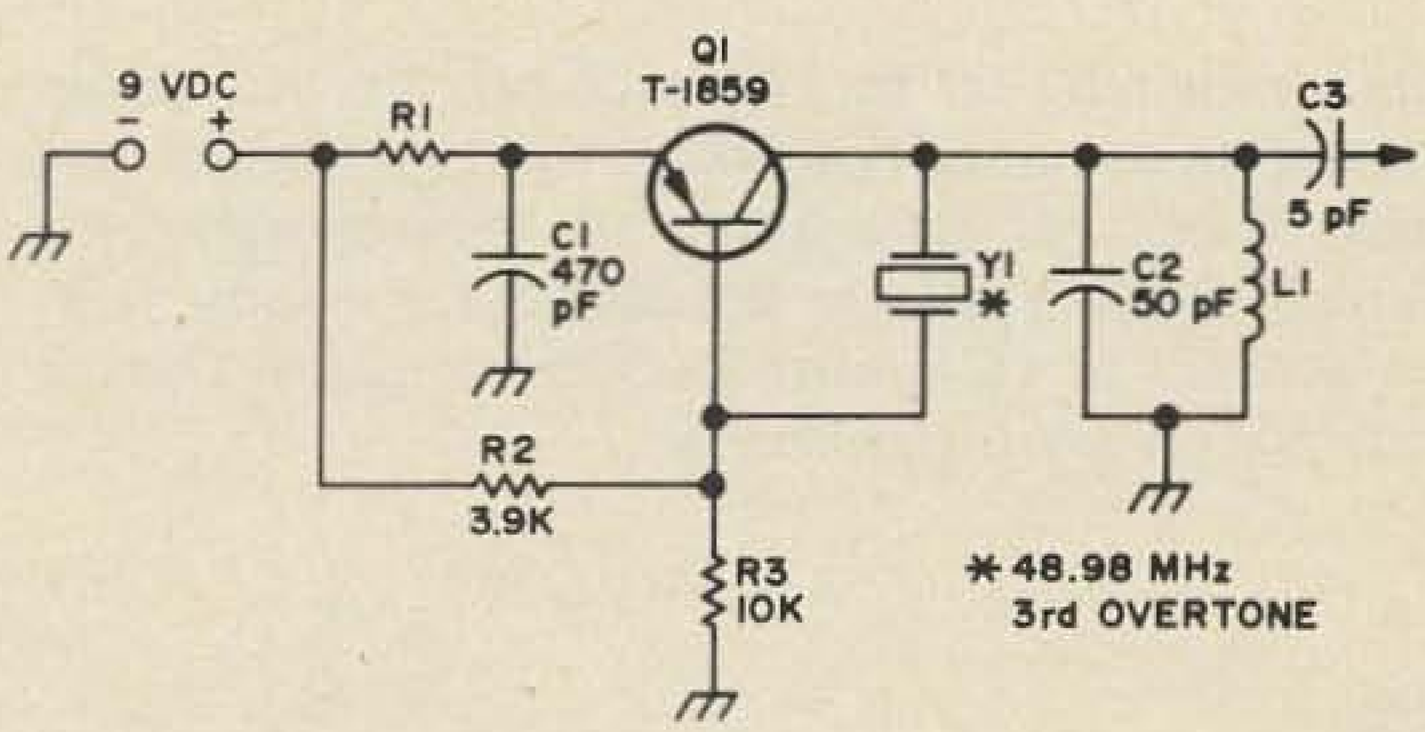
S-meter for the "Sixer," from 73, July, 1961, designed by K5VMC. The circuit is applicable to the "Tenner" and "Twoer" as well. It consists of an inexpensive 0–1 mA meter and a single transistor meter amplifier. Half-scale deflection is obtained on a signal strong enough to quiet the background hiss as compared to about 1/4- to 1/3-scale on a 20,000 ohms per volt meter or a VTVM reading the voltage drop across the plate dropping resistor.



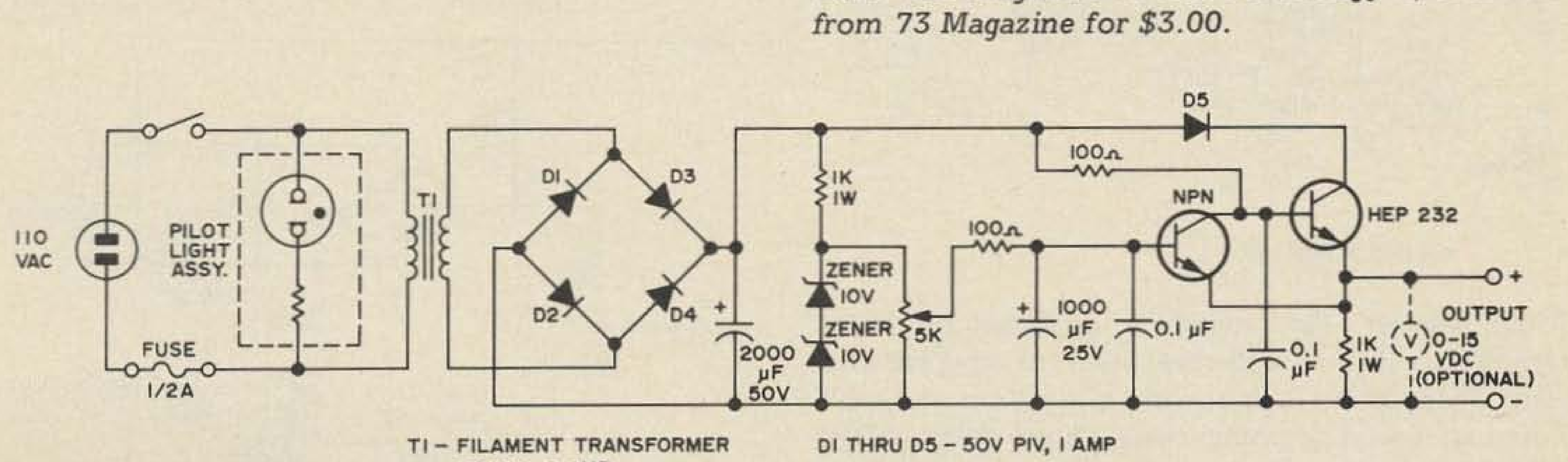
Motorola MFC6000 monolithic functional circuit, in an audio amplifier application. Circuit courtesy of Motorola Functional Circuits catalog.



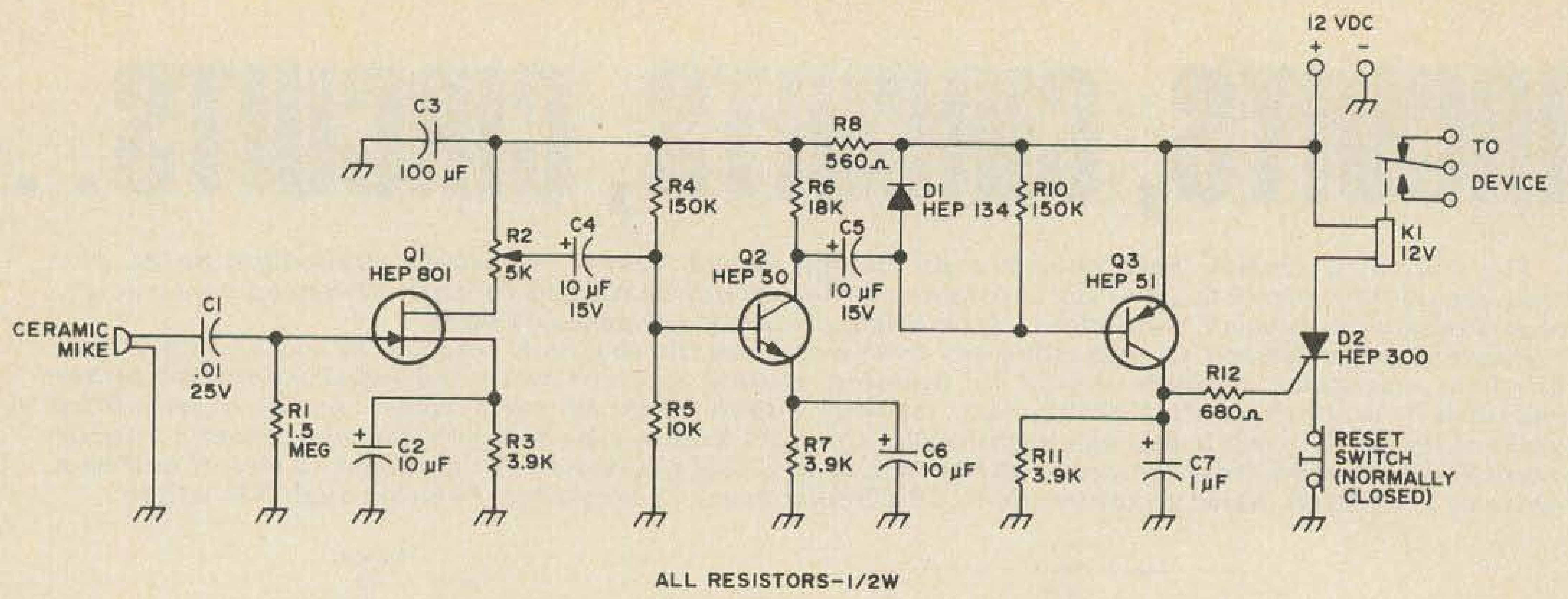
RF Sniffer designed by W5JCB, from an article by K5JKX in 73 Magazine, December, 1960.



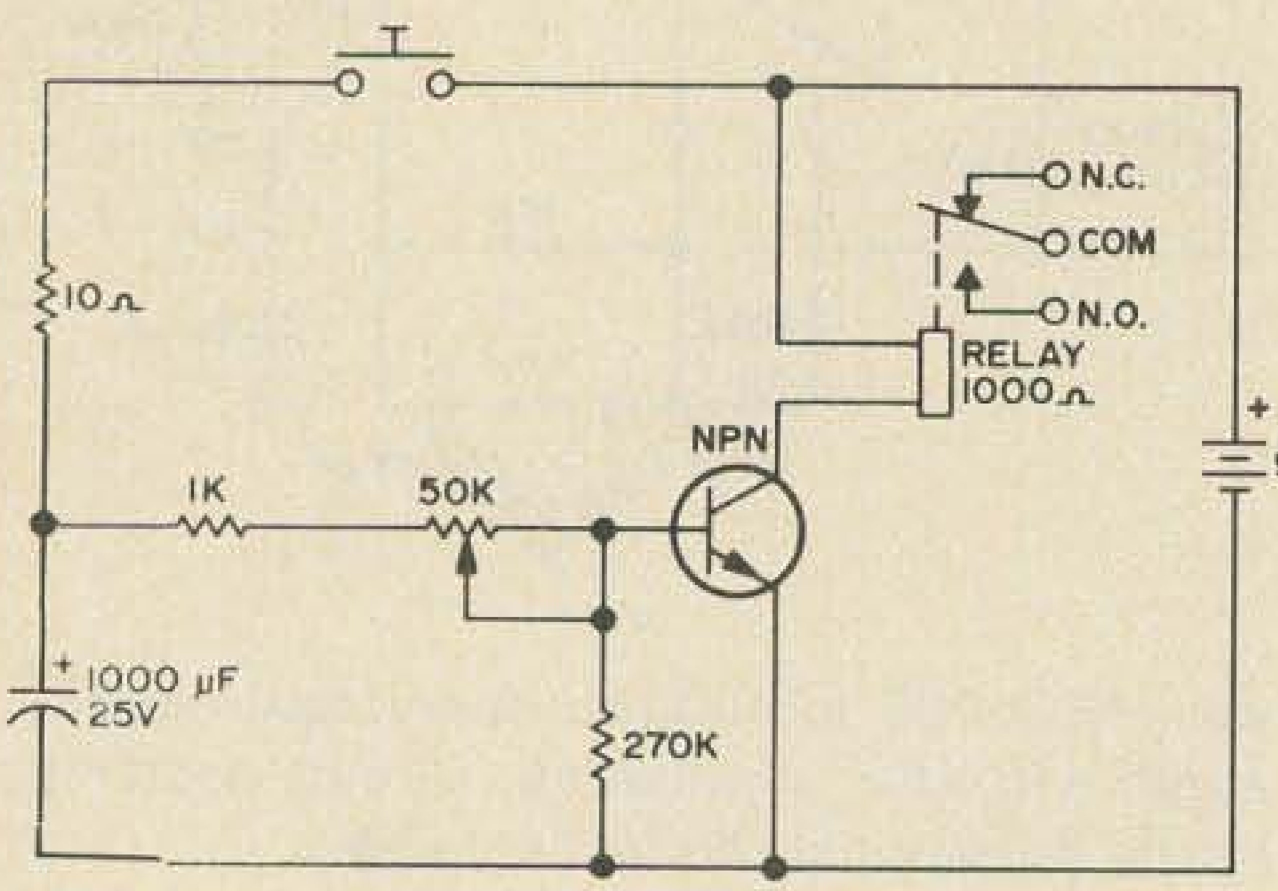
Crystal oscillator for aligning receivers, reprinted from FM Magazine in FM Anthology I, available from 73 Magazine for $3.00.



