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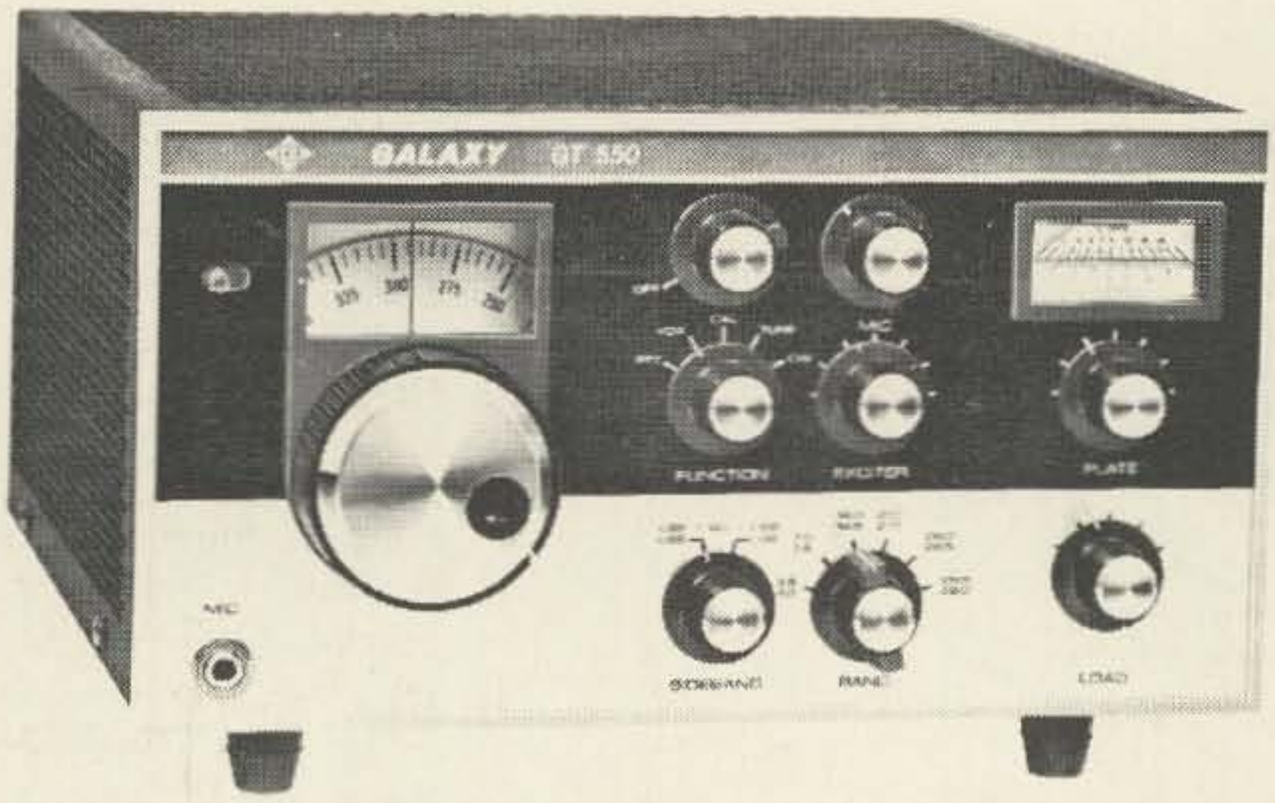

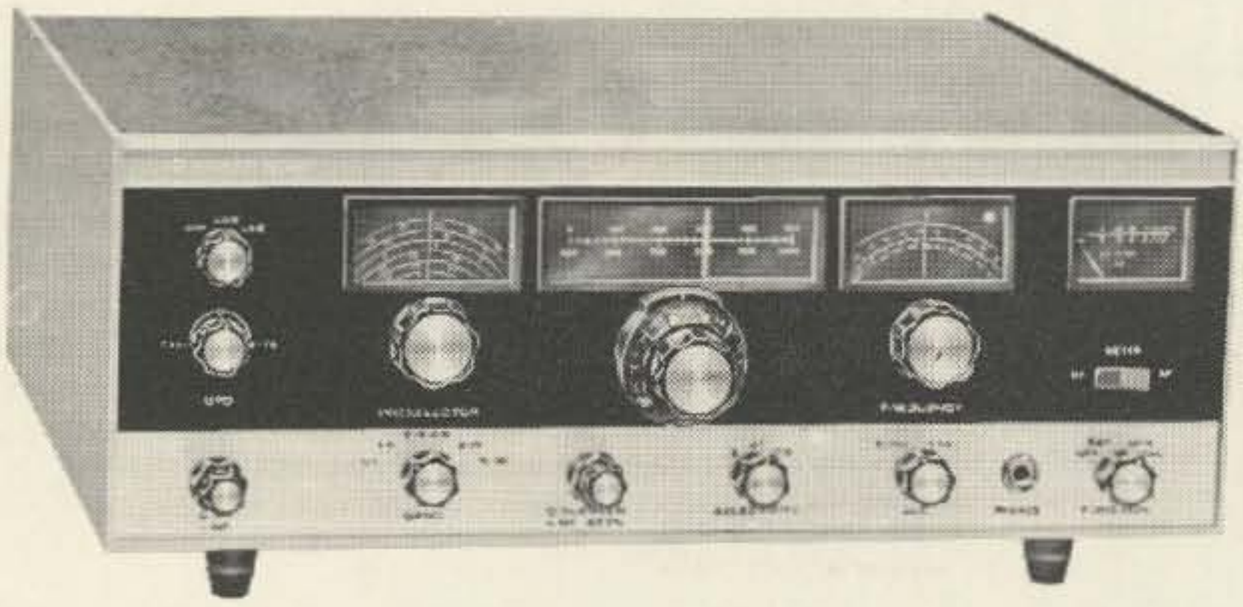

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73 MAGAZINE

#118 July, 1970

Contents

Features

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Amateur Radio News Page

July XIXLXX | Monthly Ham News of the World | 73 Magazine

NO-CODE HAM "HOBBY" LICENSE PROPOSED

Washington, DC. A brand new class of amateur license – to be designated "Hobby" class – has been proposed for the central portion of the 220 MHz amateur band. This new ticket would require no theory and no code, but would involve an exam, administered by any General, covering FCC rules and regulations governing operation in the applicable spectrum.

FM Only

The Hobby license would permit the holder to operate with a power of up to 100 watts using narrowband FM (±5 kHz deviation) in the frequency range from 220.5 to 224.5 MHz. This license would be available for a fee of $5 for a five year period and would be renewable upon proof of use and a $5 fee. The 220.0–220.5 and 224.5–225.0 MHz segments of the band would still be open to higher classes of license as presently authorized, thus preserving one MHz of the band for exclusive use of the higher classes of license.

The use of FM techniques would eliminate the problems of heterodynes which contribute so much to the frustrations of the 27 MHz band and would provide simple network systems with squelch as is now popular on the 144 MHz band. Though tion would be within the 450 MHz amateur band and would also be unlikely to interfere with commercial bands. A 500 kHz "guard" band for higher class amateurs on each side of the proposed Hobby band would provide adequate isolation for errant operators to keep them from interfering with adjacent commercial bands.

Callsigns

In order to indicate the class of license by the call letters, a new set of callsigns would be established for the Hobby license using the regular amateur call areas, but starting with NA1AAA and going through to NZ1ZZZ, a system which would provide for over 4,500,000 callsigns to be issued. When a Hobby operator goes to a higher class of license the last three letters could be passed along to the WA1AAA type of call letter, thus preserving the identity of the operator through this counterpart call.

Something for Everyone

The Hobby license would seem to fulfill a number of needs without taking anything away from anyone. It would provide a legal hobby band which is obviously needed. It would help the Commission solve the problems of the citizens band. It would

Seven Club Stations for Jordan

King Hussein has ordered seven complete amateur radio stations for installation in Jordan schools, orphanages, and remote military bases. Each of these stations will run a full kilowatt into a three-band beam and should put out substantial signals.

The King, recognizing the importance of amateur radio to the development of Jordan, has authorized an amateur radio service for the country and a drive is on to attract people into the hobby. Equipment is difficult, if not impossible, to get in Jordan, so the seven club stations should provide a means for the first amateurs to get on the air and develop their skills.

The activity of these club stations should remove Jordan, once and for all, from the ranks of the rare countries. The first amateur license in Jordan is a CW-only ticket, which means that most of the early operation of these stations will probably be on that mode.

One of the club stations will be installed at a remote air base. It will be used by air force personnel who have passed their amateur license exams. The men at this base are far from any town or any other means of communications, so we should hear quite a bit from them on the ham bands.

Arrangements are being made for the operation of some of the club stations by visitors to Jordan, thus making it unnecessary for tourists to bring their own equipment in order to operate from this rare country. The 220V 50 Hz line power that is standard there would make it particularly difficult to use the U.S. ham gear and the wide variations in line-voltage equalizing equipment to protect the rigs.

Tourists visiting Jordan will be issued special calls starting with JYØ, while the Jordanian operators will have JY7 and lower numbers. Only the King will have a JY1 call.

King Hussein surprised the amateur fraternity by turning up on the ham bands early this year using a Drake station bought for him by his wife as a Christmas present. The station was installed at his home (Hummar) just outside of the capital city of Amman with the help of SVØWI, who came over from Athens. The King chose the call JY1 for his station and, as a result of many years of no amateur operations from Jordan, had his hands full at first giving the thousands of DX'ers

crystal control would not be required, it would probably be extensively used as it is for 144 MHz FM operations.

This Hobby license would provide a band where hobby operation is legal, and would thus free the 27 MHz band for business use as originally proposed by the Commission. The large number of channels available in the 220 MHz band would provide relatively interferend provide relatively intereference-free communications for the operators, offering them adequate reasons for changing from the 23 channels on 27 MHz. The coming dropoff in skip conditions on 27 MHz will work to the end of encouraging the changeover. This band, as with all other amateur bands, would be largely self-policing, thus removing a very expensive headache from the Commission.

Repeaters

The Hobby license would permit communication through repeaters, but a higher class license would be required for the installation and maintenance of a repeater, since technical knowledge is much more necessary for the installation than the use of a repeater.

The amateur 220 MHz band is above television channel 13, so interference to television reception would be unlikely. Second-harmonic radiation would provide activity on a virtually unused amateur band. It would encourage an influx of new amateurs. It would provide millions of dollars in fees to offset Commission expenses with little overhead involved, since all of the examinations would be given by volunteer radio amateurs. It would encourage the development of commercial narrowband FM equipment for the VHF bands which would benefit all amateurs as well as users of adjacent commercial bands. It would encourage the development of fixed-station equipment, mobile equipment, portable equipment and hand-held equipment, autotuning receivers, autocall signalling equipment, etc. It would also give a number of manufacturers a very bright future.

1300-PLUS ATTEND N.Y. HAMFEST

Despite threats of rain, over 1300 amateurs gathered for the yearly Western New York Hamfest just outside of Rochester, New York on Saturday, May 16. The biggest drawing card of the hamfest was the acre or so of flea market. . .dozens of cars and trucks loaded to the hilt with equipment and parts. . .driving otherwise normal hams right out of their minds with bargains. One hundred capacitors for $1.50. . .vacuum capacitors for that 10 kW final for $3 ($5 if you want it motor-operated), and so forth. A lot of very valuable equipment (and some beautiful boat anchors) changed hands . . .all tax-free.

Inside the hamfest building the committee kept things humming with a steady stream of interesting talks, mostly VHF-oriented. The three ham magazines had booths set up and vied with each other for subscriptions and deals. QST was the only magazine absent. (The ARRL consistently refuses to support this valuable hamfest activity.)

The skies held dry for most of the day, and then late in the afternoon they tipped the heavenly bucket and down it came, folding the flea market and sending everyone into the building to finish off the last of the refreshments and jam the technical sessions.

Wayne Green was honored at a prehamfest meeting the night before where he presented the first showing of his slides of his recent JY1 trip, including photos of King Hussein operating his station in Amman, Jordan.

Wide-angle view of the Rochester Hamfest's flea market.

a new country. For the first few weeks he had to explain to virtually every contact about his unusual call. He never said it, but the answer that was intimated was, "Why not? . . .it is the King's station." Even the ITU agreed that they would go along on that basis, though the ITU regulations do call for some sort of suffix under other circumstances.

Delivery of the club stations is expected some time in July and they should be set up and in operation in short order after delivery.

Hy-Gain BUYS GALAXY

Hy-Gain Electronics Corp. announces that it is acquiring Galaxy Electronics as the result of stock trading within the two companies. As most amateurs know, Galaxy is a leading American produce of SSB and VHF FM transceivers. Hy-Gain has specialized in the manufacture of antennas and antenna systems for amateur, CB, industrial, and military applications.

According to Hy-Gain spokesmen, the shift in management will not affect existing Galaxy warranties or service policies. Also, no immediate changes in company personnel "are presently contemplated."

The major difference that should be noticeable to hams will be Hy-Gain's shift to a "systems approach" to the communications field, whereby the company will market "complete packages" for two-way radio use.

LONG RANGE PROPAGATION NEWS

by J. H. Nelson

We will soon be entering the unsatisfactory part of the SUNSPOT CYCLE which runs from about one year after maximum to about one year before the coming minimum. The highest monthly sunspot number reached this past cycle was 135.8 which was in March 1969. The coming low is expected to arrive in 1974 or 1975.

Experience has shown these periods to be unsatisfactory during the past three cycles particularly during winter evenings and nights and during the sunrise/sunset hours. However, conditions during the summer months are quite good during this period if the proper frequencies are used.

There appears to be general agreement among the people who predict sunspot high periods that the next high period which should come around 1979 or 1980 will be below normal by a significant amount. I have done some research on this subject myself using both their methods and my own long-range forecasting technique. My conclusions are similar. This can cause a significant reduction in the number of useful hours for 10 meters during the next high sunspot period.

British Steam Train Will Use U.S. Hams

This summer the British train *Royal Scotsman* will be touring the western portion of the United States advertising British-made products and giving the Americans a chance to see this famous steam-powered train. The Hallicrafters Company has decided to equip an amateur radio station on

Designation of Bands

The FCC says it is receiving inquiries concerning the exact meaning of various letters sometimes used to designate the limits of a number of frequency bands, largely in the microwave region of the spectrum. The use of these letter designators, such as L, S, and X, was initiated during World War II, primarily for security reasons. However, they still occasionally appear in electronic publications, both in technical articles and in advertisements, and are sometimes used in offices of some Government agencies. Largely, their use is confined to documentation dealing with radar, telemetry, and electronic countermeasures equipment.