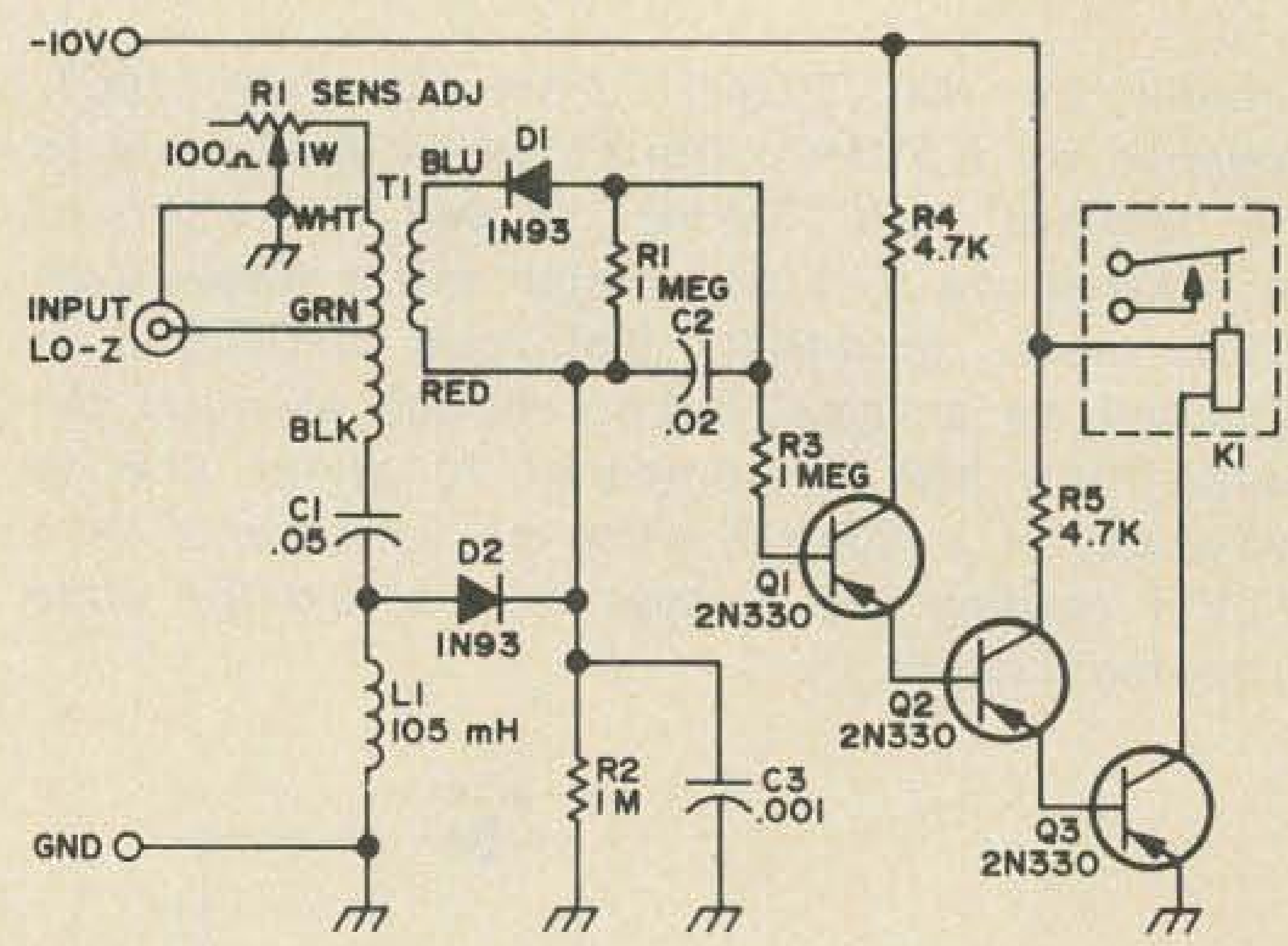
Power supply for 0–20 volts up to 1A. Run that tape recorder, transistor radio, pre-amplifier, or charge a battery. Circuit courtesy Calectro Handbook (50¢), 400 S. Wyman, Rockford IL 61101.



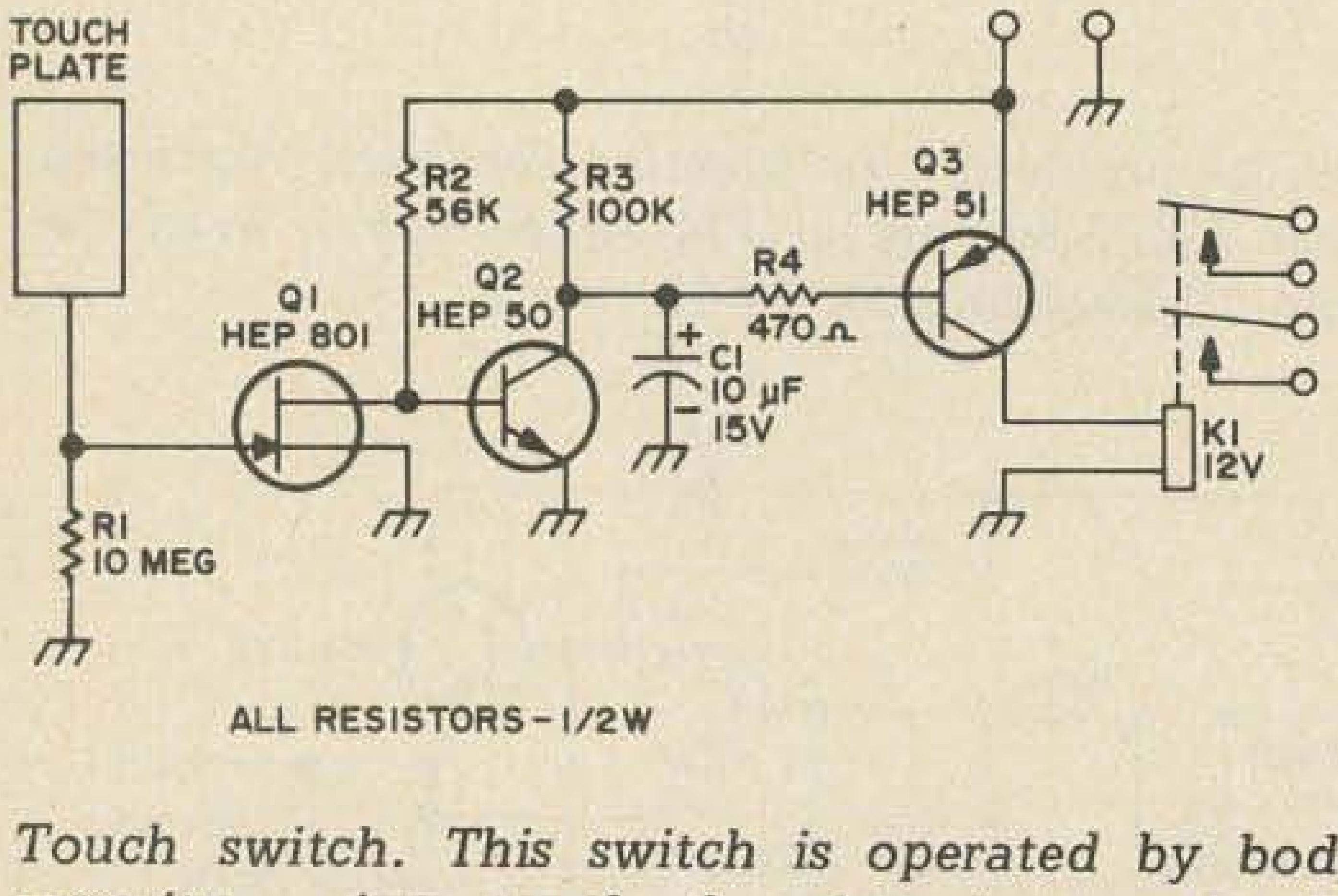
Sound activated relay. Control any circuit with a clap of the hands or any sharp sound. The circuit remains activated until manually reset. It has adjustable selectivity. Circuit courtesy Motorola HMA-33 "Tips on Using FET's."



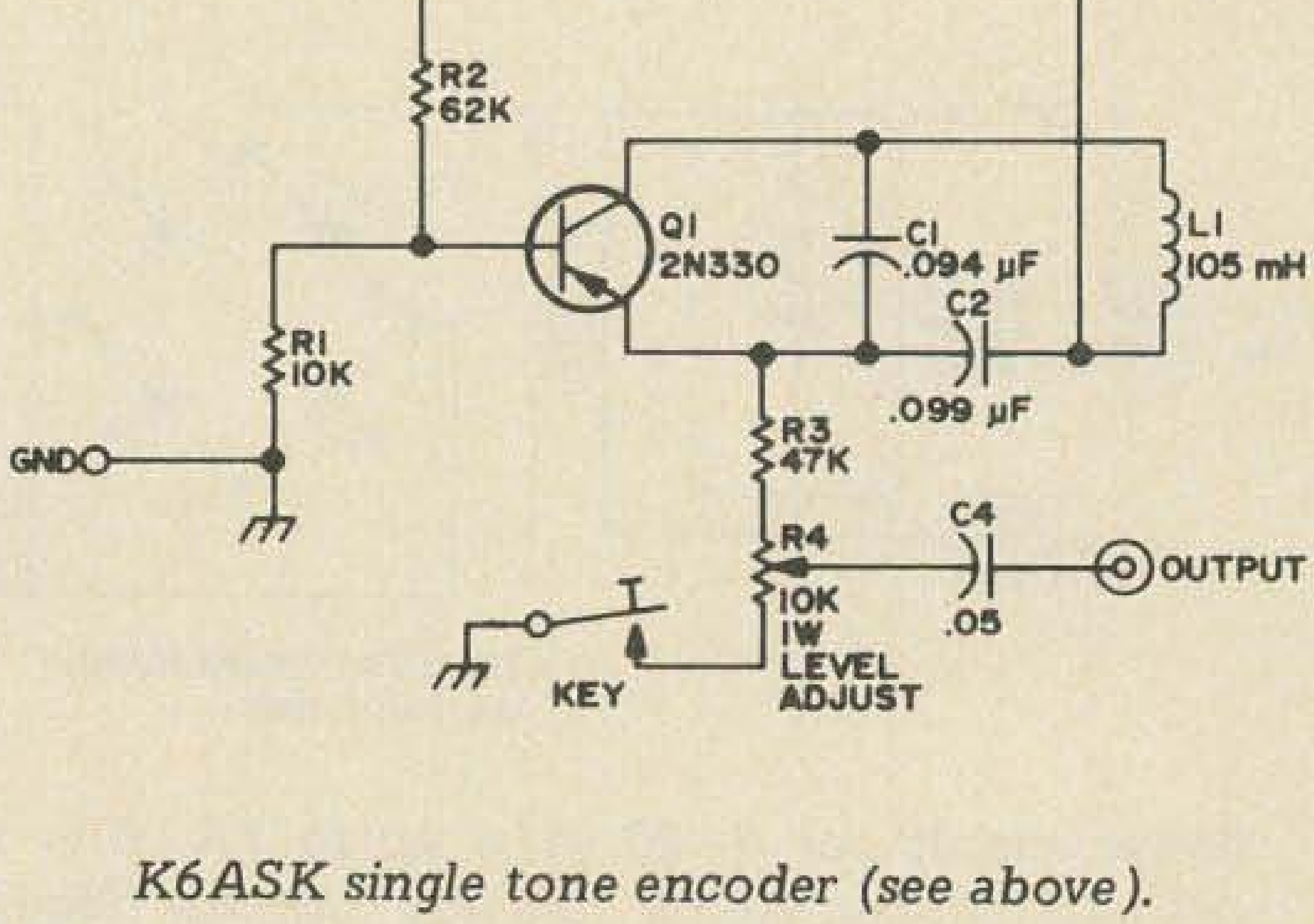
Timing switch, 10 to 100 seconds. No off switch needed since circuit draws only 1 µA when not used. Great for darkroom, 10 minute timer for identification, repeater shutdown for windy talkers, etc. Q1 is a Calectro K4-506 transistor. Circuit courtesy Calectro Handbook.



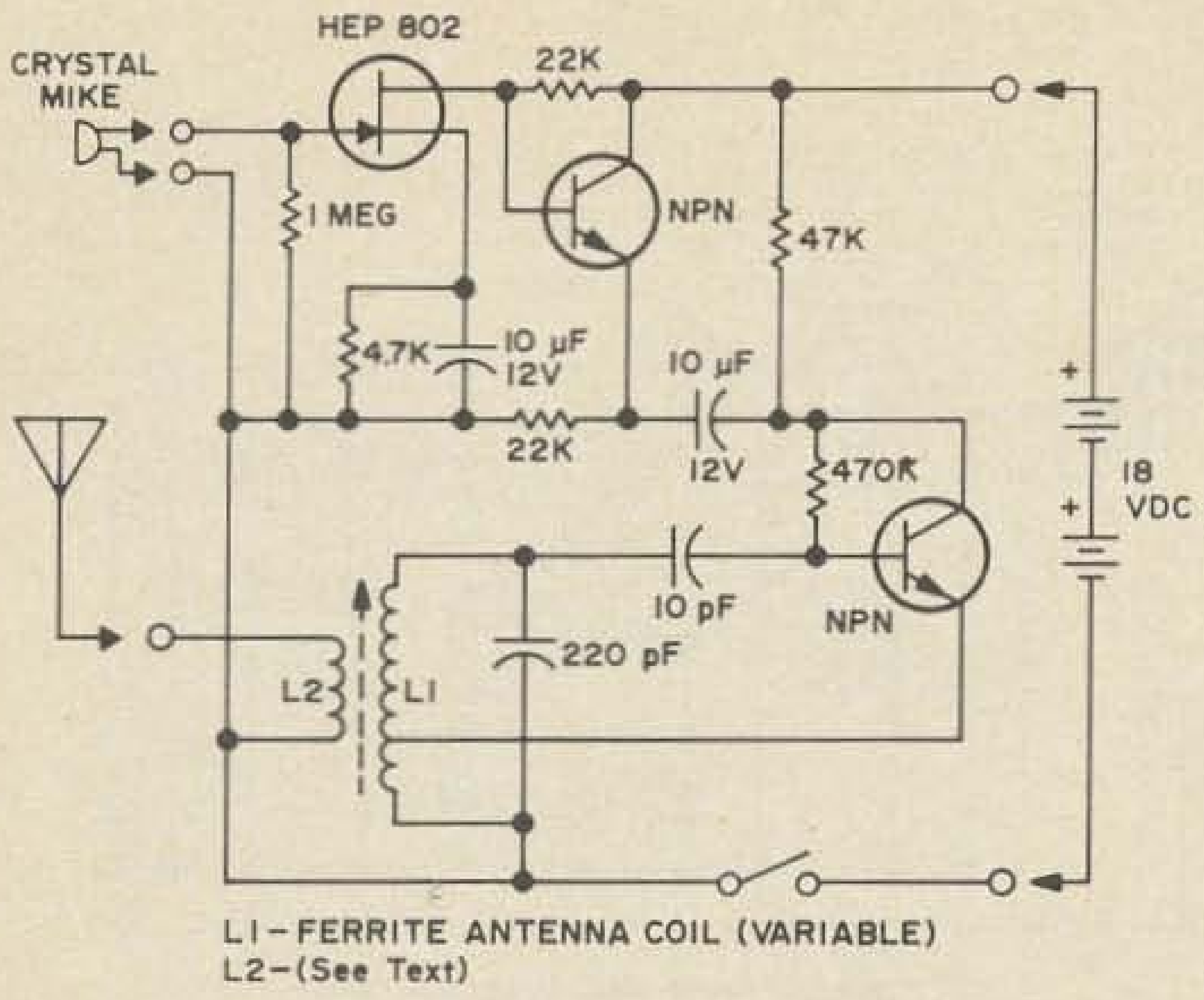
This single-tone decoder has a high degree of selectivity, stability and reliability. Designed by Bob Mueller K6ASK, it and its companion encoder below appeared in FM Magazine in January, 1968. The article is reprinted in FM Anthology I, published by 73 Magazine.



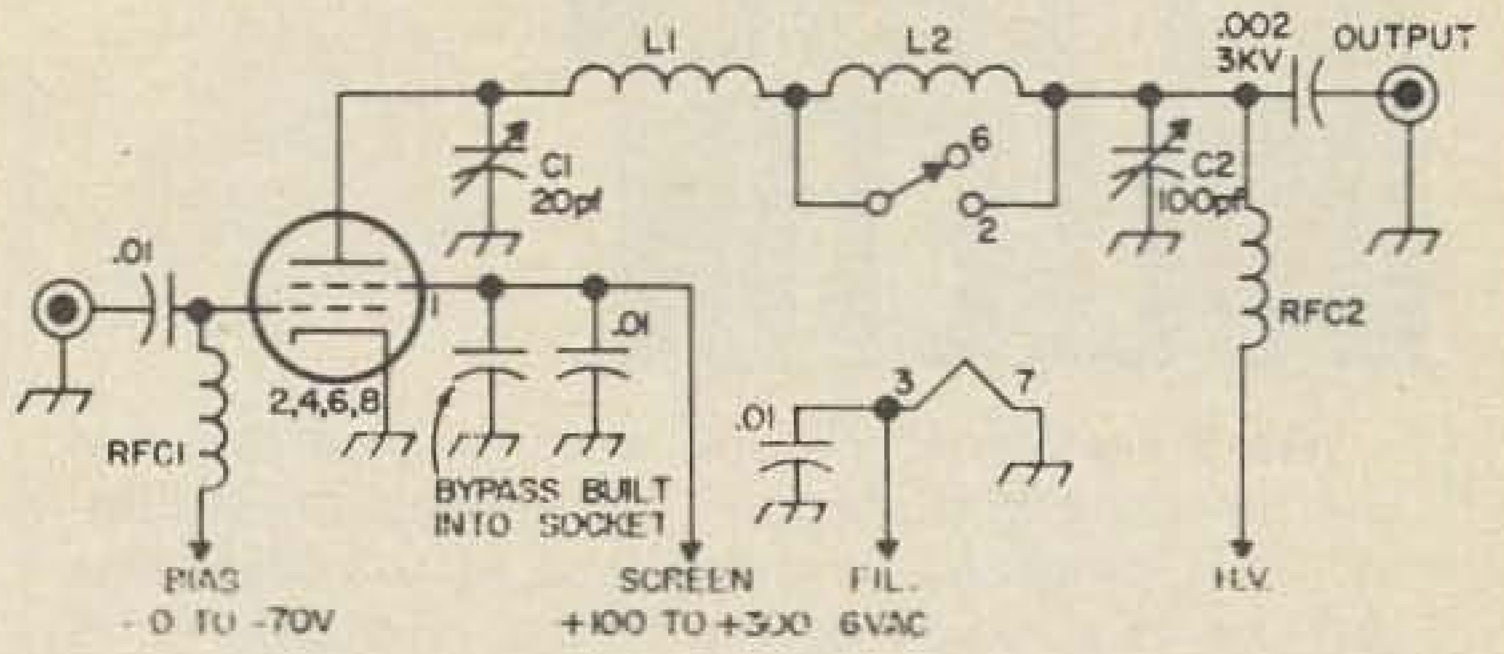
Touch switch. This switch is operated by body capacity . . . just touch the plate to operate the relay. How about this to turn the rig on and off? You can use a latching relay, time delay relay, stepping relay, to do just about anything. Circuit courtesy Motorola HMA-33 Tips on using FETs, available free from Motorola, Department 73, Box 20924, Phoenix AZ 85034.