A number of letter designator systems have appeared over the years and their use continues to generate confusion because of the lack of standardization, nationally or internationally. Difficulties arise because, in some instances, the band limits vary from one system to another, and none can be considered authoritative. Because of this, the FCC discourages the use of single-letter designations and says that it cannot answer questions regarding their meaning. Inquiries concerning them should be addressed to the source originating the information.

In the interest of avoiding confusion in this area, the frequency management interests in this country have for some years held the position that specific frequency bands should be cited in terms of their actual numerical frequency limits and have encouraged the public to do the same. For example, the U.S. FM broadcasting band is designated 88–108 MHz in our Table of Frequency Allocations, which precisely defines the band in terms well understood in the engineering and scientific community. In that connec-

ACTION IN DOCKET CASE

FCC's regulation of rf devices extended to sale, shipping, and advertising effective October 1, 1970; to implement 1968 law, reduce radio interference.

Manufacturers, vendors, and shippers of radio frequency devices that emit electromagnetic energy capable of causing harmful interference to radio communications must meet the technical standards of FCC rules after October 1, 1970. The new order implements a 1968 law empowering the Commission to make reasonable regulations governing the interference potential of certain devices. (Section 302, "Devices Which Interfere with Radio Reception," was added to the Communications Act on July 5, 1968, by Public Law 90-379, 82 Stat. 290.)

The Commission said that the purpose of the new rules is to require compliance with equipment standards by manufacturers, importers, and distributors of rf devices, as well as by users, and that the rules apply to many persons and companies not now directly subject to regulation.

The revised rules prohibit the sale, transfer, importation, shipment, or distribution of rf-generating devices unless the devices meet the Commission's technical standards or have been type-approved, type-accepted, or certified. (Type approval is based on testing by the Commission; type acceptance and certification on testing by the manufacturer, his notification to the Commission, and the Commission's acceptance of the test results.) The Commission said that it is presently reviewing its regulations to determine what changes are necessary in its type approval, type acceptance, and certifi-

News, Reviews, Announcements

Free Award

A new award is being issued free to anyone who has worked all 17 Monroe counties in the United States. Send SASE to Max Holland, Hiwassee College, Madisonville TN 37354. No QSL cards needed to verify contacts. Just state whether contacts were on single band or all bands.

Zero-Beaters

The Zero-Beaters ARC Hamfest will be held on Sunday, August 2. Washington, Mo. City Park. For further information write or contact Zero-Beaters ARC, Box 24, Dutzow MO 63342.

MVARA Hamfest

The Mahoning Valley Amateur Radio Association will sponsor a hamfest Sunday, August 2 at Lions Park, New Bedford, Pa., located nine miles east of Youngstown, Ohio, one-half mile north of Hwy 422 on Rte. 932. Door prizes and flea market. Call-in freq. 146.94 and .34–.76 repeater. For information contact Frank Dodd K8UYF.

Glacier-Waterton

The 36th annual Glacier-Waterton International Peace Park Hamfest will take place in Glacier National Park, July 18 and 19, 1970. Amateur radio operators from Montana, Idaho, and Washington, along with good neighbors to the north – Alberta, Saskatchewan, and B.C. will gather to further a mutual interest in ham radio, and to just have fun. This is a biggie; don't miss it!

board the train, and is now in the process of lining up operators to man the station for all or part of the operating period, which will extend from June 14, 1970 until early August 1970.

A special callsign will be issued for this railroad mobile expedition and a special QSL will also be available.

A spokesman for the expedition said the train will leave Lubbock, Texas on June 14 and make its way across Texas, Oklahoma, Kansas, Missouri, and on to Chicago – then to Green Bay, Wisconsin, stopping at various cities en route. Amateur operators are needed to either ride on the train to operate the station or to help operate the station while the train is at rest in the various cities. Transportation on board the train as well as sleeping accommodations will be furnished at no cost. The spokesman said dining facilities will be available on the train. Meals will be taken at stops along the way and will be at the expense of the individual participants. Participants must furnish their own transportation to and from the location of the train.

Any licensed ham who would like to participate is invited to contact one of the persons listed below for further details as to schedules, times, dates, and places:

Archie L. Julian WB4CYR
6921 Fort Hunt Road
Alexandria VA 22307
(703-768-3412)

Jim Adams
1520 Wolfram Street
Chicago IL 60657
(312-935-1687)

Hoosier Hills

The Hoosier Hills Ham Club Hamfest will be held on October 11, 1970 at the Spring Mill State Park near Mitchell, Indiana. The main prize is to be a Drake TR-4.

tion, the number of digits required to describe bands higher in the spectrum may be reduced by using the nationally and internationally adopted term GHz which is equal to 1000 MHz.

Broader portions of the spectrum may be described by a nationally and internationally adopted series of widely used phrases, and their abbreviations, as follows:

Very low freq. (VLF)	3–30 kHz
Low frequency (LF)	30–300 kHz
Medium freq. (MF)	300–3000 kHz
High frequency HF)	3–30 MHz
Very high freq. (VHF)	30–300 MHz
Ultra high freq. (UHF)	300–3000 MHz
Super high freq. (SHF)	3–30 GHz
Extremely high freq. (EHF)	30–300 GHz

FCC Rules Amended Uniform Expiration of Licenses

A uniform expiration date for amateur operator and station licenses has been provided for by the FCC in an amendment to Section 97.59. The rules for the amateur service provide for issuance of an amateur operator license, and normally the amateur operator and station license expire on the same date. During the term of his basic license, however, should the licensee obtain an additional station license, the present rules do not show the Commission's current practice regarding the expiration date for additional amateur stations. The Commission said the amendment will reflect this practice, as shown in Item 5E (FCC Form 610), that the license of an additional station will expire on the same date as the operator license. The rule amendment became effective on May 1.

cation procedures in view of the new regulation.

Only one category of rf devices – incidental radiation devices, such as electric motors, automobile ignition systems, and neon signs – was excluded from consideration in this proceeding, the Commission stated, because technical standards governing their operation have not yet been prescribed.

Devices subject to Commission authority and included under the amended rules range from the many kinds of radio transmitters used in the broadcasting, common carrier, marine, aviation, and land mobile services to restricted radiation devices; wireless microphones; phonograph oscillators; radio-controlled garage door openers, models, and toys. Various types of industrial, scientific, and medical equipment such as ultrasonic, industrial heating, medical diathermy, radio-frequency-stabilized arc welders and miscellaneous equipment, are also subject to the new rules.

The Commission exempted the manufacture of rf devices from the new regulations, so as not to curtail research. It also exempted from the new rules transmitters operated in the AM, FM, or TV broadcast services, or in the Instructional Television Fixed Service, and certain Industrial, Scientific and Medical equipment governed by Part 18 of the rules, including industrial heaters. (Industrial heaters that generate less than 10 kW of rf are subject to the condition that the purchaser be notified in writing whether the equipment, as delivered, complies with the technical requirements of Part 18 or whether a shielded enclosure is required.)

In response to comments expressing fear of an adverse impact by the new rules on preproduction marketing of products still in the design and development stages, the Commission stated that the new rules will not "preclude the proposal or execution of agreements to manufacture or produce in the future new products in the design or development stages or products which are to be manufactured in accordance with designated specifications." Advertising for sale of existing rf devices before it has been determined that the devices meet Commission requirements is prohibited, however, the Commission said.

Michigan

The 17th Annual South Western Michigan VHF Picnic will be at the Allegan County Park, August 2, sponsored by the Van Buren County Amateur Radio Club, W8JUU, Bangor, Michigan.

Iowa

The date of the Iowa 75 meter phone net picnic has been changed from August 9 to August 16. The picnic will be held in Marshalltown, Iowa at the Riverview Park. Festivities will begin around noon with the frequency of 3970 kHz being monitored.

England

Becket Festival Station GB2CF will be active from Canterbury, England, during July 19 to 26 inclusive. This station will form part of the Becket Festival and QSOs, which will be QSL'd with a suitable card, will be most welcome.

QSOs with stations in the U.S.A. particularly in towns called Canterbury or any of the following local names of towns and villages which surround our city – would be most welcome:

Ash	Chilham	Bekesbourne
Bridge	Chartham	Faversham
Herne	Kingston	Herne Bay
Ickham	Selling	Littlebourne
Sturry	Stelling	Patrixbourne
Wye	Wingham	Wickhambreux
Aylsham		

Repeater Docket Comment Deadline Extended

As a result of requests by the ARRL and a Mr. Neil Murphy, the FCC has agreed to move the deadline for comments to Docket 18803 from May 15 to June 15.

The ARRL based its request for extension on (1) the scope and complexity of the subject matter and (2) delay in considering the proposal caused by "internal procedures." When the FCC issued its order, it did not elaborate on the meaning of the League's "internal procedures" statement.

Mr. Murphy stated that additional time was needed because of the complexity involved in "preparing a proper commentary."

The Commission said that since the views and reply comments of interested parties might be useful in a subsequent rulemaking, additional time for comments seemed reasonable. In its order, released May 18, the FCC declared the comment deadline to be June 15, 1970, and the deadline for reply comments was rescheduled for July 7, 1970.

DELAYED LICENSES

A number of amateurs have complained that they have gotten letters from magazines seeking subscriptions or from companies hoping to sell them something, complete with their call letters on the address, before they have received their license from the FCC. Could this be? The following letter from the FCC tells us that it can be.

Acknowledging your recent letter, the Commission's Rules and the Public Information Act (P.L. 89-487) provide for the public inspection of all applications and related files in the Safety and Special Radio Services.

Several organizations make a regu-

Eighth Annual Illinois QSO Party

Starts 1600 GMT Saturday, August 1, 1970 and ends 2200 GMT Sunday, August 2, 1970. Use all bands, CW and phone. The same station may be worked and counted for a QSO point on each band and each mode. Illinois stations score 1 point per contact with stations either in or out of Illinois. Stations on county lines count only one point per QSO, the same as any other station. Stations outside Illinois score 1 point per QSO with Illinois stations. Illinois stations multiply total QSO points by the total number of states, VE provinces and ARRL countries worked. All others multiply total QSO points by the total number of different Illinois counties worked. Stations on county lines count as two or more counties. Additional bonus multipliers may be counted for working the same county. Each group of eight contacts with the same county count as an extra multiplier. (10 QSOs count as 1; 16 QSOs count as 2 multipliers, etc.) USA, Canada, Hawaii, and Alaska count as separate countries. KH6 and KL7 also count as states. Illinois stations give QSO number, RST, and county. Others give QSO number, RST, and state, province or country. Use approximately 3560, 3735, 3900, 7060, 7175, 7260, 14060, 14275, 21060, 21110, 21360, 28060, 28660 kHz and 145.2 MHz. In Illinois, single- and multiple-operator stations compete in separate categories, with certificates issued to first, second, and third place winners. Elsewhere, certificates will go to the top scorer in each state, VE province, and country provided that at least two valid entries are received from that region. Other certificates may be issued at the discretion of the contest committee. Decisions of the contest committee are final. Logs must show dates, GMT, stations worked,

New Jersey QSO Party

The Englewood Amateur Radio Association invites all amateurs to take part in the 11th New Jersey QSO party.

Rules: (1) The time of the contest is from 1900 GMT Saturday, August 15 to 0600 GMT Sunday, August 16 and from 1200 GMT to 2300 GMT on Sunday, August 16. (2) Phone and CW are considered the same contest. A station may be contacted once on each band – phone and CW are considered separate bands. New Jersey stations may work other New Jersey stations. (3) General call is "CQ New Jersey" or "CQ NJ." New Jersey stations are requested to identify themselves by signing "De NJ" on CW and "New Jersey calling" on phone. Suggested frequencies are: 1810, 3555, 3740, 3930, 7060, 7275, 14075, 14280, 21100, 21375, 28800 kHz, 50–50.5, 144–146 MHz. Suggest phone activity on the *even* hours. (4) Exchanges consist of QSO number, RST, and QTH (ARRL Section or country). N.J. stations will send county for their QTH. (5) Scoring: Out of state stations multiply number of complete contacts with New Jersey stations times the number of New Jersey counties worked (maximum of 21). New Jersey stations: W, K, VE, VO QSOs count as 1 point; DX stations count as 3 points. Multiply total number of points times the number of ARRL sections (including NNJ and SNJ – maximum of 74). KP4, KH6, KL7, KZ5 count both as 3 point DX contacts and as section multipliers. (6) Certificates will be awarded to the First place station in each N.J. county, ARRL section, and country. In addition, a second place certificate

VOX POP

Little Gleanings on 20

John ZK1AJ on Raratonga mentioned that ZK1AA has a 50 MHz beacon aimed at the states. That would be a nice one to hear. John's QSL manager is KH6GLU. SU1MA's QTH is Box 840, Cairo. JX4GN has been quite active of late, QSL to him via Norwegian Embassy, Reykjavik, Iceland. Odd also gets down on 3798 kHz. SVØWDD only active station on Crete, QSL to WQ3HUP if you contact Ray. Interesting development on Genada, a nonlicensed American has a ticket down there. I gather if you pay the fee you get your license. VP2GRN (Bob) and his wife Jeannie (VP2GNE) QSL via WQ4YHB. KJ6CD, Lew on Johnston, QSL to W6LTA. KG4AL is the only mobile in KG4.

QRP on 40

by WA8MCQ

Every Friday night at 2000 EST, the QRP net meets on 7080 kHz. Anyone with low power is welcome, of course, but so are those high-power boys who like to listen for the "flea-powered" stations.

From Chip Cohen WA1JHQ: 20m DXpeditions

TI9CF via TI2CMF
MP4QBK via K4MQG
W9FIU/KS4 via W9FIU
VKØHM (on Heard) via WA6EAM
OJØMI via OH2ER
5H3LV/A via VE3ODX
5HCKJ/A via W7ORN

DX Sidenotes

by WA1JHQ

Please note: OJØAA is a pirate! He was active for the first phone weekend

lar practice of excerpting license and application information from the Commission's records and making it available to their subscribers.

It occasionally happens that the excerpted information reaches subscribers to these services before the licensee receives his license.

James E. Barr
Chief, Safety and Special
Radio Services Bureau, FCC

Prayer Brings Astronauts Home?

The faith of the nation was strenghtened when the President asked all citizens to go to their knees in prayer for the safe return of the Astronauts. Now, hams who believe in prayer have the opportunity to be the vital connection between emergencies around the world and hundreds of praying people in their own communities.