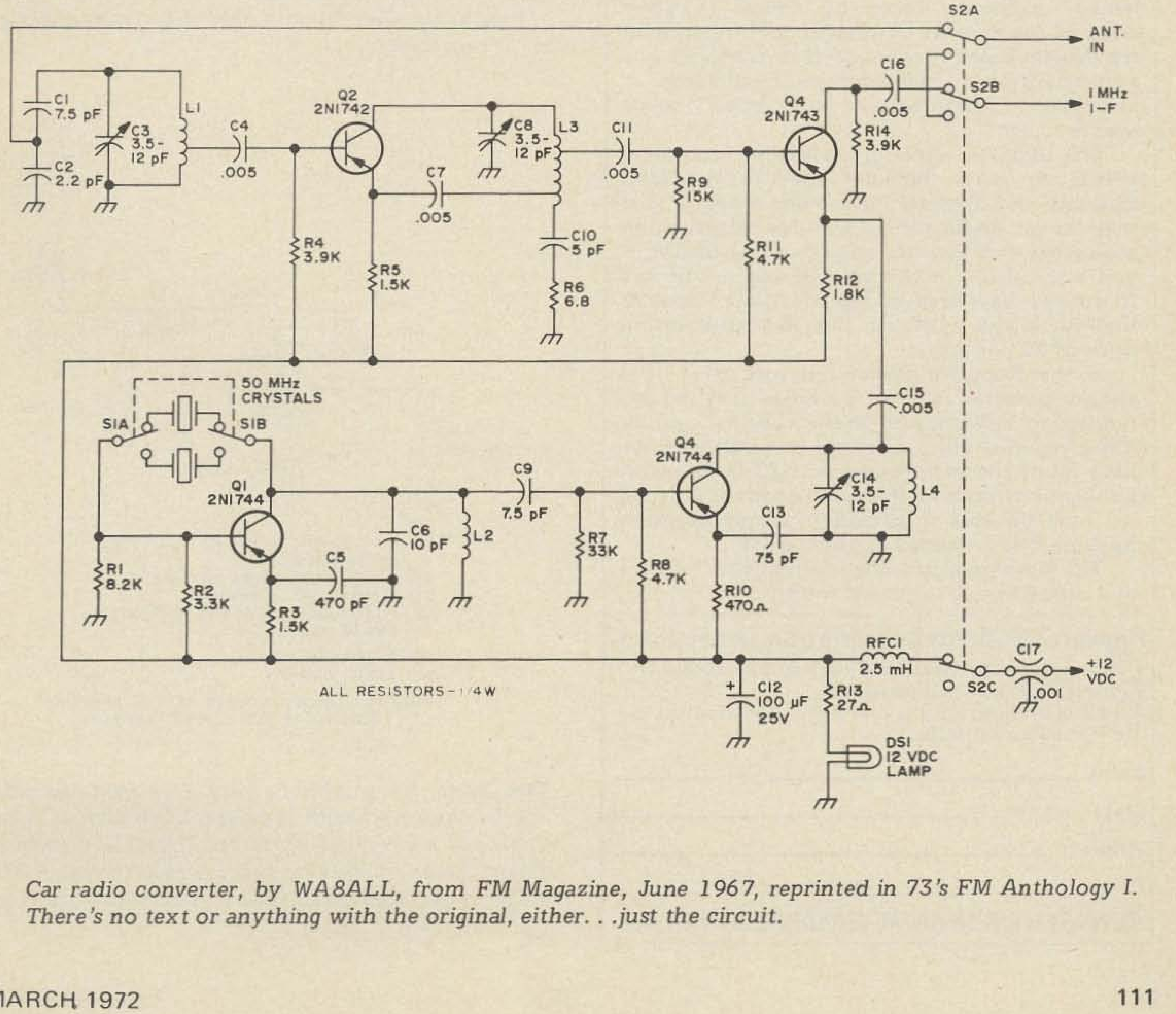
K6ASK single tone encoder (see above).



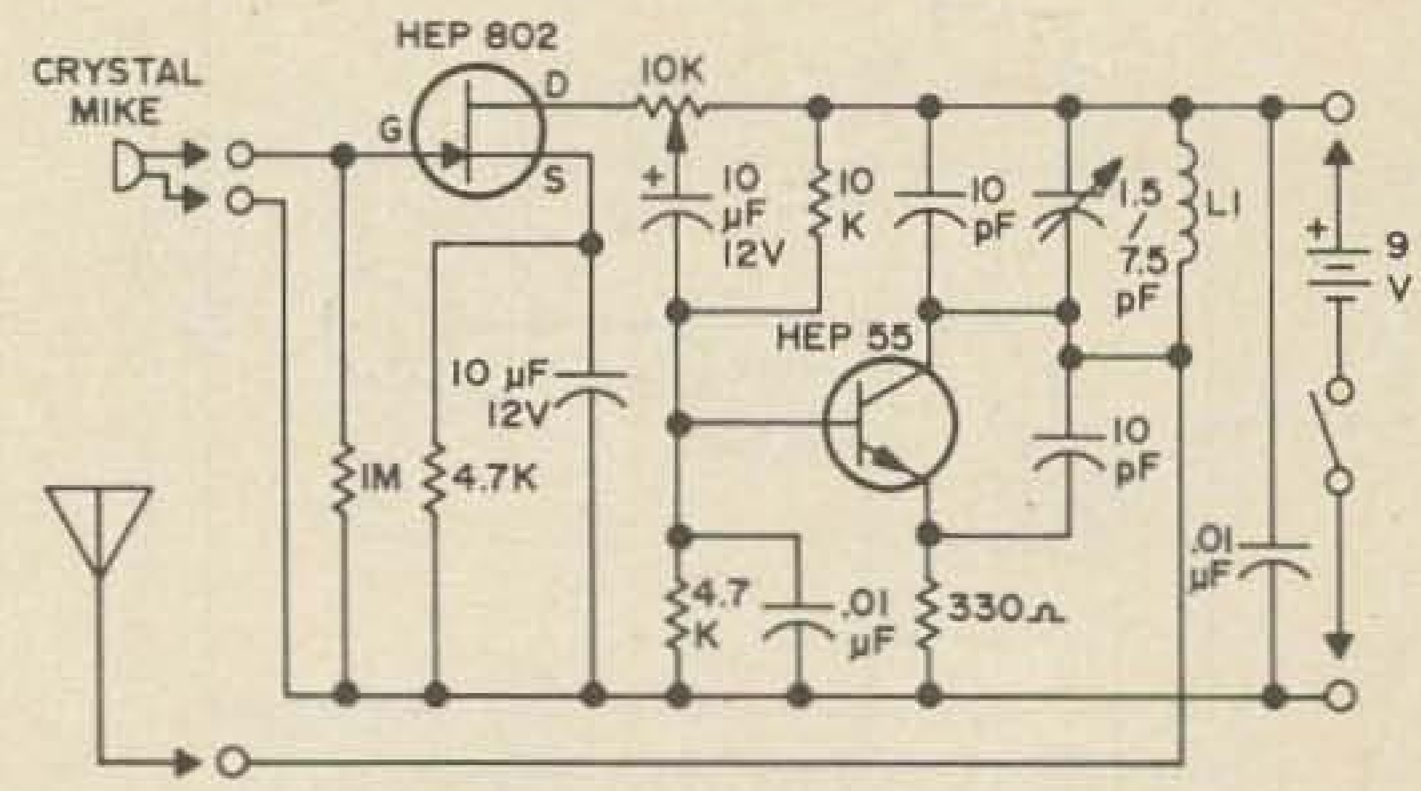
AM wireless transmitter. Useful for baby-sitting, sick watch, intercom, and plenty etc. Circuit courtesy Calectro Handbook. L1 is a variable antenna coil, ferrite, Calectro D1-841. L2 is four turns of hookup wire wound on top of L1. Q2-3 are NPN silicon transistors Calectro K4-507.



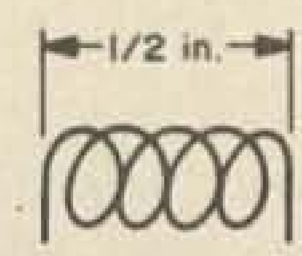
4CX250 amplifier for six and two meters, using single pole switching. By K1CLL, from 73 Magazine, April, 1966. Simple modifications by Fritz Hervey K4ETZ [forget the 6 meter coil and use smaller PA tuning capacitors, Class C bias and a grid tank] allow 10W drive, 200–250W out with enough air on the anode. Amplifier should have a screen clamp tube with G2 supply bled down from high B+ for best results, says Fritz . . . and he suggests a TV power transformer with a doubler for cheap 1.2–1.5 KV power.



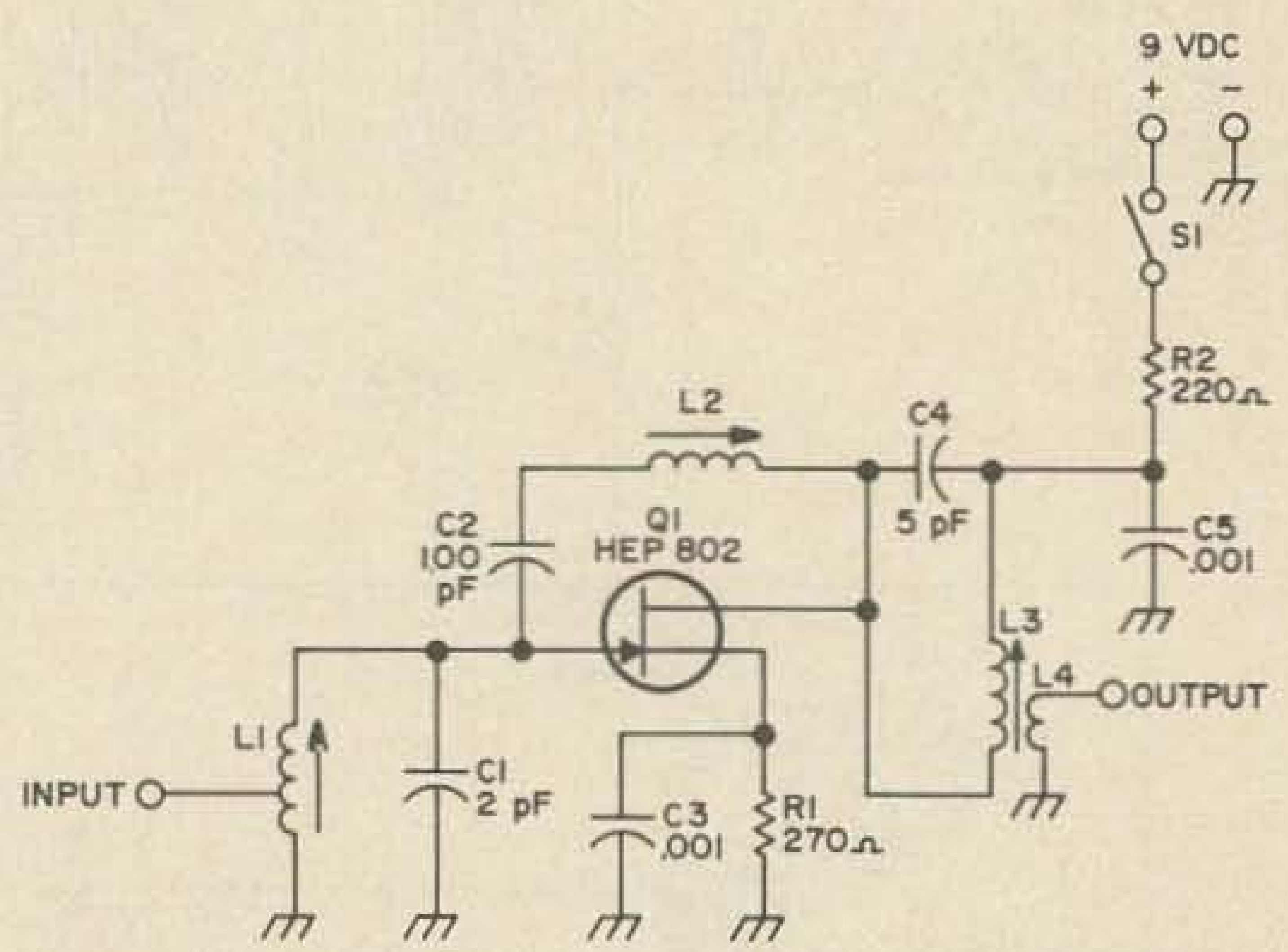
Car radio converter, by WA8ALL, from FM Magazine, June 1967, reprinted in 73's FM Anthology I. There's no text or anything with the original, either. . .just the circuit.



L1–4 TURNS 16 OR 18 AWG WIRE (See Text)



FM wireless transmitter (88–108 MHz). Might be used for bugging a room or something like that. Circuit courtesy Calectro Handbook. C7 is a short length of twisted hook up wire about 1/2 inch long. L1 is four turns length about 1/2 inch and 1/4 inch dia. Careful with this one, it can cover a lot of territory!