The Wycliffe Bible Translators, a nonprofit, nonsectarian mission, has over 2000 workers in remote areas of the world translating the Bible in to tribal languages. With a team this size, there is an emergency every day – somewhere. In U.S. cities people want to know what the emergencies are so they can pray.

The Prayer Force Net has been established to communicate these emergencies. Any ham joining the net would meet one of four weekly scheds and relay the news by phone to one or more people in his community. From there a telephone net takes over.

Here is the Prayer Force Net schedule:

Tuesday	0030 Z	14.310 MHz
Friday	0030 Z	21.390 MHz
Friday (W Coast)	0330 Z	7.258 MHz
Saturday	1600 Z	21.310 MHz

If interested, simply check into the net, and other net members will help get your community organized. For info, write: Prayer Force WA6CJB, Box 2000, Santa Ana CA 92707.

exchanges sent and received, bands, modes, and claimed score. A summary sheet should be sent, showing whether single- or multi-op, name and address of operator clearly printed, QSO points, multipliers, and score. Logs must be postmarked no later than 1 September 1970, and should be mailed to the following address with adequate postage: Radio Amateur Megacycle Society, 3620 N. Oleander Ave., Chicago IL 60634.

Mayflower 70 Award

This award has been instituted by the committee governing the Cheshire Homes Amateur Radio Network Fund to commemorate the 350th Anniversary of the sailing from Plymouth the Pilgrim Fathers for America 1620. (The Homes care for the incurably ill and permanently disabled.)

The object of this award is to continue efforts to provide amateur radio equipment to the Homes. All profits from this award will be devoted to this purpose; no member of the committee will receive payment or reward for services.

The award is open to all ham operators and SWLs, and there is no time limit.

Any band or mode of transmission will be allowed; QSL cards need not be sent with claims, but a certified copy from the station logbook must be sent in with claims.

To Qualify for the Award

Operators in the U.S. must furnish proof of having had contact with one amateur station operating from Plymouth. Shortwave listeners must show verification of reception of one amateur station.

Certificates

The cost of certificates is one dollar, which includes postage by surface mail. Forward all claims to the award manager, W.M. Clarke G3VUC, Fillace Park, Horrabridge, Yelverton, Devon. PL20-7TE.

will be awarded when four or more logs are received. Novice and Technician certificates will also be awarded. (7) Logs must also show GMT date and time, band, and emission, and be received not later than September 12, 1970. The first contact for each claimed multiplier must be indicated and numbered and if possible, a check list attached. Multi-operator entires should be noted and calls of participating operators listed. Logs and comments should be sent to Englewood Amateur Radio Association, Inc., 303 Tenafly Road, Englewood, New Jersey 07631. A size 10 SASE should be included for results. (8) Stations planning active participation in New Jersey are requested to advise the EARA by August 1st of your intentions so that we may plan for full coverage from all counties.

1970 International Field Day

The Burlington Amateur Radio Club, Inc., invites you to the 1970 International Field Day to be held at the Old Lantern, Charlotte, Vermont, on Sunday, August 16. Come one day early on Saturday and join the crowd with trailer, camper, or tent. Featured will be the popular flea market, net meetings, antenna raising contest, junkbox amplifier contest, hidden transmitter hunt on 2m FM, mobile and portable rf output contest, Bingo for the ladies, door prizes, and raffle drawing. Talk-in frequencies include 3909 kHz and the .34–.94 MHz facilities of the W1KOO and W1ABI repeaters. Food, refreshments, and camping supplies available all day. Registration is $3 at the gate (or send $2.50 for early-bird to Bill Fake W1FS, 30 Southill Dr., Essex Junction, Vt.) For further information, write or call Bob Hall W1DQO, General Greene Rd., Shelburne VT 05482.

of DX competition but Eric, OH2ER, tells me he has no authorized permission to land or operate from Market Reef. Besides, OJØMR and OJØMI keep Market Reef busy.

Also note that W9FIU/KS4 at Serrana Bank were very active in the last week of February. As far as 5H3LV/ and 5HCKJ/a go they made a one day stay in Zanzibar, which should count for awards. VKØHM was put on by Hugh, WA6EAM but he wasn't on too much, probably not enough time.

TI9CF, Cocos was what many of us were waiting for.

He and all other's mentioned weren't on (as far as I know) for DX competition.

MP4QBK is another mouth watering tidbit since he was very active in mid-February from Qatar.

Wayne Green made great DXing for lots of us during his short stay in ultra-rare JY land. He operated JY1, the call of King Hussein.

Please announce a new net which meets. It is the technical discussion net meeting on 7.265 MHz and at 20:00 GMT. This net is to discuss problems with theory and rig troubles. We also discuss physical phenomena such as propagation, LDEs, etc. Net coordinator is WA1JHQ and net manager is WA1JYY.

What – No FM?

A "Ham & CB Swapfest-Picnic" is slated for Sunday, August 9, 1970, at the City Park in Levelland, Texas. Sponsored by the Northwest Texas Emergency Net and Levelland Communications Club, this is an unusual CB-Ham get-together that should prove fun for the entire family. Bring your own picnic basket. Registration begins at 9 a.m. Lunch at 1. Mobile talk-in frequency is the net frequency, 3950 kHz and channel 11 for CBers.

Publisher's Comment

Not long ago a letter came in from an irate subscriber in Europe. He complained that the magazine took a month to get to him and that it was stale by the time it arrived. This extreme sample of idiocy made me so exasperated with the human condition that I decided to try just leaving the confounded month off the cover. The material in 73 is almost all made up of articles, more like a handbook than a radio magazine, and there is little in each issue of any real time value. So what possible difference could it make to anyone whether the issues arrives in a week, a month, or two months?

Sure, we rush through articles on new developments, but most of the material could just as well be published next year or last year. This is one of the reasons that back issues of 73 have held their value so well.

Spreading the Blame

Many ex-ARRL members who have written to HQ expressing their dissatisfaction with the ARRL-sponsored incentive licensing have received replies which point out that Wayne Green W2NSD/1, editor of 73, also filed a proposal having to do with incentive licensing. This is true – I did file RM-577, but this proposal suggested rewards for obtaining the higher class licenses and did not in any way support the ARRL concept of punishing those who did not advance. RM-577 suggested the issuance of two-letter calls to Extra class licensees as an incentive, and this was accepted. It also proposed that there be separate Extra licenses for phone and CW and this was essentially enacted with the Extra phone being embodied in the reactivated Advanced class license. RM-577 proposed the opening of the following bands for SSB: 3750-3800, 14150-14200, 21.20-21.25, 28.4-28.5,

Classified

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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.

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

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WANTED: Up-to-date roll chart part no. 425-001806 and manual for Philco tube tester model 9100. Top dollar paid. Gerald Moore K8AYJ, 5305 Woods Rd., Sidney MI 48885.

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Men From MARS Are Friendly At Phan Rang

by Maj. John Tabor

Phan Rang AB, Republic of Viet-

AMECO PT, modified for high power. Barefoot xcvr use only; xcvr must have extra spst normally-open relay contacts. $40. Paul Snyder WA3HWI, 7940 Gilbert, Philadelphia PA 19150.

2 METER: HEATH Twoer, $25; Motorola 41V ac/dc, mike, xtals, $45; SCR-522 Professionally converted. RECEIVERS: "Super-Pro," $50; Heath Chyenne MR-1, 80–10 SSB & power supply, $40; misc power supplies. Carl Heintz WB6RXC, 2635 Oak Knoll, San Marino CA 91108 (213-283-5296).

DTL INTEGRATED CIRCUITS: Guaranteed new - gates 70¢, buffers 80¢, F/F 90¢, dual F/F $1.15 - add 20¢ for postage. Also other inexpensive parts. Lists & prices from Mitch-Lan Electronics Co., Dept. 870, P.O.Box 4822, Panorama City CA 91412.

FOR SALE: Heathkit two meter transceiver Model HW17-A. This unit has been factory aligned and checked. Price $100. Lee Jamison, 3461 Via Barba Lampoc CA 93436.

FM MOBILE UHF Transceiver, RCA CMU-15A.(12V), all accessories. Fleet turn-in. Each $50. Matched pair manual $90. Gordon W2MPT, 25 Norma, Lincroft NJ 07738.

JOHNSON VALIANT, like new, $75. Johnson Viking II with VFO, $40. Johnson Rotator with indicator, $35. K6MXN, 3231 W. 13th St., Hawthorne, CA. 213-7

TOWER HEADQUARTERS! 12 Brands! Heights Aluminum 35% off! Antennas—20% off! Galaxy, Hammarlund, Gonset, SBE at discount. Catalog—20¢. Brownville Sales Co., Stanley WI 54768.

SELL: DRAKE 2B with Calibrator and Speaker, asking $165.00; Heath DX60, asking $50.00; 2 Motorola Hiband P-2550 Handy Talkies as, $35.00, $50.00 for both. John Fearon, 3384 Peachtree Rd. NE, Suite 705, Atlanta GA 30326.

"HOSS TRADER ED MOORY" says he will not be undersold on Cash Deals! Shop around for your best cash price and then call or write the "HOSS" before you buy! New Equip-

FM MOBILE TRANSCEIVER 450 MHz, 2-channel trunk mount RCA rig in perfect condition. Fully duplexed and operating as a mobile telephone. Includes transmit crystals for 442.12 and 442.05; receive crystals for 448.82 and 448.85. Crystals are from Sentry and are enclosed in ovens. Complete less control head and cables: $100. Will throw in two 4 dB Com Prod mobile gain antennas. Ken Sessions K6MVH/1, RFD 2, Peterborough NH 03458.

WORLD RADIO's used gear has trial-terms-guarantee! Gonset 910A — $179.95; SR160 — $149.95; Swan 350 — $289.95; Swan 400/420 — $299.95; HT40 — $49.95; Apache — $99.95; DX60 — $49.95; T4X — $319.95; HQ180AC — $349.95; SP600JX (rack) — $269.95; Galaxy R530 — $649.95; 75A3 — $209.95; Drake 2A — $149.95. Free "blue-book" list for more. 3415 West Broadway, Council Bluffs IA 51501.

FOR SALE: HRO5 coils E, F, G, H, J, JA. HRO60 dial. Make offer for all or any part. Wells Chapin W8GI, 2775 Seminole Rd., Ann Arbor MI 48104.

GET YOUR "FIRST!" Memorize, study—"1970 Tests-Answers" for FCC First Class License, plus "Self-Study Ability Test," Proven. $5.00. Command, Box 26348-S, San Francisco CA 94126.

HAMFESTERS 36th ANNUAL HAMFEST and picnic. Sunday, August 9, 1970, Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, southwest of Chicago. Exhibits for OM's, XYL's. Famous Swappers Row. Information and tickets, Tom Ondriska WA9YZW, 6609 South Kedvale, Chicago IL 60629.

40th ARRL WEST GULF DIVISION CONVENTION July 17, 18—19, Orange, Texas. Come by car, plane, or boat, but come to the fun, fellowship and entertainment. A bargain you can't afford to miss. Registration $8.50. Orange Amateur Radio Club, Box 232, Orange TX 77630.

and 50.01-50.1. Unfortunately the FCC went along with the ARRL and decided to use punishment instead of reward in the matter of frequency allocations. It seems to me like a pretty cheap copout for the ARRL to now try and shift some of the blame for the catastrophe they brought on us onto someone who did everything possible to try and stop them from doing this.

One Dollar a Copy?

Perhaps you have noticed that only two of the four ham magazines appear on the newsstands. The reason for this may not be readily apparent. I won't go into the details of this problem, but the plain fact is that few, if any, magazines are able to turn a profit on their newsstand sales.

Most magazines are able to charge enough for advertising to make up for the newsstand losses, but in our field we have the advertising rates held artifically to about one fourth those of just about any other field (for comparable size magazines) by nonprofit tax-free QST. They are not on the newsstands, so they don't have to make up for these losses. The idea behind the low ad rates, I believe, is that this is supposed to keep down competition. It hasn't, but it has kept the competition struggling to try and break even with magazines that would in any other field be big money makers.

If we kept the size of 73 down to that of CQ, used cheap junky paper and printing, and made our writers whistle for their money, we probably could break even on newsstand sales. But our much larger magazine, with more articles than all the other magazines combined, fast and high payment for authors, plus everything else has kept the newsstand operation strongly in the red for the last year. The dollar price should allow us to break even, and that is considered by many businessmen today as being a runaway success.

nam (7AF) – "To be successful in this business you have to be friendly, patient, and like people," explained the noncom-in-charge at the base Military Affiliate Radio System station.

Air Force Staff Sergeant Robert L. Johnson from Henderson, N.C., handles the MARS station within the 1882d Communication Squadron. The local staff handles about 1300 phone calls per month for airmen to locations in the continental United States and the Pacific area.

"Not only do we place calls home for personnel at Phan Rang AB, we also receive calls for them from relatives and friends in the United States," stated Airman 1st Class Larry D. Orsak from Wichita Falls, Texas.

Outgoing calls fall into three categories: Red Cross priority, chaplain priority, and routine. The Red Cross and chaplain's calls usually are for emergencies and are put through as soon as possible.

"The great majority of our calls are routine, however," stressed the genial noncom, "and they usually concern promotions, base assignments, and 'R&R' which is by far the most popular subject."

When a serviceman desires to make a call to the United States, for example, he places his name on the waiting list. As soon as it comes up, the MARS operator on duty will place a call to an Air Force MARS or Civilian Affiliate station in the United States. The stateside operator in turn dials the requested telephone number.

The only expense to the serviceman is the cost of the call from the MARS station in the United States to the number which he is calling.

Unless the weather conditions are particularly bad, an airman can usually get a call through within 24 hours – often within minutes of his deciding to make the call.

"When you work in the MARS station for a little while, some pretty amusing things happen," chuckles Sqt. Thomas J. Sumpter from Covina, Calif. "Probably the funniest and most frequent mixup is when a serviceman is matched with the wrong wife, or vice versa. I remember just recently when an airman first class got his call put through to a major's wife in Kansas.

"The conversation went something like this: 'Hello, Honey, this is Bob. How are the kids?' And the answer from the states came back: 'Bob who? And *what* kids?'

While all MARS stations in Vietnam are staffed by military personnel, MARS stations in the United States are manned by both military and civilian stations. The civilian operators freely give their time and money to support the program which brings a touch of home to thousands of servicemen in lonely places around the world.

Vietnamese MARS stations play cupid, too, according to Sgt. Johnson: "We have a marriage coming up later this spring. One of our MARS operators at another base in Vietnam is getting married to a young lady in the United States via the MARS radio network. All MARS operators in Vietnam have been invited to listen in and be witnesses to this unusual marriage by ham radio."

NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

May I be so audacious as to propose a solution to a whole assortment of problems that are plaguing the FCC and amateur radio? This is consistent with my pleas for solutions rather than problems.

Problem: The FCC took away the amateur 11 meter band and opened 23 channels for business and personal use. The result was, as all of us well know, complete chaos with some 800,000 CB'ers hamming away on those poor little 23 channels. The dimensions of the problem have prevented any reasonable solution. What can be done to straighten all this out?

Problem: Virtually every newcomer to the hobby of radio gets on CB instead of going the old route of SWL and then amateur. A few manage to survive the frustrations of the CB band, but most fall by the wayside, disillusioned, and never get to ham radio. The number of new hams has been disastrously low in recent years and most of us feel that something should be done to reverse this trend. This shortage of new amateurs is already being reflected along into industry, with colleges complaining that there is a substantial drop in students interested in engineering. A cutback in amateurs must reflect itself along as an eventual shortage of engineers and technicians.

Problem: We have one amateur band that is virtually unused and which would easily be lost to us soon if this isn't changed. This is the 220–225 MHz band, which has only dozens of active users, while the 2 meter and 420–450 MHz bands have thousands. There are good reasons why this is so, but it is activity that counts, not excuses; if we don't use 220 it will go away. I think we can put it to a spectacular use.

Proposed solution: How about our having a new class of amateur license, a Hobby Class license, requiring no theory and no code, just a test of knowledge of rules and regulations? This license could permit operation within the middle four megahertz of the 220 band, from 220.5 to 224.5 MHz, thus providing two good-sized buffer bands on each end which would be regular amateur bands (providing more than enough room for the few 220'ers that are active today, as well as plenty of room for 220 crossband repeaters). With 100 watts of power, the Hobby licensees could communicate over 50–100 miles with normal beams. Further, I propose that they be limited to narrowband FM, thus eliminating heterodynes and greatly reducing QRM. I propose that they can use repeaters that repeat to or from their band, but that the repeaters must be operated by higher class amateurs.

In order to indicate the new license, I propose that a new set of calls be established starting with NA1AAA and following the other amateur radio calls in districts. When an NA (NB, etc.) moves up to a Technician or General license he would receive a counterpart call that is available (WA1AAA or WB1AAA). I propose that this program be funded by the charge of $5 for the license and that the license be valid for five years, renewable.

Such a service should provide an outlet for the hundreds of thousands (and perhaps millions) of people who want a hobby license and who have been using CB to fill this need. It should enable the FCC to move these people up to 220 and get them off the 23 channels so that these can be used as originally intended. The coming loss of skip contacts on 11 meters should help this changeover, with skip enthusiasts being able to transfer their operations to repeaters and such.

The use of FM techniques will enable millions of operators to use these frequencies without serious QRM problems. I do think that the signals should be stabilized, but that crystal control should not be required. I think that something on the order of 5 kHz deviation should be a good compromise, keeping down bandwidth, and yet giving us all the benefits of FM. With 15 kHz channel spacing this would permit an adequate number of individual channels in the band – plenty of room for nets and repeaters.

In addition to giving us super activity on 220, which is nice, we would see the rapid development of commercial gear for this band, which would benefit everyone interested in using 220. It would also help the development of 420 and even 1296 by making stabilized FM UHF equipment available at relatively low cost. The day of the $100 FM transceiver is not far off when you have a market of millions of users. Transceivers,

(continued on page 100)

For The Experimenter!

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OSCILLATOR / RF MIXER / RF AMPLIFIER / POWER AMPLIFIER

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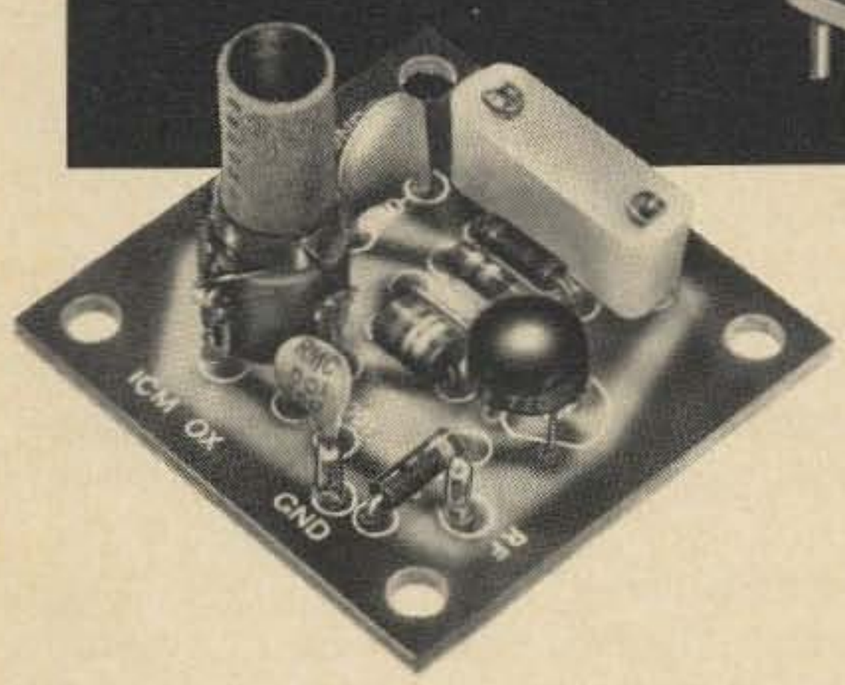

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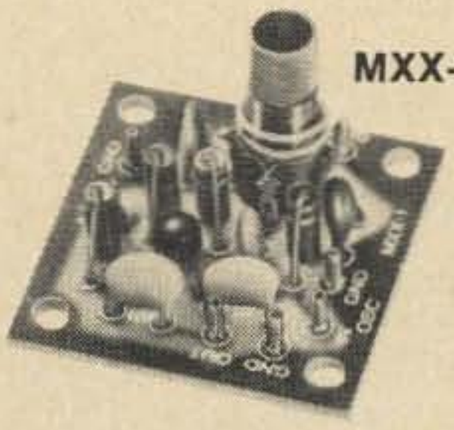
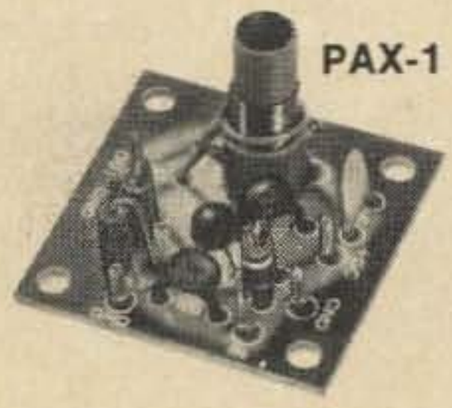
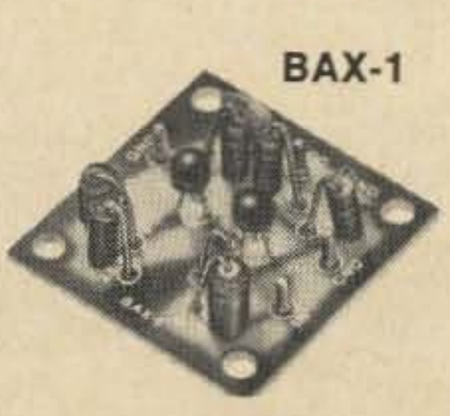

MXX-1


SAX-1


PAX-1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SAX-1 Transistor RF Amplifier **$3.50**
A small signal amplifier to drive MXX-1 mixer. Single tuned input and link output.
Lo Kit 3 to 20 MHz
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PAX-1 Transistor RF Power Amplifier **$3.75**
A single tuned output amplifier designed to follow the OX oscillator. Outputs up to 200 mw can be obtained depending on the frequency and voltage. Amplifier can be amplitude modulated for low power communication. Frequency range 3,000 to 30,000 KHz.

BAX-1 Broadband Amplifier **$3.75**
General purpose unit which may be used as a tuned or untuned amplifier in RF and audio applications 20 Hz to 150 MHz. Provides 6 to 30 db gain. Ideal for SWL, Experimenter or Amateur.

Write for complete catalog.

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Mr Virgo Himself

Editorial by Ken Sessions

The Convention Scene

Convention watchers ought to keep their eye on the Orlando Hamfest and East Coast FM Convention. This combined meeting is turning out to be one of the biggest shows in the East. Two adjacent motels (Hilton and Jamaica) were booked for the occasion, and both were filled to capacity with advance reservations.

At the Hilton, an exhibit area was set up indoors and a "swap-type" flea market was formed in the nearby parking lot. The flea market was so active on Saturday (first day of the weekend hamfest) that getting into and out of the exhibit area was difficult. The exhibit area was laid out rather poorly by Hal Shea W4BKC, who managed to resist all suggestions for improvement. Prize drawings, for example, were conducted just inside the entranceway, so that getting in or out of the building during the drawings was virtually impossible.

Also, Shea managed to string several booths into an area that doubled as a meeting place. It didn't seem to disturb him that activities in these booths conflicted with activities in the meeting area. Fortunately for the Orlando Hamfest, however, Shea's bumbling was restricted to this single level of responsibility. There were enough conscientious planners and workers to see that the convention was a success anyway.

A repeater goes up at the East Coast FM Convention in Orlando, and everybody helps. There's a lot of standing around to be done when a repeater goes up, and these fellows are doing it. Sam Carson adjusts the gain on his hip-mounted Handie-Talkie while John Perry makes preliminary checks of the repeater's coverage. The fellow grinning is Enyaw Neerg, 73's ace subscription salesman. In the background Gene Rhodes and Lou Goldstein examine the solid-state Touchtone decoders and the digital identifier to be used in the repeater when it gets permanently installed.

The FM boys from the Brevard Repeater Association put together a mobile relay station, complete with 70 ft tower, diplexer, and solid-state identifier, and installed it right at the Jamaica motel. The range was not as great as a mountaintop machine, but it certainly extended the coverage of the walkie-talkies carried by so many visiting FM'ers.

The sidebanders held a special dinner, and Wayne Green spoke briefly to the guests. After dinner, he showed a series of slides he'd taken during his recent trip to Jordan – which included photos of the American embassy taken right after the incident. (Wayne was in Jordan when it happened.) He also had some interesting views on the Arab-Israeli conflict and gave a first-hand report on the reasons for so much anti-American sentiment in Jordan.

The convention was rained out on Sunday. Like California, Florida gets fickle sometimes and provides rain when it's least wanted. The downpour all but shut down the flea market, but it seemed to have no great impact on the indoor activities. As a matter of fact, they probably benefited by the situation.

In all, the convention was an outstanding success. Hal Shea stated that some 3500 amateurs attended. Figuring a probable error factor of 50%, that brings the number to maybe 1800 – still a success by ham convention standards.

Candid Encounters

Whoever invented the ham convention deserves to be immortalized in some hall of fame somewhere. The convention, you see, is like ham radio itself – you meet people face to face, get to know them better. I can't think of a better way to demolish preformed opinions. I met Dick Cowan at a convention recently, for example. Now, to you newcomers, that name may not mean anything, but to the oldtimers, it ought to be pretty familiar. Dick Cowan is the publisher of CQ, 73's nearest competitor.

My preformed opinion of Cowan, I must admit, was negative. I had only recently read a full-scale attack on the character of Wayne Green in one of his editorials, and as a result I had decided that this was a petty, troublemaking personality whom I definitely would rather not meet. But I did meet him. And, oddly enough, I liked him. He seems nowhere near as imposing in person as he does in his vitriolic anti-Green prose.

As a matter of fact, when we got to talking, I learned that he wasn't really all that anti-Green in the first place. He said he ranked Wayne as a genius who could do more single-handedly than many magazines can with a whole staff. Back in the old days, he said, when Wayne was editor of

CQ, Cowan would tear his hair out wondering how the monthly deadlines would be met. Then, right at the last possible second, in would walk Wayne. The whole building would go into a state of siege and chaos would reign. But then, as if by magic, the whole magazine would suddenly be finished, and ready for the printer. Cowan's apparent antagonism seems to stem from the painful fact that he no longer has a Wayne Green to perform that monthly magic. Actually, Wayne should feel flattered.

It was a convention that gave me the chance to renew acquaintances with another, less threatening, competitor. At Dayton, I spent a lot of time with Skip Tenney and Jack Morgan, publisher and ad manager of Ham Radio magazine. This was a particularly interesting experience because I watched them get involved in 2 meter FM, a new mode of operation for both of them. They both returned to New Hampshire with new Varitronics radios. Their initial CQs and AM-type S-meter readings embarrassed me a little at first, but they soon got the hang of FM operation. Now they're on quite a bit, and we chat once in a while through the local repeaters. So I learned that those folks over there in Greenville really aren't all bad; as a matter of fact, they're downright lovable once you get to know them.

Conventions have other advantages, too. They expose people to new ideas. At the recent Orlando convention, I saw diehard sidebanders get converted to FM. The prospect of carrying a hand-held transceiver to a ham get-together was just too tempting for them, and they succumbed. Art Housholder, of Spectronics (Oak Park, Ill.) may have been largely responsible. He carried one of Motorola's newest dream things: a pocket-sized FM transceiver that puts out 5 watts and has a receiver that matches even the largest and best. (The price tag would scare you away, but the thing does have the power to impress you even if you aren't the impressionable type.)

I really shouldn't have said those sidebanders were "converted," because that isn't exactly true. Their interests were expanded to *include* FM, but not as a replacement for their regular bands and modes. One of the fellows, in fact, told me that he was going to get on 2m FM just so he could keep active at conventions. And he said he knew quite a few DX'ers who keep in contact with each other via FM when their regular band is hot; if one of the group spots something rare, he passes the word over the FM "intercom."

Conversion is a two-way street, too, I might add. I looked and sounded pretty ridiculous working 20m sideband when Wayne was in Jordan. Not only was I totally unfamiliar with the traditional "list" style of DXing, but I had almost forgotten how to tune in a sideband station. As it happened, I got bit by the bug, though, and now find myself sitting at Wayne's Galaxy all too frequently, working stations halfway around the globe. (Got me some good ones, too.)