L1 – 5-1/4 TURNS, TAPPED AT 1-1/4 TURNS, NO. 26 AWG WIRE.
L2 – 9-1/2 TURNS, NO. 34 AWG WIRE.
L3 – 5 TURNS, NO. 26 AWG WIRE.
L4 – 1-1/4 TURNS, NO. 26 AWG WIRE, AT LOW END OF L3.

ALL RESISTORS–1/2W.
ALL CAPACITORS–10V.

NOTE: ALL LEADS SHOULD BE KEPT AS SHORT AS POSSIBLE (PC BOARD IS RECOMMENDED)

Two meter preamplifier. Very few receivers will not be improved with a preamplifier such as this. The coils are wound on Miller #60A022-4 forms, or any other small brass slug ceramic forms. A PC board is recommended. Circuit courtesy Motorola HMA-33, Tips on using FETs.

Neil Johnson W2OLU
74 Pine Tree Lane
Tappan NY 10983

SIMPLE DIODE CONTROLLER

Some time ago I had a problem with the night light in my entrance hall. The little bulb kept burning out. The next step was to install a larger bulb. This was not too bright. About this time, I pulled the Variac from the workbench and determined what constituted a satisfactory setup. But it seemed foolish to keep a 1 kW Variac tied up in controlling less than 10W of power. The simple circuitry used in the solution to the problem should appeal to the reader, not only for light control, but for many other ac-dc applications. Light control, soldering iron heat control, and speed control for small universal ac-dc motors are but a few examples.

Most experimenters are acquainted with the fact that with a small current load, the dc output of a capacitor-input type of filter will soar to relatively high voltages. Advantage is taken of this fact in the simple circuit under discussion. The circuit, shown in Fig. 1, has only seven parts: three capacitors, three inexpensive slide switches, and a silicon rectifier. Cost for the whole thing? Three or four dollars, if you buy all new parts.

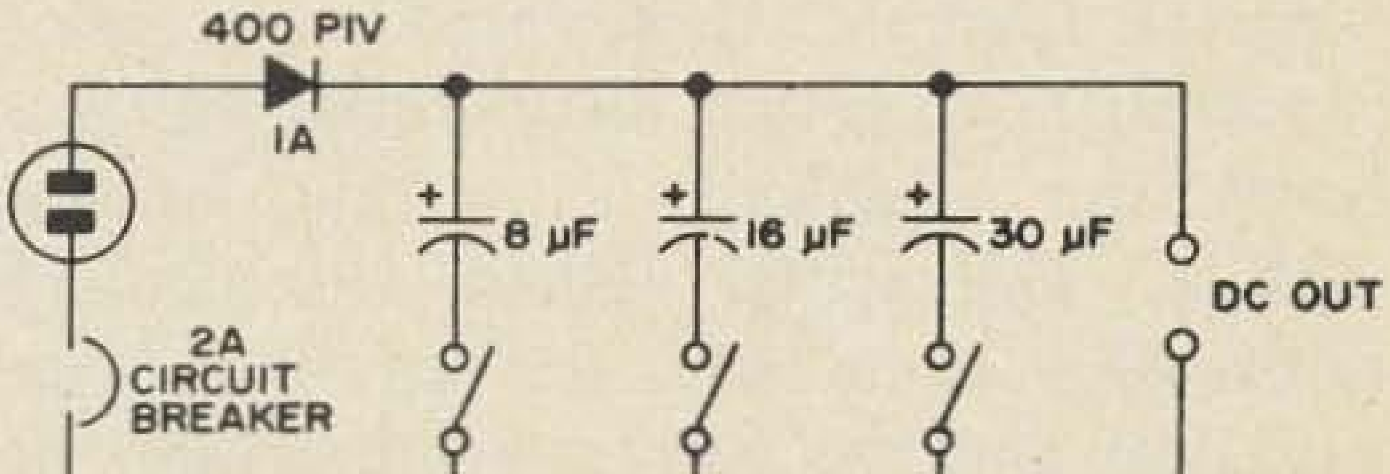


Fig. 1. Schematic diagram.

A diode will rectify the ac at 120V and convert it to pulsating dc. Due to a small loss through the silicon rectifier, the output voltage will come out close to half of what is fed into it. If the ac is 120V, the pulsating dc will be close to 60V. When read on a dc voltmeter, the true DC voltage will be roughly 54V (60V due to half-wave rectification x 0.9). If this voltage is then applied to an incandescent lamp, the actual input wattage will be approximately 25% – that is, half voltage at half current. I say "roughly 25%" since my calculations have been simplified and do not include

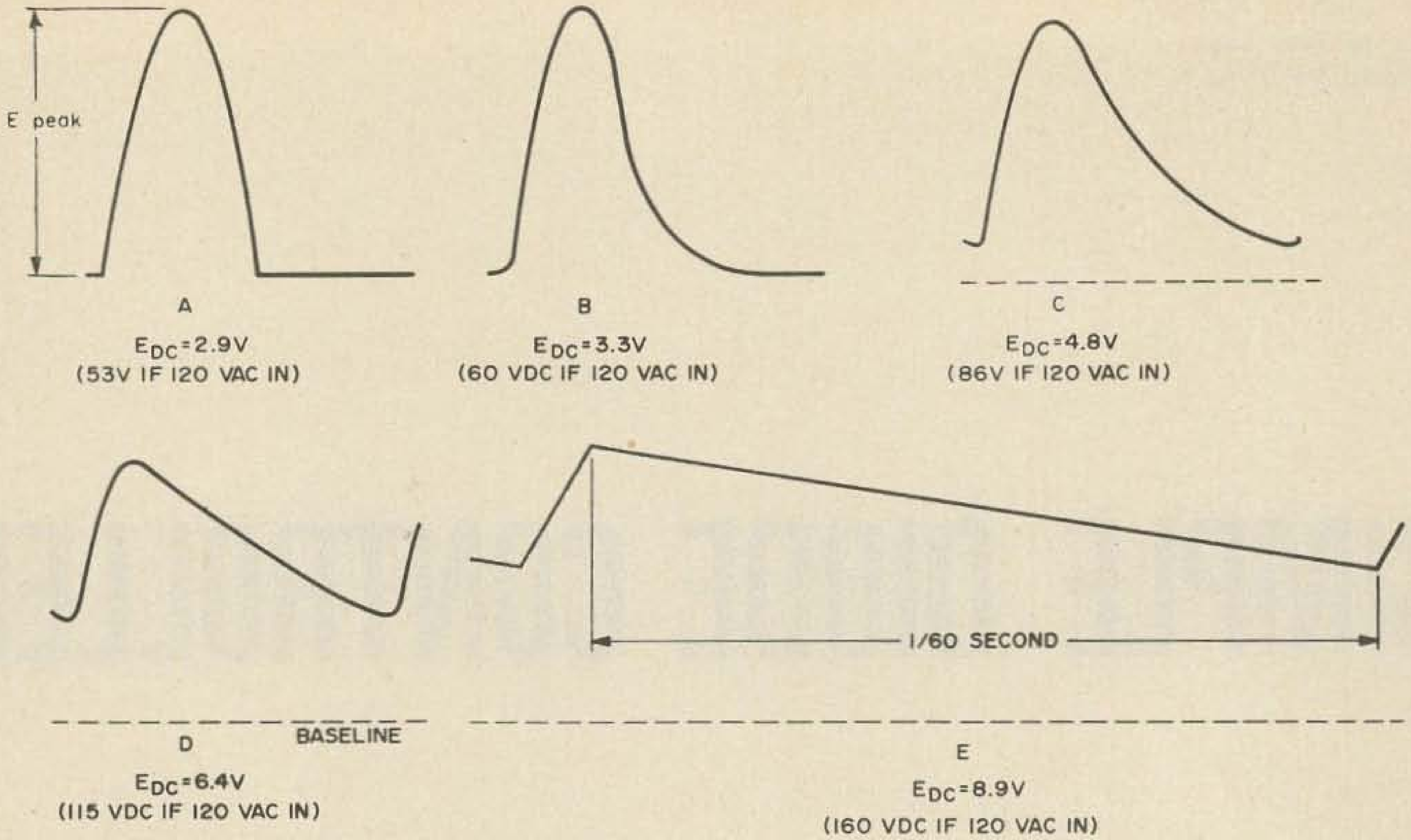


Fig. 2. NOTE: These waveforms and dc voltages shown are for purposes of illustration only. The actual dc output voltage from the unit diagrammed is much higher, running from a minimum of 53V to a theoretical maximum of 168V dc when fed with 120V. These CRO pix illustrate how a condenser-input type of filter will give more "boost" with varying amounts of capacity when feeding a fixed load.

the resistance-vs-temperature factor of the tungsten filament. If we introduce a small capacitor at the input to the filter, this will boost the pulsating dc output voltage slightly. The actual voltage will depend principally upon the size of the filter capacitor and the current requirements of the load being supplied. Through the application of three capacitors of 8, 16, and 30 μF, we can obtain eight discrete steps throughout the range of the controller. That is, we can use the output of the silicon rectifier with 0 - 8 - 16 - 24 - 38 - 46 or 54 μF of input capacity. This will give a wide range of control for small loads, any nonreactive type of load, up to a maximum of 50W with the normal line voltage of 120V ac being fed into the input. Strictly ac types of electrical equipment, such as a transformer, cannot be fed from the controller, since the output voltage is pulsating dc.

A look at the oscilloscope will show how this variation in voltage is effected. In Fig. 2 the unaltered half-wave of the rectified and unfiltered dc shows above the baseline. As more capacitance is added across the rectifier output, the valleys between the alternate pulsations of dc start to fill in. A close examination of the last CRO presentation will reveal that the rectified dc pulse does not return to the baseline, where it would touch zero. Instead it remains at a much higher average level, due to the storage effect of the capacitors.

With a 120V ac input, this would amount to 169V. For this reason, it is always wise to start the controller with zero capacity, and then add small increments of capacity. When the characteristics of a particular load become familiar, the controller may be turned on to a predetermined setting.

My main use for this simple controller is the setting up of certain light intensities, plus heat control for a small soldering iron. There are no theoretical limits for a device of this nature, but economic realities limit its function to controlling powers up to 50W. Beyond that range, other devices begin to come into their own. However, the simple diode controller does a very effective job up to 50W or so, and does so with low cost and simplicity.

. . .W2OLU■

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Oakville, Ontario

Some Harmonic-Suppression with a Low-Pass Filter

or

How to Eliminate THE Major Source of TVI

TVI is predominantly caused by radiated harmonics. Particularly the 14, 21, and 28 MHz bands cause harmonics that fall into TV channels 2–6. This was my problem also and it was fairly easy to cure it.

I was stuck with TVI a long time because most literature listed several sources of TVI and I was not able to classify my source. As for remedy, I didn't want to spend any money on a trial-and-error basis. But eventually, it became obvious that the problems were antenna-radiated harmonics, and that the cure would be a low-pass filter.

To make triple-sure, I borrowed a grid-dipper and fiddled myself a standard pick-up coil, which I hooked up to my dummy

Fig. 1. Diagram of filter set-up.

load. Then I tuned the spectrum while I switched to 10, 15, and 20m bands. And there they were – harmonics. 57 MHz, 63 MHz, 85.5 MHz. And when I checked the TV channel frequencies, I really understood why I had to have TVI. I estimated the power level of my harmonics by switching my pickup coil over to a little transistor oscillator, on 27 MHz, which puts out 30 mW, rf. This indicated that my harmonics at 57 MHz were 5–15 mW on

14 MHz and 15–30 mW on 28 MHz. This would be 35–45 dB down compared to my transmitter output, which is 100W. I looked through the specs of a few transmitters in this price and power bracket and found specs to read around –40 to –45 dB for harmonic suppression. So I was in the ballpark with my measurements.

The Filter

Surprisingly, none of the handbooks emphasized the urgent need for a low-pass filter to eliminate harmonics that go to the antenna. One would expect this to be just as standard as the transmitter itself. After I obtained my results on the cause of my TVI, I purchased a good quality low-pass filter. Good design, I should really say, because it has a few features that are essential if you want the filter to work efficiently – and which not all available low-pass filters have.

Two most essential tuning adjustments are the input- and output-impedance adjustments which are an asset if you want to avoid excessive power loss on transmitting and receiving. (See Fig. 1 for schematic.) Another important feature is the three tuning adjustments for channels 2-3-4, 4-5-6, and 7 & up. The filter manufacturer claims a suppression of 70 dB minimum for frequencies of 45 MHz and higher. This put my harmonics from 40 dB down to 110 dB, which is about 1 nW in my antenna. It eliminated all my TVI problems except for channel 2 on my own set, but then – my TV antenna is right below my groundplane.

This filter is a Radio Society of Ontario design and is manufactured by Taylor Communications, Uxbridge, Ontario. The price is $24.95 Canadian. It is not cheap, but it *is* effective.

How to Tune the Filter

The success of the filter depends on how well you tune it, and to do this you must have an swr bridge or some kind of reflectometer. The best way to set it up is as Fig. 2 shows. From your transmitter you should go through your reflectometer to the filter, from there to the antenna. Since the filter is designed to work in a 50–75Ω line, you have to use this type of coax for the interconnections. If you want to use a 450Ω open feeder you have to install everything between transmitter and tuner. Now, before you start tuning you also need a dummy load. With all the equipment hooked up as in Fig. 1, first adjust the input and output impedance of the filter. Tune C1 for a maximum *forward* reading on your reflectometer, tune C4 for minimum *reflected* on reflectometer. Repeat the adjustments several times. Your reflected power should be less than 1%, or below 1.2:1.

The next adjustments are to get maximum rejection of the interference frequency. To do this I turned on my TV set and switched it to the channel that I wanted to clear up. I increased the signal of the transmitter until the picture would get crossbars. Then I started to tune the related C on the filter in small increments. After each incremental adjustment I repeated the tuning procedure for C1 and C4 to maintain the low swr. Since I did not have any TVI at TV channels 7 & up I simply adjusted this C5 for maximum *forward* deflection.

After tuning the filter according to this procedure, I eliminated TVI on channels 3, 4, 5, 6; only 2 remains somewhat a problem in my own house. Neighbors of mine who had TVI before do not have any at all. One chap with a color TV can merely see a faint change in color on channel 2.

You will find that you might not have the optimum filter setting when optimizing for one particular frequency. In my case, when tuned for 20m I found swr tuning was not quite maximized on 15m and somewhat more off on 10m. I set my filter

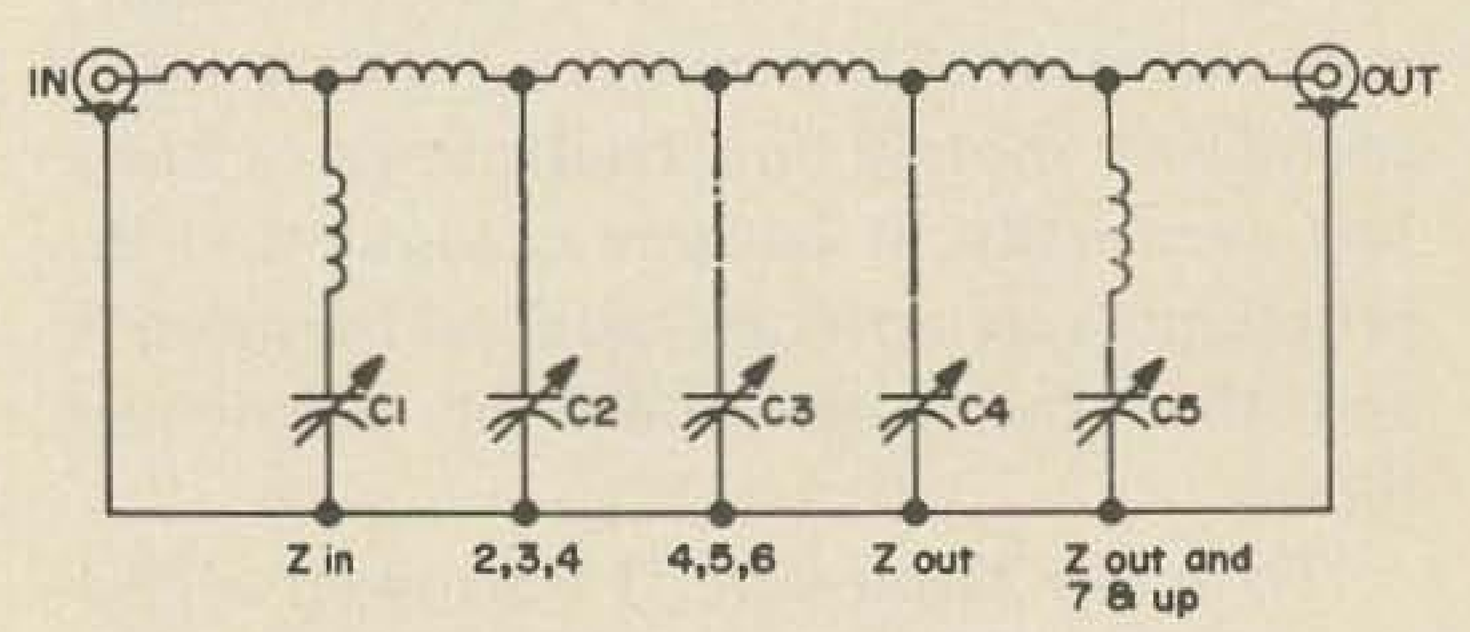

Fig. 2. Schematic of filter.

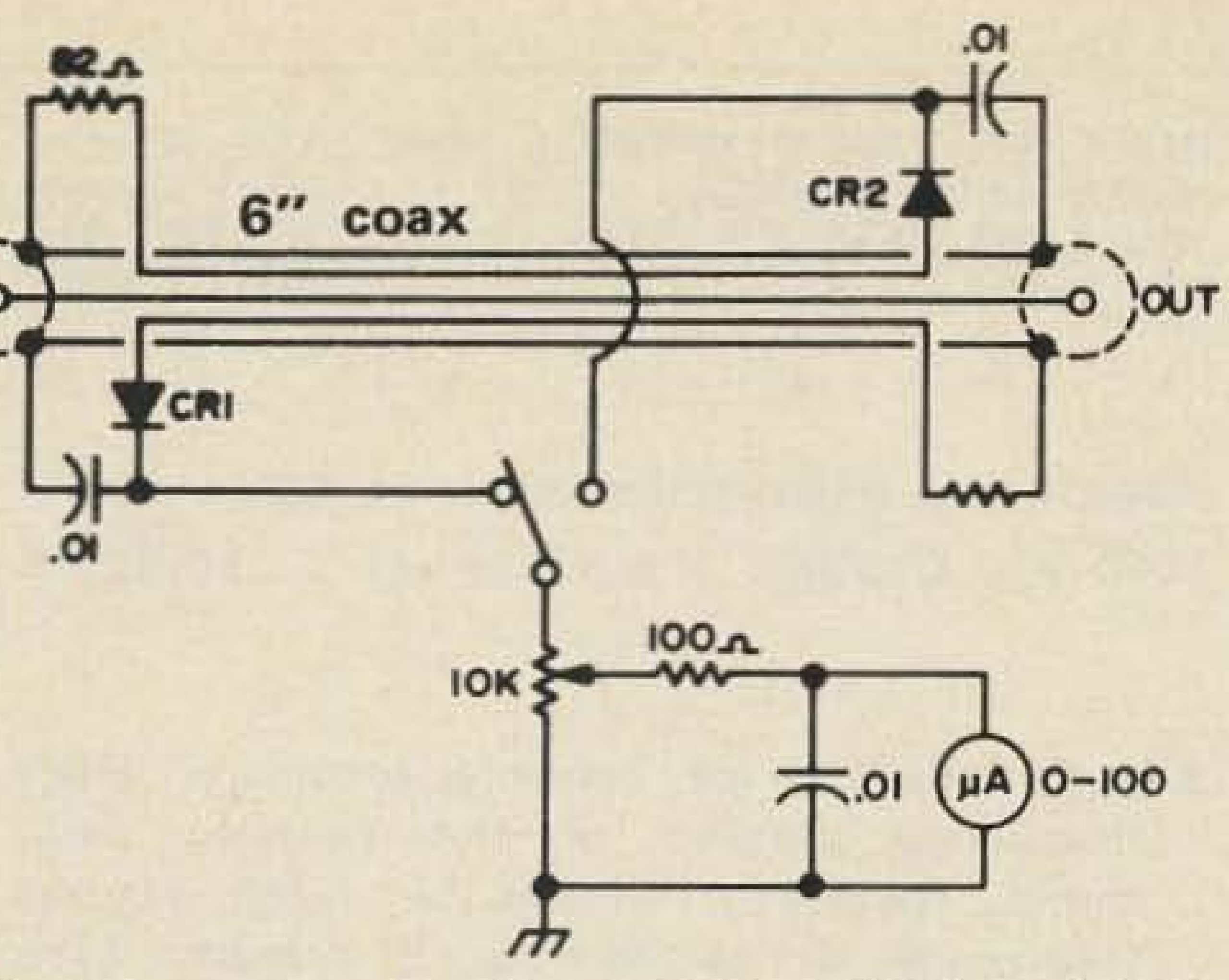

Fig. 3. Schematic of reflectometer. CR1 and CR2 are any matched pair of silicon or germanium diodes.

to compromise between the 3 bands. With a dummy load, reflected power on a compromise setting reads between 1 and 2% depending what part of the bands I use. Switching to my groundplane antenna, I am getting between 2 and 6% power reflected.

The Reflectometer

The reflectometer I used (Fig. 3) is a modified version, as the one listed above. As a conductor and pickup I used 6 in. of RG-8/U coax with two insulated wires pulled into the braid. This is less of a mechanical job than the original of W4BRS (73, Sept. 1967). As for the meter scale, I also calibrated it in "% reflected." This is more meaningful to me than swr.
Dial calibration based on a 100% meter scale:

Scale %	= SWR	= % reflected power (coax losses disregarded)
9	1:1.2	.8
20	1:1.5	4.0
33	1:2.0	10.5
43	1:2.5	18 5
50	1:3.0	25.0
60	1:4	36.0

The Dummy Load

This dummy load (See 73, Feb. 1968, WA6OBH) was built and I found it can take 80W rf for quite some time. However, I do not advise you to use motor oil for coolant, since its dielectric constant is much to low because of inorganic additives.

...VE3GSP■

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141-60 73rd Ave.
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HW 100... Adding the 400 Hertz CW Filter

Many operators like to work both CW and phone. The HW-100 is supplied with the SSB filter only. Heath states in the HW-100 manual that the CW filter can be placed in the rig, but at the cost of leaving out the SSB filter. This of course leaves the transceiver good for CW only. Many operators, like myself, operate both CW and phone, so of course I put in just the SSB filter. Being very human, I later decided it would be nice to have a narrow, 400 Hz slot for CW. This, of course, was realized after the rig was completed. I spoke with some boys who placed the CW filter into the *completed* HW-100, doing it as it is done in the SB-101. This is a herculean task in the completed rig, but it can be done.