ARRL Sees It Our Way

73 and QST are in almost complete agreement on the FCC's repeater proposal. In QST's June issue, the ARRL listed comments that amounted to an almost 100% replay of 73's April and May comments, a fact that should lend solidarity to the amateurs' position on Docket 18803. Briefly, here are the results:

Docket 18803 Recommendation	73 Comment	and month	QST Comment	and month
Remote activation only from fixed site	No	Feb. Apr. May	No	June
No intermediate relay for remote control	No	May	No	June
Repeater has failsafe dropout timer	Yes	May	No	June
Repeaters to be tone-coded	Yes*	Feb. Apr. May	No	June
No crossbanding of repeaters	No	May	No	June
Repeaters confined to subbands	No	May	No	June
600W limit	No	May	No	June
Repeater linking prohibited	No	Apr. May	No	June
3-minute ID	Yes	Feb. Apr. May	No	June
Logging relaxation	Yes	Feb. Apr. May	Yes	Apr. June

(* If UHF monitor is not required.)

A quick look at the chart will show that QST and 73 are in real disagreement over no more than two points: automatic dropout timers and 3-minute ID.

The automatic dropout, in 73's opinion, is a good thing. In essence, the FCC proposes to limit single transmissions to 3 minutes, with a timer to assure that the repeater drops out if the timed period is exceeded. This approach offers a built-in safeguard for repeater control when something goes wrong. The wise repeater owner already has such a system installed, because it serves the dual purpose of (1) failsafe control, and (2) discouraging longwinded ragchewers.

The other area of 73—QST conflict is the 3-minute ID rule, an unofficial FCC requirement for the past several years. The ARRL feels that identifying repeaters at 10-minute intervals is satisfactory. 73 does not.

In my early days of FM, while I was editor of FM Magazine, I had the view ARRL has today. It just seemed that 10 minutes was often enough to ID a repeater that's always in the same spot. In practice, though, I learned that I was wrong — as I'm sure the ARRL will in time. Here's why:

Many repeater QSOs do not last 10 minutes. The repeater will be "alive" for two or three minutes, dead for a few more minutes, then active again perhaps five or six minutes later. With a repeater, it's hard to know where a given QSO starts and ends, because the contacts often just run together. With a repeater ID'ing once at the start of a QSO, then every 10 minutes thereafter, experience shows that actual ID may only occur every half-hour or so with a reasonably active repeater — assuming the time is cumulative with a COR-triggered timer. The only alternative is to have the repeater identify itself whether it is being keyed or not, and there aren't too many repeater boys who want that.

The FCC has learned that IDs are far too few and far between if a 10-minute elapsed-time indicator is used. But with a 3-minute timer operated from the COR, actual identification takes place approximately every 6 minutes while the repeater is in use. This disparity exists because most repeater timers are COR-operated. The timer comes on when a carrier appears, and stops timing when the carrier drops out. No time is logged during the repeater's "extended carrier" operation or during the "squelch tail" and "space" periods between transmissions. Thus, it takes anywhere from 6 to 8 minutes of normal operation to log up 3 minutes of actual use.

If you wonder why cumulative COR timers are so much more practical than simple elapsed-time indicators, just ask the repeater owners. There are plenty of reasons; they're complicated, to be sure, but very valid.

. . . K6MVH

May I entreat you to call upon your best qualities; forbearance, objectivity, maturity, understanding, and tolerance, before you read what I have to say in this editorial? There is a serious and profoundly important issue at stake, and while this is not going to be any sort of statement of my own personal views concerning the substantive questions involved, there is a tangential point which merits examination. In other words, the matter at the heart of this issue, namely the world political situation, is not in question here. I wish to discuss another phase which bears upon it merely as a corollary.

AN
EDITORIAL
by
DAVE MANN K2AGZ

Leaky Lines

1 DANIEL LANE, KINNELON NJ 07405

On Saturday, May 9th, on a frequency of 14.292 MHz, a net was organized. It consisted of college club stations and others, and was supposed to be operating for the express purpose of exchanging information with respect to the student demonstration which took place in Washington on that day. Periodically, between these exchanges, and in anticipation, perhaps, of a not unwarranted negative reaction on the part of the casual audience on the frequency, announcements were made, stating that the net was intended to be nonpolitical, and nonexpressive with respect to any views on the war, campus disorders, the Administration, or any such things, but was merely seeking to implement the logistics of the Washington demonstration . . . moving the people, rotating buses, providing emergency medical attention for the ill, etc. There was, however, as it turned out, some propagandizing and political drum-beating, which obviously was inevitable.

On the air, many persons have expressed horror and revulsion at the idea of our ham bands being used for such a purpose. Wholesale comment has been noted, during which some have suggested that the licenses of participants ought to be suspended or revoked altogether. Some have gone even further, and have demanded imprisonment, the imposition of heavy fines, and even loss of citizenship! And a few outspoken intemperates have gone so far as to suggest that all such persons ought to be "stood up against a wall and shot!"

Now, this question is not one to be discussed in an atmosphere of fearful hush-hush or careless facetiousness, for it is a deadly serious matter, demanding sober and prudent coolheadedness. The central core of the question is not whether it is right or wrong to dissent privately from the mainstream opinions held by the majority. The question of the right to hold private opinions has nothing to do with this, for that particular issue was settled long, long ago. I am sure that most of us can and do agree that everyone is entitled to his own opinion.

The core of the matter is whether persons who do dissent shall be allowed to air their ideas on our radio spectrum, which has always been confined to a rather limited range of allowable topics. And, if they are allowed to extend the range of discussion to include some form of dissent, just how far may they go? Must they be restricted to small controversies, or can they open up the whole can of beans . . .let out all the stops . . .and really get to digging into the "gut" issues?

Dissenters are utilizing the campuses, and many of us object to this, regarding it as inordinate license and abuse of privilege. They are using the public streets and squares, and we object to this also. But how about the ham bands? Just where is the point beyond which amateurs may not conduct such activities, or, more specifically, is there such a point? Or, if there is not, ought there to be such a point?

Should the bands be preserved as a sort of ivory-towered vacuum, removed from life and all its ramifications? Should hams be restricted to subjects which are divorced from all vestige of germane relationship to our times and our conditions? Must they avoid visceral issues, and be Pollyannas?

The issuance of a license by the FCC constitutes a grant of privilege. Is this grant limited, carrying an implicit power of censorship, cutting off the ordinary provisions of the First Amendment of the Bill of Rights? Does the holding of a license constitute acceptance on the part of the licensee of a set of behavioral standards, somehow at variance with those which pertain to the rest of the citizenry? In other words, when you take a ham ticket, are you agreeing to waive a significant section of your constitutional rights as an American citizen in good standing?

Are hams, in fact, under an obligation of some sort which compels them to avoid the controversial in all their contacts on the air? Before you reach for any glib or easy answers to these questions, remember just one thing: It has

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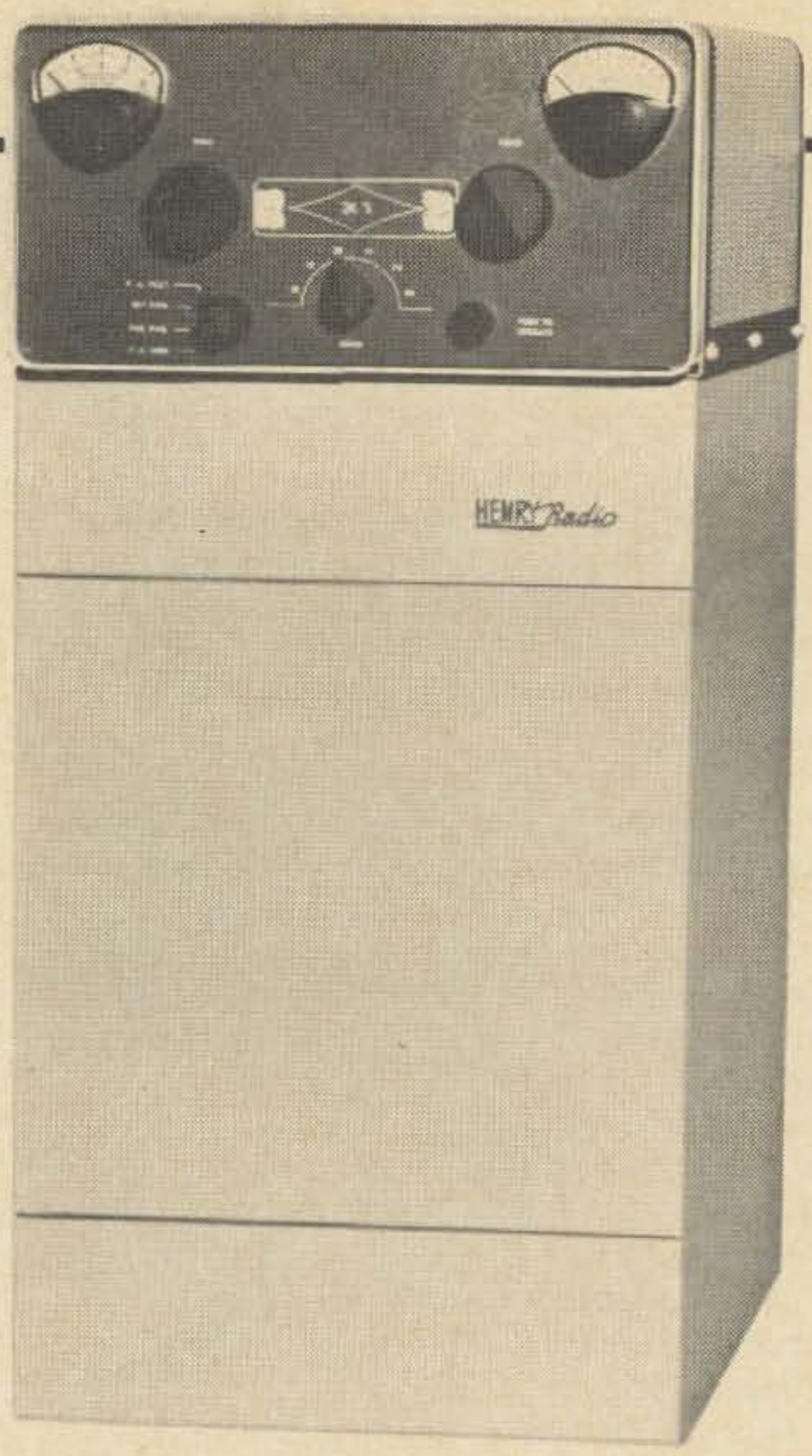

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never been considered wrong for hams of the opposite persuasion to display at times the most outspoken advocacy of violence imaginable, just so long as it had not been against what is generally referred to as the Establishment. No one seems to take issue with a man who wants to restore capital punishment, to impeach the Chief Justice of the United States, to send all Black persons back to Africa, or to drop a hydrogen bomb on Moscow or Peking. But just once, let someone express some idea which appears to run against the Establishment line politically, and that's when the fur begins to fly. So when you search inside yourself for answers to these dilemmas, I urge you to try to be perfectly fair and objective about it.

Once, at a Veterans' Day Parade on Fifth Avenue, a female spectator shoved a man standing in front of her, because he failed to doff his hat as Old Glory went by. As he fell flat on his face in the gutter, she cursed at him vehemently, calling him a communist SOB. When some less acrimonious persons helped him to his feet, it was seen for the first time that he could not very well remove his hat, since he had no arms! He was wearing a Purple Heart rosette in his lapel, and was also wearing a VFW insignia. This double amputee had sacrificed his limbs in the service of his country, while protecting the life and security of the very one who had pushed and villified him!

All of us have had occasion to observe the excessive zeal of superpatriotic fanatics, who desire every American to conform in dress, haircut, opinion, life-style, religious piety, politics, and so forth. Sometimes the figuratively armless and legless among us must contrive to prove every single day of their lives that they have earned their right to individuality. Yet, that is precisely the cause for which their sacrifices have been made. There is always some zealot, ready and eager to push them down into some gutter, when they fail to salute the flag, don't wear a red "buddy poppy," or don't care to have their kids join the Little League. Among certain people, the very worst transgression of all is the refusal to conform.

When will we learn to recognize the difference between patriotism and blind conformity to convention? There is a vast gulf between the two, yet the line of demarcation is becoming increasingly harder to discern. There really is not much of a generation gap to speak of, so much as there is an adamant refusal to tolerate the next fellow's point of view. Once we can overcome this intolerance, the schisms will be minimal.

In one of these pieces, some time ago, I stated that free speech was very much like pregnancy . . .there's no such thing as a little of it. You either have got it, or you haven't got it. And once you interfere with its progress, or try to limit it in any way, it is destroyed completely.

Now, please bear in mind that all of this has absolutely nothing to do with acts of violence. . . incendiary fires, bombings, stoning the police, unlawful occupation of buildings, destruction of private property, flinging of ordure on the heads of persons in the streets below, looting, burning of draft cards in violation of the law, and so forth. Where such violence occurs, free speech no longer exists. The very idea of free speech. . .its heart and soul. . .exists in the fact that *both* sides of a dialog should have the right to express themselves. Where only one side has the floor, freedom of speech is a mockery. And the majority is not necessarily compelled to grant free speech to the minority, while it gives up its own right to the same privilege. Many persons who wish to be granted all democratic rights because they are expressing minority points of view think that the majority should be silenced. This is just as distorted as the other side of the coin.

Anyone who commits acts of violence, no matter what position he takes on the issue, should be tried, and if convicted, put into confinement. The idea that wrongdoers should be treated permissively on the grounds that they will develop complexes if they are held accountable, is one of the worst causes of violent behavior in our society. We simply cannot afford to allow malefactors to get away with some of these atrocities they commit in the name of Constitutional Rights.

The difference between freedom and license is clearly definable, and society cannot afford to allow the latter to devour and destroy the former!

This nation of ours, almost two hundred years old, can easily endure all the verbal attacks of the dissenters. It can stand all the mealy-mouthed vituperation, the arrant nonsense, the short-sighted ravings of Utopians who propound the false syllogisms of misbegotten political creeds. But this nation cannot survive the rigid, sanctimonious ignoramuses, who, in the name of blind patriotism and conformity, arrogantly demand that everybody must think, talk, and act as *they* do.

No country which demands of its people that they vote 'Ja,' can hope to endure, for such demands grow out of an all-consuming fear. And such fear grows out of a lack of faith in the system, the political institutions, and worst of all, out of a country's failure or unwillingness to recognize and respect the rights of its individual citizens.

God help us on the day when anyone in America, whether of the majority or minority, is muzzled, and cannot freely express his opinions. We have a splendid, unparalleled legacy here, of both liberty and the courage to preserve it. Let us repudiate those fears which tempt us to limit our liberties.