After reviewing the circuitry, Fig. 1, and the method of mechanically performing the switching of either filter in or out of the circuit in the SB-101, I felt there must be an easier way to do it. The following modification is easier, faster to install, and *cheaper*. I spent 49¢ over the cost of the filter and a new matching panel knob.

Modification Procedure

Additional parts needed:

1. CW filter with mounting nuts.
2. Matching panel knob for HW-100.
3. Rotary wafer switch containing the equivalent of 3 SPDT contacts (Fig. 2).
4. New mounting bracket for filter. The old one can be redrilled, as I did, to accommodate the two filters as both filters are physically identical and the bracket for both filters is the same as the CW bracket alone, except for the holes being in different places.

Considering the frequent use of both filters at my QTH, front panel installation for the switching of the filters was needed. Since the mike will usually remain connected, access to the mike connector was of secondary importance.

The PTT mike connector, at hole M on the front panel, was moved to the left rear apron where the unused hole was enlarged to receive it. Additional hookup wire was used to lengthen the circuitry resulting from the move. The wafer switch was placed in the hole M. The CW filter was mounted on the filter bracket with the SSB filter. The two capacitors, C506 and C101 and the resistor R929 are not connected to the filter, only to the circuit board points as instructed in the HW-100 manual. The remaining connections of the capacitors and the resistor will be done on the wafer switch as in Fig. 2. Make sure the lugs of the phone jack at hole L does not contact the lugs on the wafer switch. Bend the lugs away as needed on the phone jack. All leads from the wafer switch to the filters will pass through grommet CA for neatness and ease of installation.

Ground connections can be made at any convenient point. R929 went to the ground foil of the modulator board. The

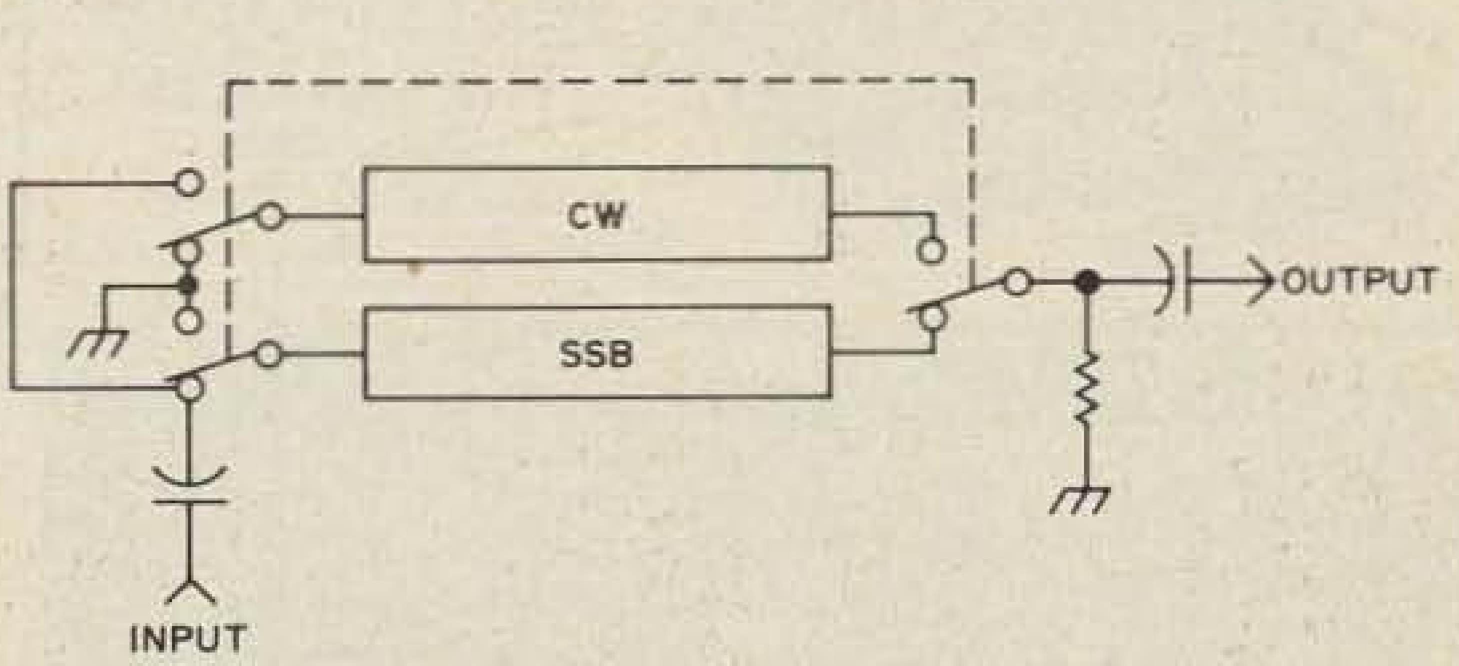

Fig. 1. Schematic for CW and SSB filters in SB-101.

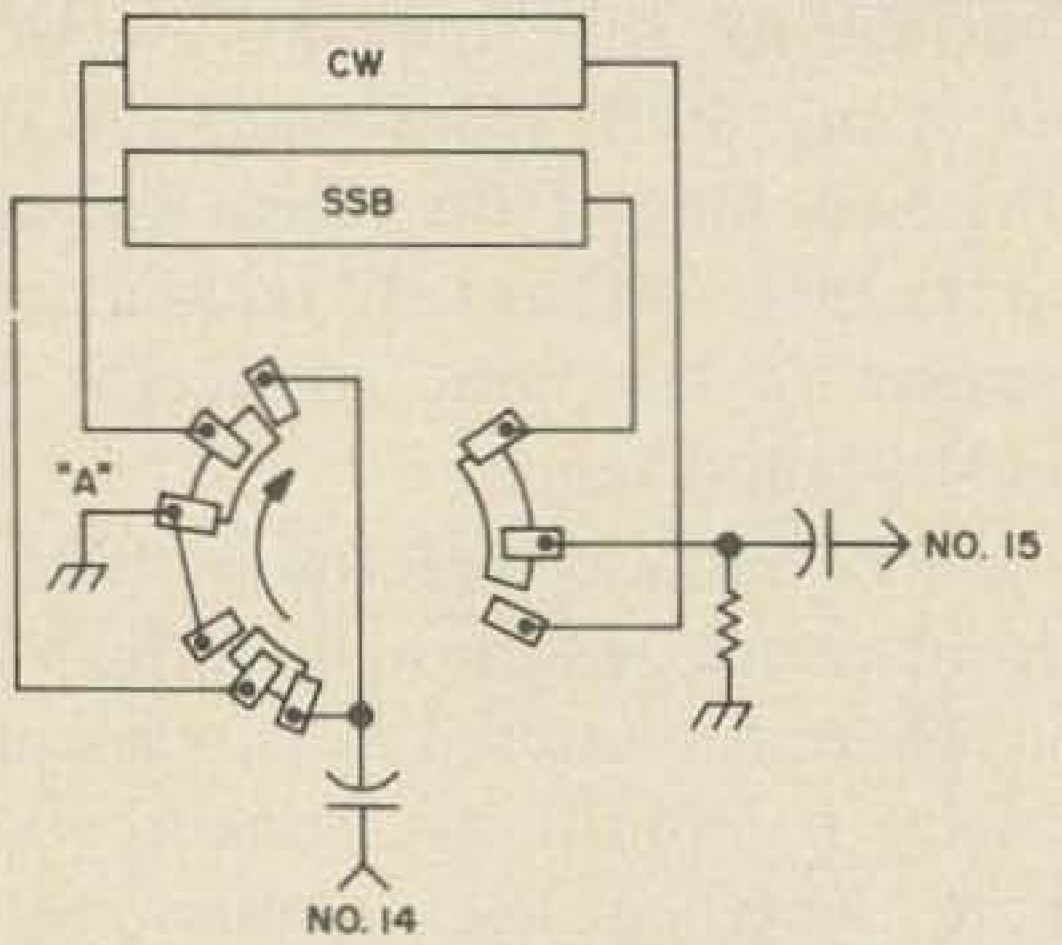

Fig. 2. Schematic/pictorial for CW and SSB filters in HW-100.

"A" ground (Fig. 2) I put to a bolt holding the modulator board to the chassis. Insulated wire was used and sleeving as needed to prevent unnecessary bare wire exposure.

I strongly suggest that if the original filter bracket is going to be redrilled as I did, that you remove the bracket from the rig, even though it means removing the VFO also. This little extra work will save a load of time, effort and possible expense in trying to find short circuits and/or resultant damaged components caused by those small bits of metal dropping into the works of the rig. Also do not try to get away with the grounding on the input side of the filter when not in the circuit. These filters have, I am told, bifilar windings. Because of the close coupling of these two filters, induced emf can be generated in the filter while not in use. This in turn will create its own field which will affect the filter in the circuit. This induced emf in the unused filter must be removed and is done so by grounding. You can count on this to hamper the filter qualities and to interfere with good receiver operation.

The advantage of this method of installation is that the front panel does not have to be pulled away from the chassis. This can be a big undertaking for the type of switching used in the SB-101 because the wires are short on the band and mode switches on the front panel of the completed rig. Besides, the purchase of the 2 slide switches and the mechanical linkages for the switching of filters as in the SB-101 will cost far more than the 49¢ I spent for my wafer switch.

. . .WA2EAW

CQ U.S. with PHONE PATCH TRAFFIC

Ralph Steinberg K6GKX

Dial one one zero on your telephone and a pleasant voice answers, "Operator." This is nothing unusual except when a phone patch is being arranged by a long distance operator for some serviceman to talk to his family from Vietnam.

Thousands of phone patches are beamed daily to the United States by MARS stations in Vietnam. Handling thousands of phone patches takes team work; the long distance operator, the overseas radio operator, and the station in the United States receiving the overseas calls make up the team.

It is fascinating to see at first hand how these operators work the long distance switchboards The girls have boards with switches, jacks, and plugs. Each position has nine incoming and nine outgoing circuits and each operator is responsible for these circuits. If phone patching is in operation, each operator can handle nine calls at one time. To keep the calls moving smoothly, the operator always has another ready to talk when the preceeding call is finished. Usually, on phone patch operations, one operator will stay on the circuit until all phone patch operations are completed.

All phone patch calls are not just routine and many times the operator has difficulty in locating the person to receive the call. Frequently calls are for families living in small villages in mountain areas far from a long distance phone line. The operator will try to locate the nearest long distance phone so that the phone patch can be completed. Often company officials have assisted in locating hard-to-find parties, sometimes at all hours of the night.

Fig. 1. View of long distance telephone switchboard operations. Pacific Telephone Co. photo.

Fig. 2. Phone patching at MARS station K6WAH/AA6WAH. U.S. Army photo.

A serviceman in Vietnam was calling his family, and the long distance operator advised the father that she had a collect call from his son and would he accept the call. The father refused the call thinking someone was joking until the operator explained it really was his son on the line and the father then accepted the call. It was a happy and exciting event as this was the first call the family had received since the son left home to go overseas. They were unaccustomed to receiving phone patch calls, especially collect. On other calls proposals of marriage are heard several times a day. As one serviceman proposed, the sound of guns could be heard in the background.

Drama has an equal share in the phone patching. One call from a serviceman to his wife was never completed as she was among the missing in a plane crash. There are also calls to the families by the servicemen, explaining that they have been injured, but not to worry. One serviceman was talking to his wife and asked if the new baby had been born. When he learned that triplets were born, the telephone line went dead on his end. He had fainted.