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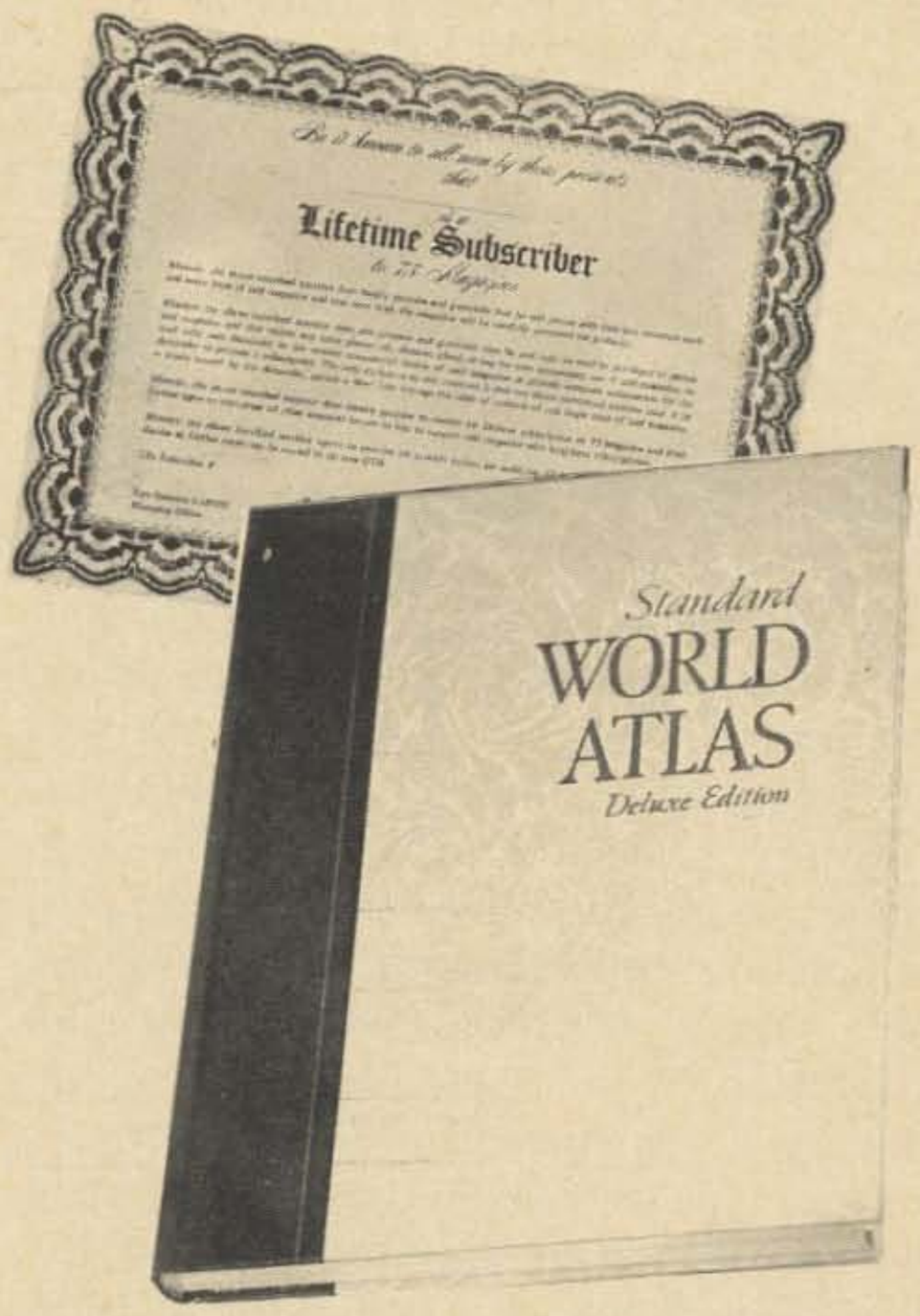

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AN IMPROVED METHOD FOR THE TRANSMISSION OF COLOR INFORMATION BY SLOW-SCAN TELEVISION

Photograph of televising process.

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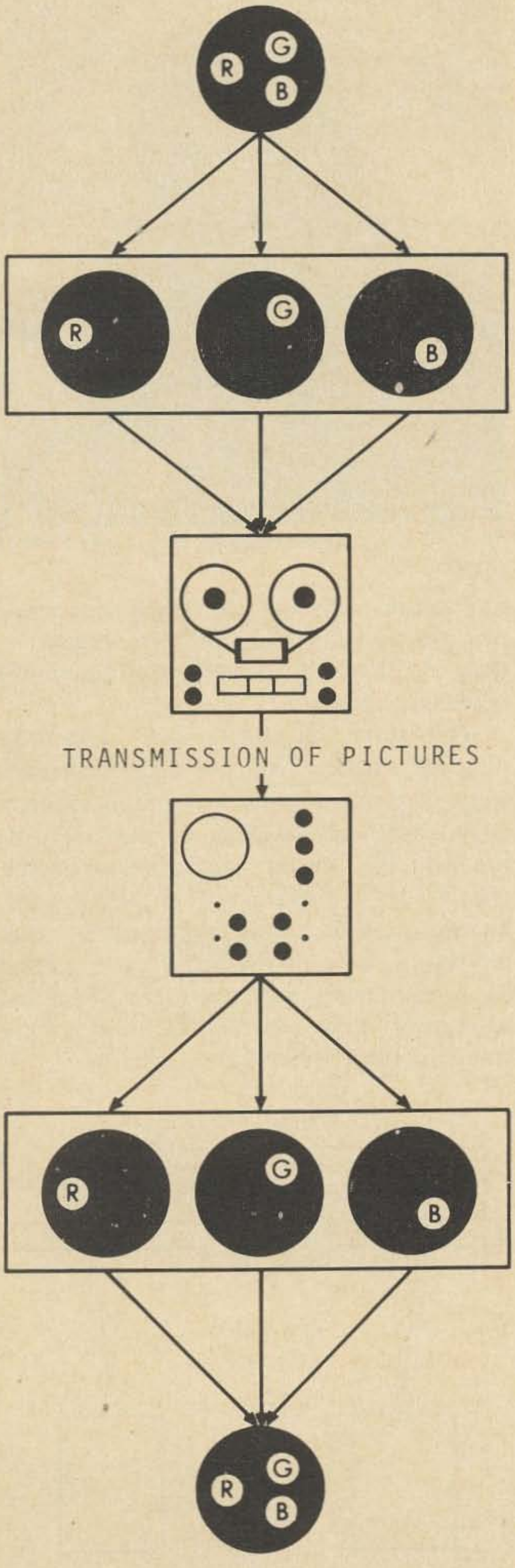
In a recent article (73, Jan. 1970) we described a method for transmitting a color picture by slow-scan television. The method essentially was one of performing a tricolor analysis of the color picture, transmitting the resulting black-and-white separation pictures by slow-scan television, and reconstituting the original color picture using a separable, subtractive synthesis process (Color-Key). The separable synthesis process used had many advantages, including a relaxed registration requirement (small deviations in the size and orientation of the separation pictures can, with care, be corrected in the synthesis process) and a capability for controlled color correction in the fabrication of the reconstituted picture. The method, however, does suffer one major drawback: too many photographic steps are required in the synthesis phase. The method we now describe contains at most two photographic steps. As these steps can involve the use of Polaroid film, it is now possible to produce, both quickly and economically, a good reproduction of a color picture transmitted by slow-scan television.

Method

The improved method proposed for analyzing and synthesizing a color picture is shown in Fig. 1.

The subject – here a set of red, green, and blue circles on a black background – is photographed three times, once each time through a red, a green, and a blue filter. The three black-and-white separation pictures (positives) so produced are then televised and tape recorded; transmission of the taped pictures proceeds via high-frequency SSB, the telephone, or the mail. Upon receipt, the separation pictures are displayed on an SSTV monitor, and three successive time-exposures of the separation pictures are photographed *on a single color film frame* through corresponding red, green, and blue filters. When this film is developed, a reproduction of the original color subject should result.

Basic to this method of color analysis and synthesis is a strict registration requirement. As the actual color synthesis is done *within the camera containing the color film*, correction of magnification or positional differences in the separation pictures is, for all practical purposes,



ORIGINAL COLOR SUBJECT

PHOTOGRAPH COLOR SUBJECT THROUGH RED, GREEN, AND BLUE FILTERS. SEPARATION PICTURES MUST BE IN REGISTER.

TELEVISE, IN REGISTER, THE BLACK AND WHITE SEPARATION PICTURES; TAPE ON CONVENTIONAL AUDIO TAPE RECORDER.

DISPLAY, IN REGISTER, THE BLACK AND WHITE SSTV SEPARATION PICTURES

TAKE THREE SUCCESSIVE TIME EXPOSURES THRU RED, GREEN, AND BLUE FILTERS. ALL THREE EXPOSURES MADE ON ONE COLOR FILM FRAME.

SYNTHESIZED COLOR PICTURE

Fig. 1. Improved method for transmission of color information.

impossible. Thus, in the analysis phase, it is absolutely necessary that the three black-and-white pictures be photographed and televised in register. In synthesizing the color reproduction, no relative movement between the SSTV monitor and the film camera, or changes in the scanning dimensions, can be tolerated.

The method described here is similar to that investigated by Davies (1964) for use in the Surveyor moon-probe program. In working with color film processes, Davies employed both Polaroid Polacolor and Kodak Ektachrome film. Objections raised by Davies to the use of these films were:

1) Polacolor film lacked dynamic range.
2) Photographs had a blue cast resulting from the blue hue of the monitor screen.

The latter fault is somewhat negated by the use of P7 phospors (blue-green) in SSTV monitor screens. Should additional hue correction be required, however, variations in f/stop settings and filter densities can be instituted in the final photographic step. It should also be noted that in the developing process for Polacolor film, a shorter developing time will bias the print towards the red end of the spectrum. In printing pictures from films such as Ektachrome the use of color-correction filters is common practice.

Lack of dynamic range in Polacolor film is not so great as to deter use of this film in amateur SSTV work.

Color Analysis

The method described was tested using the picture shown in Fig. 2. To aid in the synthesis process, red, green, blue, light gray, and black chips were mounted beneath the picture; accurate reproduction of the color chips assured proper rendition of the main color subject. The subject card was photographed through the necessary filters with a Polaroid Model 110B camera. Type 47 Polaroid black-and-white film (ASA 3000) was used and a closeup lens was attached to the camera. Filters used were: red (Wratten 25A), green (Wratten 58B), and blue (Wratten 47). The subject picture was indirectly illuminated by four 300W photoflood lamps. Every precaution

Fig. 2. Color subject. Photo courtesy VARIG Airline.

was taken to insure the three separation pictures remained in absolute register – that is, that the camera did not move between exposures.

The three black-and-white separation pictures resulting from the analysis process were carefully aligned and mounted on a keyed cardboard backing. In the televising process, this keyed backing was shifted relative to a fixed piece of keyed cardboard, insuring proper alignment of each picture in front of the SSTV camera (Fig. 3). The three separation pictures, televised in register, were recorded at 3-3/4 ips on standard 1-mil Mylar audio tape.

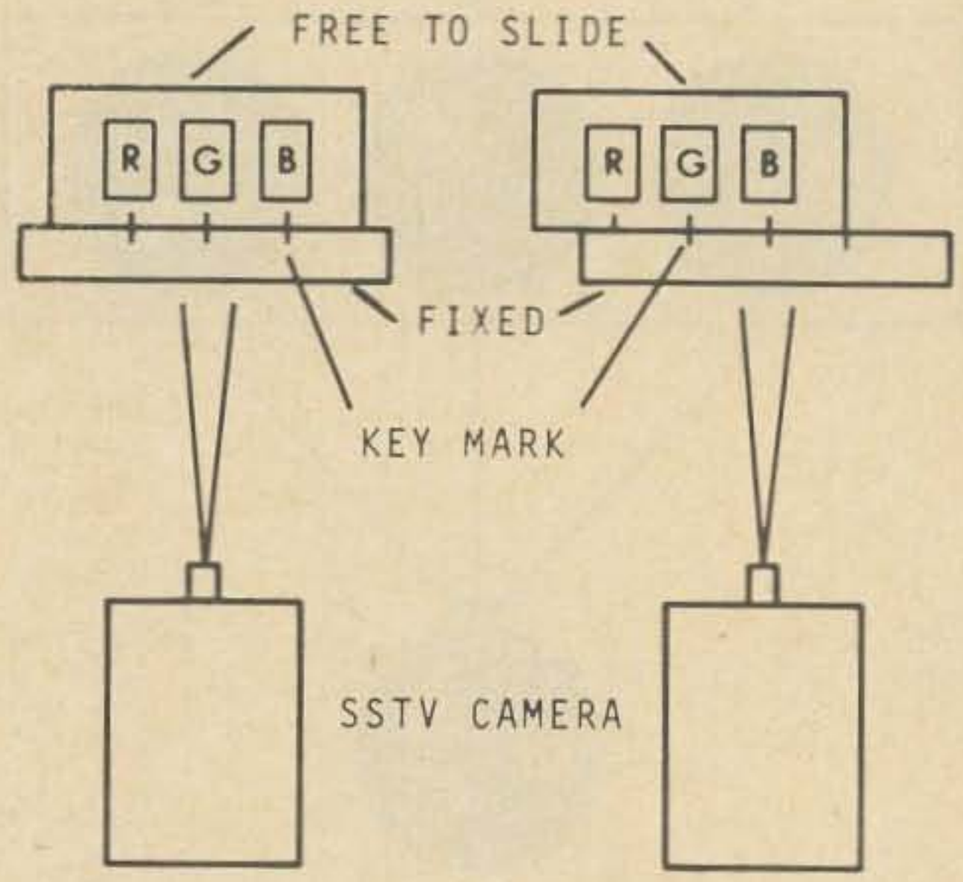


Fig. 3. Alignment method used in televising process.

It is possible, with some SSTV imaging systems, to do direct color separation with the SSTV camera. Slow-scan systems employing 931A photomultiplier tubes (Hutton, 1968) or conventional vidicons such as the 6326 (Taggart, 1968; Hutton, 1969) have spectral response functions suitable for use in direct color separation (Cohen and Tarr; 73, Jan. 1970). Slow-scan vidicon tubes, however, peak in the blue-violet, and cameras employing these tubes (Macdonald, 1965) can not be used for direct color analysis. As a camera employing a WL-7290 vidicon was used in the present work, it was necessary to perform the color separation by photographic means.

Color Synthesis

The separation pictures were displayed on a 3 in. hybrid monitor employing a 3RP7A cathode-ray tube (CRT). The Polaroid 110B camera, now loaded with type 48 Polacolor film (ASA 75), was rigidly fixed in front of the monitor. To minimize relative camera-monitor movement, the camera shutter was not used, and a black card placed before the lens between exposures. All work was done in a completely darkened room. No changes in monitor control settings were made between a given set of time exposures. Some experimentation with exposure time was necessary to produce an acceptable Polacolor print. The direction such experimentation took was influenced by careful analysis of preceding exposures. For the type CRT and film used, we found it necessary to photograph 8 frames of each separation picture, through its respective filter, at an f/stop setting of 4.7. The room temperature, 75°F, dictated a developing time of 60 seconds.

Results & Conclusions

We have demonstrated a method for quickly and economically analyzing and synthesizing a color picture. At most, two photographic steps are required, both of which can involve the use of Polaroid quick-processing film. Careful attention must be given to insure registration of the black-and-white separation prints. However, by exercising care, amateurs should now be able to use this method to transmit color information by slow-scan television.

Fig. 4. Synthesized color subject.

The synthesis of the color subject is shown in Fig. 4. This picture was obtained on the third try. To the extent that the color in the reconstructed picture matches the color of the original subject and the color chips, we classify the picture quality as "good."

Acknowledgment

We thank D.J. Holscher, Hughes Aircraft Company, Culver City, California, for supplying a copy of D.R. Davies' report. Subject photo courtesy VARIG Airline.

W4UMF and Wade Tarr ■

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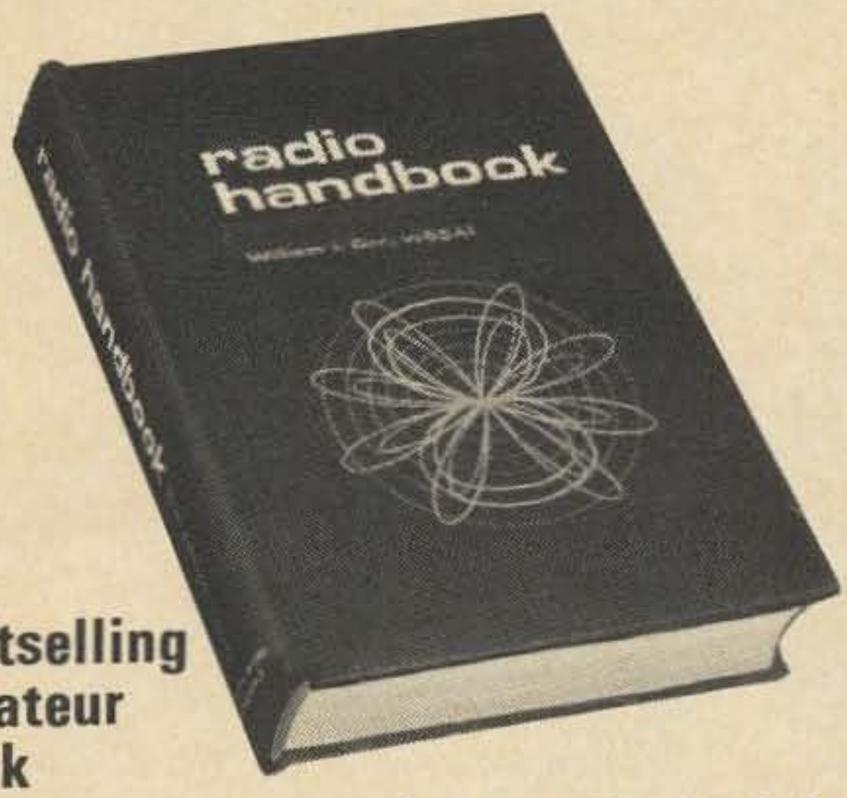

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JTA–JVZ	Mongolia
JWA–JXZ	Norway
JYA–JYZ	Jordan
JZA–JZZ	Indonesia (West Irian)
KAA–KZZ	United States of America
LAA–LNZ	Norway
LOA–LWZ	Argentina
LXA–LXZ	Luxembourg
LYA–LYZ	USSR (Lithuania)
LZA–LZZ	Bulgaria
MAA–MZZ	United Kingdom
NAA–NZZ	United States of America
OAA–OCZ	Peru
ODA–ODZ	Lebanon
OEA–OEZ	Austria
OFA–OJZ	Finland
OKA–OMZ	Czechoslovakia
ONA–OTZ	Belgium
OUA–OZZ	Denmark
PAA–PIZ	Netherlands
PJA–PJZ	Netherlands West Indies
PKA–POZ	Indonesia
PPA–PYZ	Brazil
PZA–PZZ	Surinam
QAA–QZZ	Service Abbreviations
RAA–RZZ	USSR
SAA–SMZ	Sweden
SNA–SRZ	Poland
SSA–SSM	United Arab Republic
SSN–STZ	Sudan
SUA–SUZ	United Arab Republic
SVA–SZZ	Greece
TAA–TCZ	Turkey
TDA–TDZ	Guatemala
TEA–TEZ	Costa Rica
TFA–TFZ	Iceland
TGA–TGZ	Guatemala
THA–THZ	France, Overseas Territories & Overseas States of the French Community
TIA–TIZ	Costa Rica
TJA–TJZ	Cameroon
TKA–TKZ	France, Overseas Territories & Overseas States of the French Community
TLA–TLZ	Central African Republic
TMA–TMZ	France, Overseas Territories & Overseas States of the French Community
TNA–TNZ	Congo (Republic of)
TOA–TOZ	France, Overseas Territories & Overseas States of the French Community
TRA–TRZ	Gabon
TSA–TSZ	Tunisia
TTA–TTZ	Chad
TUA–TUZ	Ivory Coast
TVA–TXZ	France, Overseas Territories & Overseas States of the French Community
TYA–TYZ	Dahomey
TZA–TZZ	Mali
UAA–UQZ	USSR
URA–UTZ	USSR (Ukraine)
UUA–UZZ	USSR
VAA–VGZ	Canada
VHA–VNZ	Australia
VOA–VOZ	Canada
VPA–VSZ	Overseas Territories for

List

Tnx to W1SWX

	Which The United Kingdom Is Responsible for International Relations
VTA–VWZ	India
VXA–VYZ	Canada
VZA–VZZ	Australia
WAA–WZZ	United States of America
XAA–XIZ	Mexico
XJA–XOZ	Canada
XPA–XPZ	Denmark
XQA–XRZ	Chile
XSA–XSZ	China
XTA–XTZ	Upper Volta
XUA–XUZ	Cambodia
XVA–XVZ	Vietnam (Republic of)
XWA–XWZ	Laos
XXA–XXZ	Portuguese Overseas Provinces
XYA–XZZ	Burma
YAA–YAZ	Afghanistan
YBA–YHZ	Indonesia
YIA–YIZ	Iraq
YJA–YJZ	New Hebrides
YKA–YKZ	Syrian Arab Republic
YLA–YLZ	USSR (Latvia)
YMA–YMZ	Turkey
YMA–YNZ	Nicaragua
YOA–YRZ	Romania
YSA–YSZ	El Salvador
YTA–YUZ	Yugoslavia
YVA–YYZ	Venezuela
YZA–YZZ	Yugoslavia
ZAA–ZAZ	Albania
ZBA–ZJZ	Overseas Territories for Which The United Kingdom is Responsible for International Relations
ZPA–ZPZ	Paraguay
ZQA–ZQZ	Overseas Territories for Which The United Kingdom is Responsible for International Relations
ZRA–ZUZ	South Africa (Republic of)
ZVA–ZZZ	Brazil
2AA–2ZZ	United Kingdom
3AA–3AZ	Monaco
3BA–3FZ	Canada
3GA–3GZ	Chile
3HA–3UZ	China
3VA–3VZ	Tunisia
3WA–3WZ	Vietnam (Republic of)
3XA–3XZ	Guinea
3YA–3YZ	Norway
3ZA–3ZZ	Poland
4AA–4CZ	Mexico
4DA–4IZ	Philippines
4JA–4LZ	USSR
4MA–4MZ	Venezuela
4NA–4OZ	Yugoslavia
4PA–4SZ	Ceylon
4TA–4TZ	Peru
4UA–4UZ	United Nations
4VA–4VZ	Haiti
4WA–4WZ	Yemen
4XA–4XZ	Israel
4YA–4YZ	International Civil Aviation Organization
4ZA–4ZZ	Israel
5AA–5AZ	Libya
5BA–5BZ	Cyprus
5CA–5GZ	Morocco
5HA–5IZ	Tanzania
5JA–5KZ	Colombia
5LA–5MZ	Liberia
5NA–5OZ	Nigeria
5PA–5QZ	Denmark
5RA–5SZ	Malagasy Republic
5TA–5TZ	Mauritania
5UA–5UZ	Niger
5VA–5VZ	Togo
5WA–5WZ	Western Samoa
5XA–5XZ	Uganda
5YA–5ZZ	Kenya
6AA–6BZ	United Arab Republic
6CA–6CZ	Syrian Arab Republic
6DA–6JZ	Mexico
6KA–6NZ	Korea (Republic of)
6OA–6OZ	Somali Republic
6PA–6SZ	Pakistan
6TA–6UZ	Sudan
6VA–6WZ	Senegal
6XA–6XZ	Malagasy Republic
6YA–6YZ	Jamaica
6ZA–6ZZ	Liberia
7AA–7IZ	Indonesia
7JA–7NZ	Japan
7OA–7OZ	South Yemen (Peoples Rep.)
7PA–7PZ	Lesotho
7QA–7QZ	Malawi
7RA–7RZ	Algeria
7SA–7SZ	Sweden
7TA–7YZ	Algeria
7ZA–7ZZ	Saudi Arabia
8AA–8IZ	Indonesia
8JA–8NZ	Japan
8OA–8OZ	Botswana
8PA–8PZ	Barbados
8QA–8QZ	Maldive Islands
8RA–8RZ	Guyana
8SA–8SZ	Sweden
8TA–8YZ	India
8ZA–8ZZ	Saudi Arabia
9AA–9AZ	San Marino
9BA–9DZ	Iran
9EA–9FZ	Ethiopia
9GA–9GZ	Ghana
9HA–9HZ	Malta
9IA–9JZ	Zambia
9KA–9KZ	Kuwait
9LA–9LZ	Sierra Leone
9MA–9MZ	Malaysia
9NA–9NZ	Nepal
9OA–9TZ	Congo (Democratic Rep. of)
9UA–9UZ	Burundi
9VA-9VZ	Singapore
9WA–9WZ	Malaysia
9XA–9XZ	Rwanda
9YA–9ZZ	Trinidad & Tobago

FOR EMERGENCIES: THE SUPER

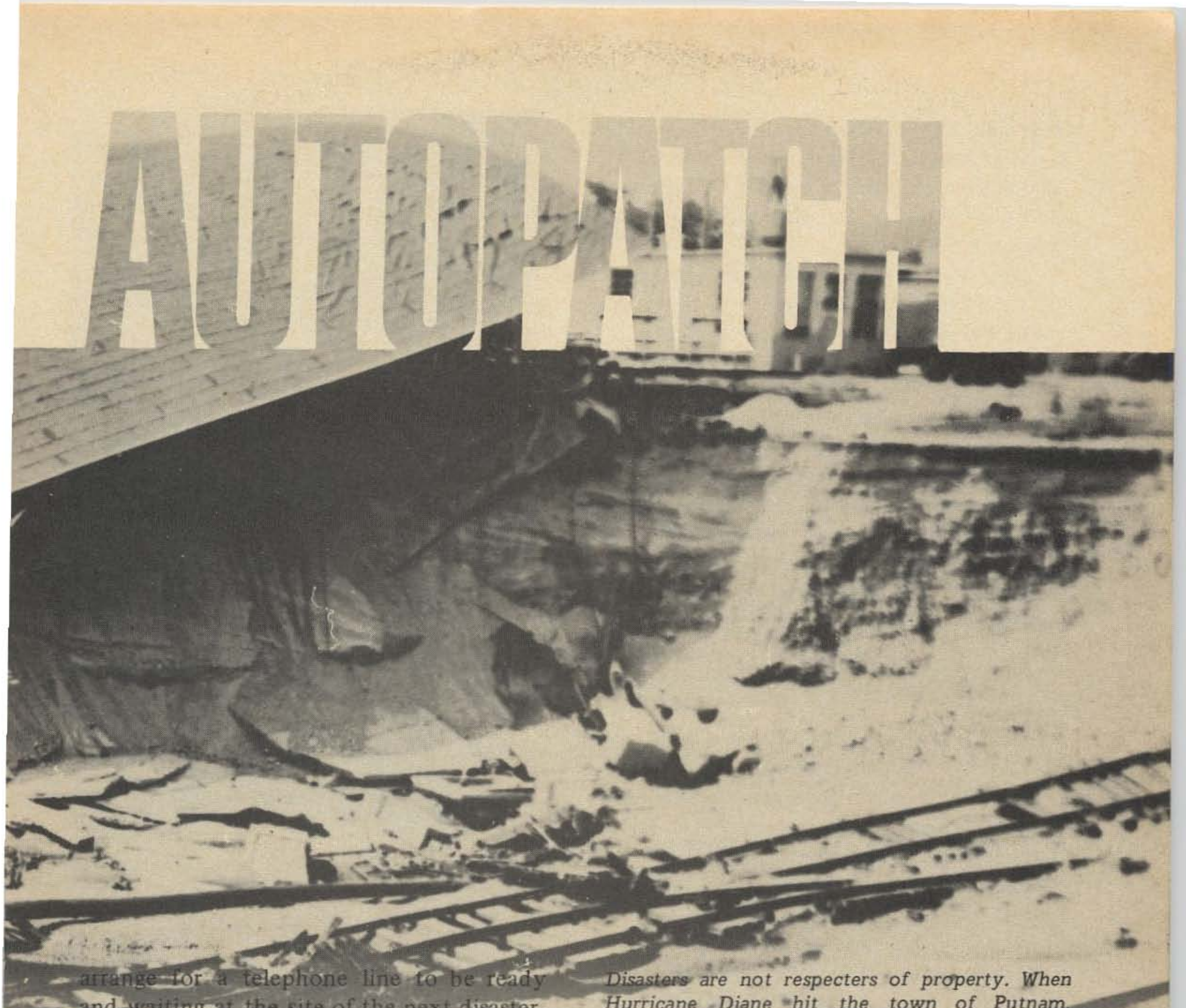
by Ken Sessions, Jr. K6MVH

When disaster strikes, there's no substitute for thorough, effective, versatile, and handy communications capability. Nothing gives these features quite so impressively as an autopatch. This one is ideal because it does everything – even lets you answer the phone, on command, without tones. Perfect for public service and emergency use, where phone access from hand-held units is desirable.