The long distance operators are exceedingly interested in the phone patch work they are doing. They, too, have sweethearts, husbands, brothers or sons in the military service, and frequently receive phone patch calls from them. These girls take their work very seriously, and even with all the thousands of phone patch calls they handle, each call has some feeling of excitement attached to it.

Most phone patch traffic from Vietnam is received on the west coast at MARS stations from San Diego, California, to Ft. Lewis, Washington. In southern California, there are more than twelve MARS stations located on Army, Air Force, and Navy installations. Many thousands of phone patches are completed each month through these stations, with additional calls being handled through radio amateurs, members of the Military Affiliate Radio System. One of the busy MARS stations in the Long Beach, Los Angeles area is K6WAH/AA6WAH at Fort McArthur, with radio operators on duty twenty-four hours a day. This station completes an average of 4000 phone patches a month.

It was not my purpose to glamorize the long distance operators, but to commend them for the fine work they are doing to keep up the morale of our servicemen.

. . . K6GKX ■

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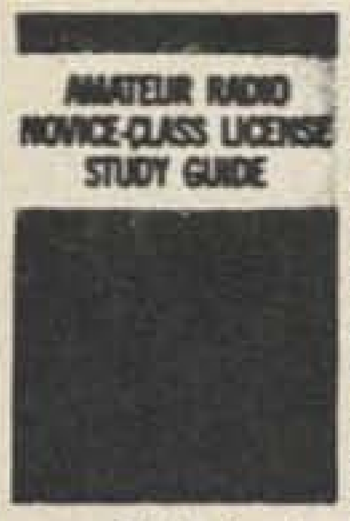

Getting a Novice license is just about as easy as falling off a log—with this new study guide. All the mystery and confusion is taken out of learning the theory involved in the FCC exam. It is simple and logical, taking the basics of electricity and radio and exposing them as the really simple things they are. This book was written by an average ham to be read by absolute beginners. It is not for engineers, nor for children, but for the reader with the equivalent of a high school education and the interest to think things through. The theory is simple, and there is no reason why anyone cannot get an amateur Novice license after a few days study. 160 pps.

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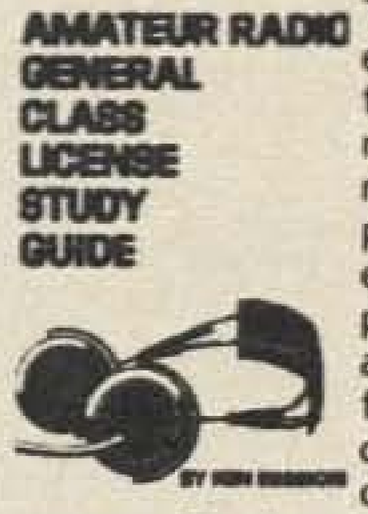

Teaches, in simple everyday language, the technical aspects of ham radio considered necessary prerequisites to passing the General-Class exam. The author takes a patient and personable approach, yet gets right to the heart of the technical questions the FCC will ask on the General-Class exam. Each question is dealt with individually, and the answers are explained in depth, but at a level that can be easily understood by relatively inexperienced, nontechnical readers. The text follows the philosophy that learning—not memorizing—is the key to successfully entering the higher grades of amateur radio. Pertinent facts are grouped into palatable doses.

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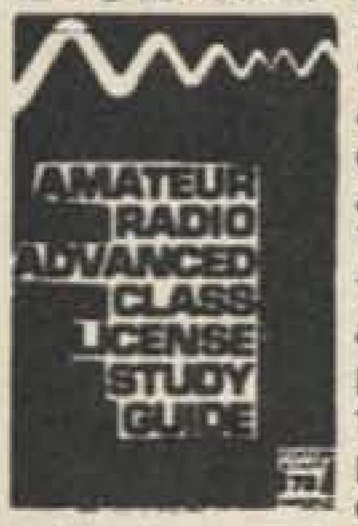

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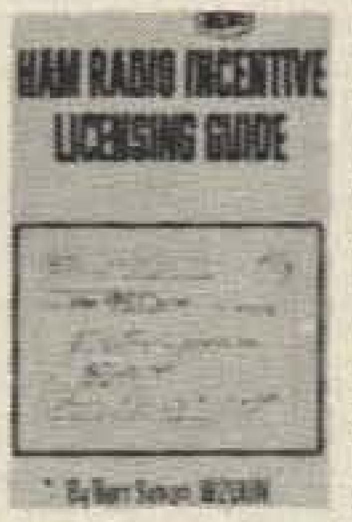

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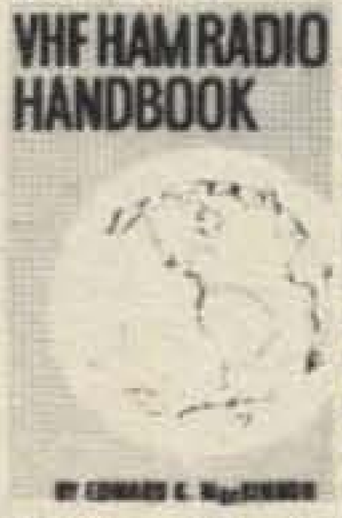

Explains how to make use of the many VHF-UHF techniques—hints and kinks, transmitters, antennas, equipment modifications, receiver and modulator circuits, etc. The final section describes 25 VHF construction projects, including transmitters, receivers, preamps, filters, RF amplifiers, a field strength meter, noise generator, and a VFO for all bands. Other chapters cover VHF propagation phenomena and power supply considerations. Written for the ham who takes pride in contributing to the advancement of the art. Truly a book every ham will want to own. 176 pps., over 100 illus. Scores of construction projects.

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Confessions of a Surplus Hound

Some hams are builders and prefer to experiment, some do otherwise. This article is dedicated to the first group. Before the war, I got started in the ham game . . . scrounged and swapped for parts and made do with whatever was available. Slightly used Weston meters at $3 each, secondhand midget tuning condensers at 50¢ . . . that sort of stuff.

Came the war and the subsequent flood of surplus equipment, some good and some not so good, but all of it very cheap. Incredible bargains! An awful lot of that stuff found its way into my basement. I had accumulated so much junk that prior to moving to the new location several years ago, I started six months early to swap, sell and give away all the gear that couldn't be carted to the new QTH. Resolved never to let it happen again! But it did. Maybe that's because I'm hooked on surplus . . . at any rate, here are a few useful tips.

As I said, there is some very good stuff on the surplus market and some not so good. If you should buy a damaged night-light control and fool around and fix the thing, that's all right. Even though you may never use it, you've learned something. But never buy a piece of gear just because it looks nice. Otherwise you will end up with a shack full of surplus and no room in which to put your operating equipment. Don't laugh, please. This has happened to stronger men than you!

Where to purchase the surplus? When Cortlandt Street – New York's oldtime "Radio Row" – was in existence, it was quite simple for thousands of bargain-minded hams to snoop and shop, to visually inspect the gear that was for sale. Today Radio Row is but a fond memory but this illustration points up rule number one: See before you by. This might be impossible in certain cases, so we go on to rule number two: If your buddy bought an item from a particular surplus merchant and was happy with the deal, the chances are good that you can buy the same or similar gear from the same outlet with satisfaction. I can now hear you asking "What happens if I can't apply rule number one or rule number two?"

You could take pot luck and perhaps end up unhappy. But there are a few angles whereby you can tip the odds in your favor. No guarantee of success, mind you, but a big improvement in your chances. Take a close look at any surplus hound's catalog file. Along with all the popular mail order catalogs you will find catalogs from some of the larger surplus houses. This is usually a good sign, for it shows that this particular firm thinks enough of its customers to go to the time and trouble to assemble, print and distribute a catalog. What with annual or more frequent updating, this all takes time, money and effort. These firms put out these catalogs because they want you to be a satisfied customer. Also, when you receive a catalog, many of the items are illustrated. This works in your favor, since you will have a fairly good idea of what the gear looks like before you buy it. In a catalog there is room for a description, plus specs such as size, weight, color and so on. Less chance for misunderstanding.

Other merchants operate along slightly different lines. That is, they do not feel justified in making up and issuing a catalog at regular intervals. This is particularly true in some cases where the firm specializes in big-ticket items, fewer in number, such as HF receivers, used oscilloscopes and relatively expensive test equipment. The majority of firms that advertise are ethical, and in case you are disappointed, a letter to the firm in question will usually rectify the situation. The chances of your getting burned are greatly reduced if you will follow these simple rules. Why shouldn't you profit from someone else's mistakes?

I have been well served by many of 73's advertisers, among them Meshna, Fair Radio, Jefftronics and Columbia to mention just a few. In the old days I was forced to buy surplus in order to save money. Now I find that I buy the stuff to save time and trouble, not to mention exasperation, since the nearby radio stores don't always carry the particular parts needed. What's that saying by the French to the effect that "The more things change, the more they become the same?"

W2OLU

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7A	14	14	14
ARGENTINA	14	14	7A	7B	7	7	14	21	21	21	21	21
AUSTRALIA	21	14	7B	7B	7B	7B	7	14	14	14	21	21
CANAL ZONE	14	14	7	7	7	7	14	21	21	21	21A	21
ENGLAND	7	7	7	7	7	7B	14	21	21	21	14	7A
HAWAII	21	14	7B	7	7	7	7	7B	14	21	21	21
INDIA	7	7	7B	7B	7B	7B	14	14	14	7	7	7
JAPAN	14	7B	7B	7B	7B	7	7	7	7	7B	7B	14
MEXICO	14	14	7	7	7	7	7	14	21	21	21	21
PHILIPPINES	14	7B	7B	7B	7B	7B	7B	7	14	14	7B	14
PUERTO RICO	14	7	7	7	7	7	14	14	14	21	21	14
SOUTH AFRICA	14	7A	7	7	7B	14	21	21	21	21	21	14A
U. S. S. R.	7	7	7	7	7	7B	14	14	14A	14	7B	7
WEST COAST	14A	14	7	7	7	7	7	14	21	21	21	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7	7A	14	14	14
ARGENTINA	14A	14	14	7B	7	7	14	21	21	21	21	21
AUSTRALIA	21	21	14	7B	7B	7	7	7	14	14	21	21
CANAL ZONE	21	14	7	7	7	7	14	21	21	21	21A	21
ENGLAND	7	7	7	7	7	7	7B	14	14	14A	14	14
HAWAII	21	21	14	7	7	7	7	7	14	21	21	21
INDIA	7	14	7B	7B	7B	7B	7B	7B	14	7	7	7
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MEXICO	14	14	7	7	7	7	7	14	14	14	21	21
PHILIPPINES	14	14	7B	7B	7B	7B	7B	7	14	14	7B	14
PUERTO RICO	14A	14	7	7	7	7	14	21	21	21	21	21
SOUTH AFRICA	14	7A	7	7	7B	7B	14	21	21	21	21	14A
U. S. S. R.	7	7	7	7	7	7B	7B	14	14	14	7B	7B

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ALASKA	14	14	7A	7	7	7	7	7	7	14	14	14
ARGENTINA	21	21	14	7B	7	7	7B	14	21	21	21	21
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CANAL ZONE	21	14	7A	7	7	7	7	14	21	21	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	7B	14	14	14	7B
HAWAII	21A	21A	21	14	7A	7	7	7	14	21	21	21
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JAPAN	21	21	14	7B	7B	7	7	7	7	7B	14	21
MEXICO	21	14	7	7	7	7	7	14	21	21	21	21
PHILIPPINES	21	14A	14	7B	7B	7B	7B	7	7	14	7B	14
PUERTO RICO	21	14	7	7	7	7	7	14	21	21	21	21
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