The most useful single commodity there is when an emergency occurs is communications capability. Not just any communications capability, though; to be useful in an emergency, a communications network must be readily accessible by officials and it must be capable of giving two-way coverage to and from any other single point in the country. Not ham radio, you say? You think the telephone is the only qualifying form of communications here?

Wrong and right, in that order! No one could deny the value of an unencumbered telephone line at the scene of a disaster. A phone can give almost instant two-way communications between any two points at will. Further, those people who *need* to communicate with the "outside world" in an emergency situation are accustomed to using a telephone – they feel more at home, more sure of the results – they'll be less confused at a time when confusion reigns. But of course it is impossible to

AUTOPATCH



Disasters are not respecters of property. When Hurricane Diane hit the town of Putnam, Connecticut, the power and phone lines went, too. The hurricane also brought torrential rains that caused New England rivers to flood many cities and towns along their paths. The only form of communications in such emergencies is the mobile or portable radio units; and these can provide the phone coverage ravaged by nature. (Photo by Motorola News Bureau.)

arrange for a telephone line to be ready and waiting at the site of the next disaster.

So let's take a look at what we've always considered to be the next-best thing: a ham radio traffic network. On the plus side, such a net can give the officials what they need most: a means for communicating. But a negative aspect is the fact that the choice of places where direct two-way communications can be maintained is restricted to places where amateurs are stationed. And communications effectiveness is hampered to a certain extent by the officials' inherent unfamiliarity with a ham radio setup. We've all seen the official who wants to talk to his contact while the contact himself is transmitting. Ham radio simply takes some getting used to.

The modern ham can, however, offer a disaster communications system that offers all the advantages of a conventional telephone, plus the capability of working into and through an organized message network. The secret is operating a simple autopatch in conjunction with an existing FM repeater.

Use of an autopatch offers a number of advantages that even Ma Bell can't match. For example, the official who wants to initiate a telephone call need not leave the area where he is needed in order to find a telephone. He can access the repeater autopatch through a hand-held walkie-talkie or from the amateur's car. (If the autopatch is built around a UHF repeater, say the control facility for a 2 meter

repeater, the official should feel particularly at home, for he won't be able to tell the autopatch from a regular telephone – he'll be able to dial directly, enjoy full duplex, etc.)

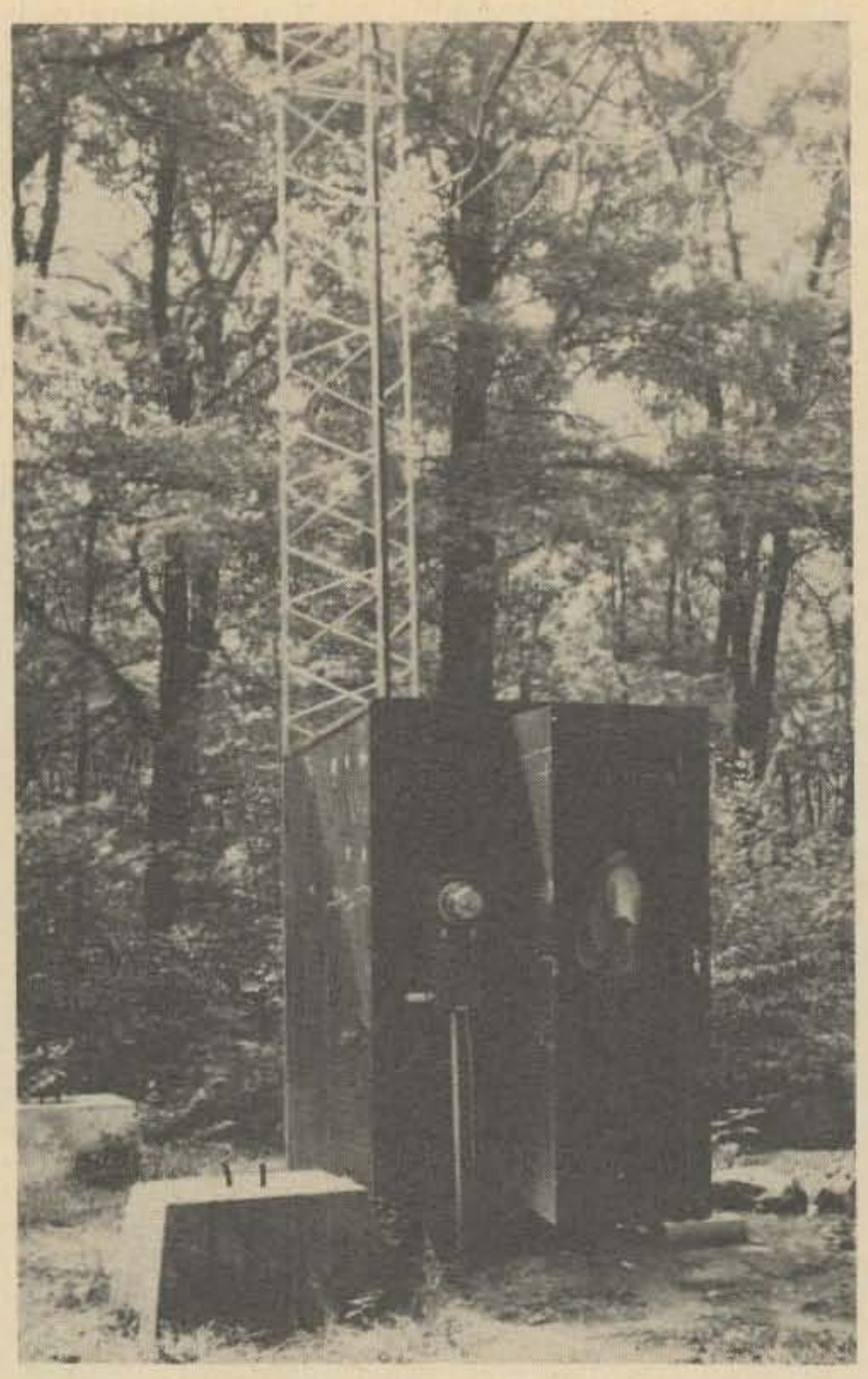
One of the most obvious disadvantages of a landline in an emergency is that *there may be no landline after the disaster strikes*. A flood could wash away the phone poles. A jet crash might take out all the lines in the vicinity of the site. Disasters of all kinds – fire, tornado, hurricane, earthquake – all have a habit of wiping out the telephone service in the vicinity of where the phone is needed most. But with an autopatch, the phone line may be far removed from the disaster scene. The chances of a landline outage at the repeater site occurring simultaneously with a disaster somewhere else are slim indeed.

One thing is certain. Bring a telephone to the site of a disaster and you'll be one welcome fellow. If you are already operating through a repeater that has public service ties, those ties will be strengthened immeasurably by adding telephone capability.

There is no guarantee, of course, that operating a telephone-interconnected repeater from a portable or mobile installation will be legal after the FCC gets through fiddling with repeater rules. But even the FCC would have to agree that an autopatch is certainly in the best interest of the public, which is what ham radio is all about when you get right down to the basics of the issue. A sensible approach, then, would be to proceed with plans for increasing the usefulness of your system, having faith that the Fed will not tighten the vise later.

Legality of Radio/Telephone Autopatch

A great many amateurs seem to think it is illegal to interconnect a telephone with a repeater for automatic patching. As my own remote control license will attest, this is simply not true. The legality of a remotely operated telephone system depends on its ability to meet the requirements of FCC Rules and Regulations. The principal requirement is that incoming calls must not be capable of keying the transmitter when no licensed operator is monitoring from the control point.



Most autopatches are simply phone patch panels installed at a remote repeater site where telephone service is available. Often, owners of commercial remote installations such as the one pictured here will permit amateurs to install an autopatch-equipped repeater. The key word is service, and no facility fills the bill more perfectly than a ham repeater whose users are prepared to act fast in an emergency. (Photo by Motorola News Bureau.)

Another area of questionable legality is that of controlling a remote station from a mobile unit. The FCC says that a remote station must be controlled from a fixed site. To many, this automatically precludes the possibility of setting up a control station in the mobile. But close scrutiny of Part 97.43 of the Rules reveals no prohibition of mobile control. The currently popular interpretation of the Rules is that control can be accomplished from anywhere as long as fixed control is maintained.

Some amateurs even go further, and do not maintain a fixed control *per se*. They say they get their authority to control exclusively from a vehicle because of the

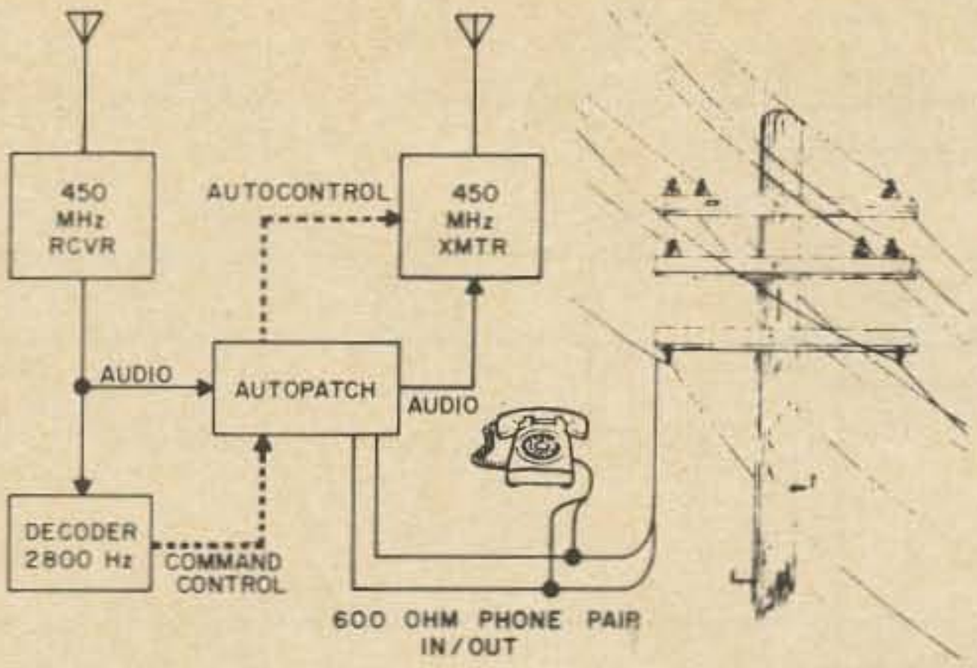


Fig. 1. The autopatch's interconnection with the phone line has no effect at all on an existing telephone connection since it is wired in parallel with the instrument. The block diagram shows how a fully duplexed autopatch system is set up with a UHF repeater.

permission to do so given by the conditions on the back of the amateur license. According to the statement on the reverse of General and Technician class licenses, the remote control point is considered "fixed" even though it may be actually mobile or portable. (Take a good look at the back of your license; it pays to read the small print.)

Not all individual officers of the FCC go along with wording on the back of the license, I hasten to add. James Barr, for example, who happens to be an FCC wheel, says the control station must be fixed – the disclaimer on the license notwithstanding. But Barr might have a rough time making his opinion stick when the official documentation plainly counters it.

In spite of all those hair-splittings, no one within the FCC has ever been known to deny the legality of mobile control *as long as a licensed fixed station is manned by an operator authorized to turn the remote system off should the need arise.* (Docket 18803 would change this, however, if it goes through.) And even Barr has gone on record as endorsing *subcontrol* (which is what exists when a mobile operator controls a remote station that is capable of being controlled by an overriding authorized control station).

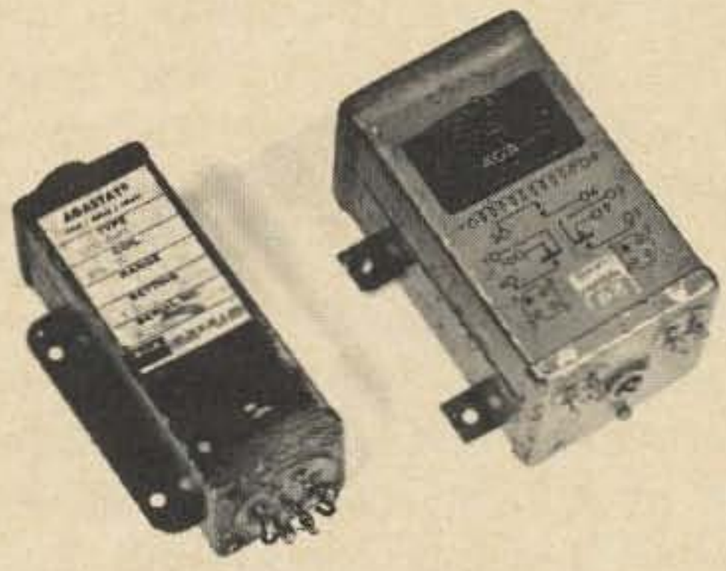
Understanding the Telephone

The conventional telephone uses but two wires to accomplish what may amount to a multitude of different functions. There is typically a low voltage dc level across the line to drive the carbon microphone element. When the telephone rings, however, a higher voltage ac signal is superimposed on the line pair to energize the bell in the instrument.

A telephone with its receiver on the hook is an open circuit. The circuit closes when the receiver is lifted, introducing a moderately low-resistance load (several hundred ohms). The dial is a rather complex switch device that has the capability of opening the circuit briefly for a number of times that correspond to the number dialed. The circuit stays closed as the finger hole is brought around to the stop. Then, circuit "opens" are pulsed out sequentially as the dial returns to its "home" position. Thus, the dialing function could be simulated by rapid manipulation of the hang-up button, provided that the required speed of 10 switching operations per second could be maintained manually. And hang-up could be effected (temporarily) by controlled positioning of the dial.

The "Super" Autopatch

The block diagram of Fig. 1 shows the method by which an automatic patch such as the one described in this article is interconnected into a UHF repeater. The broken lines represent control signals and the solid connecting lines represent audio signals. As can be seen, the telephone needs no modification, and is interconnected with the system by merely tapping into the two wires that are already part of the



Agastat pneumatic timers are perfect for autopatch applications because they can switch plenty of current, they are instantly resettable, and they offer a high degree of reliability. The unit at left is a standard adjustable time delay relay (TD1, TD2, TD3 in schematic of Fig. 2); at right is a delayed dropout. Units are available surplus for $3 to $5 each.

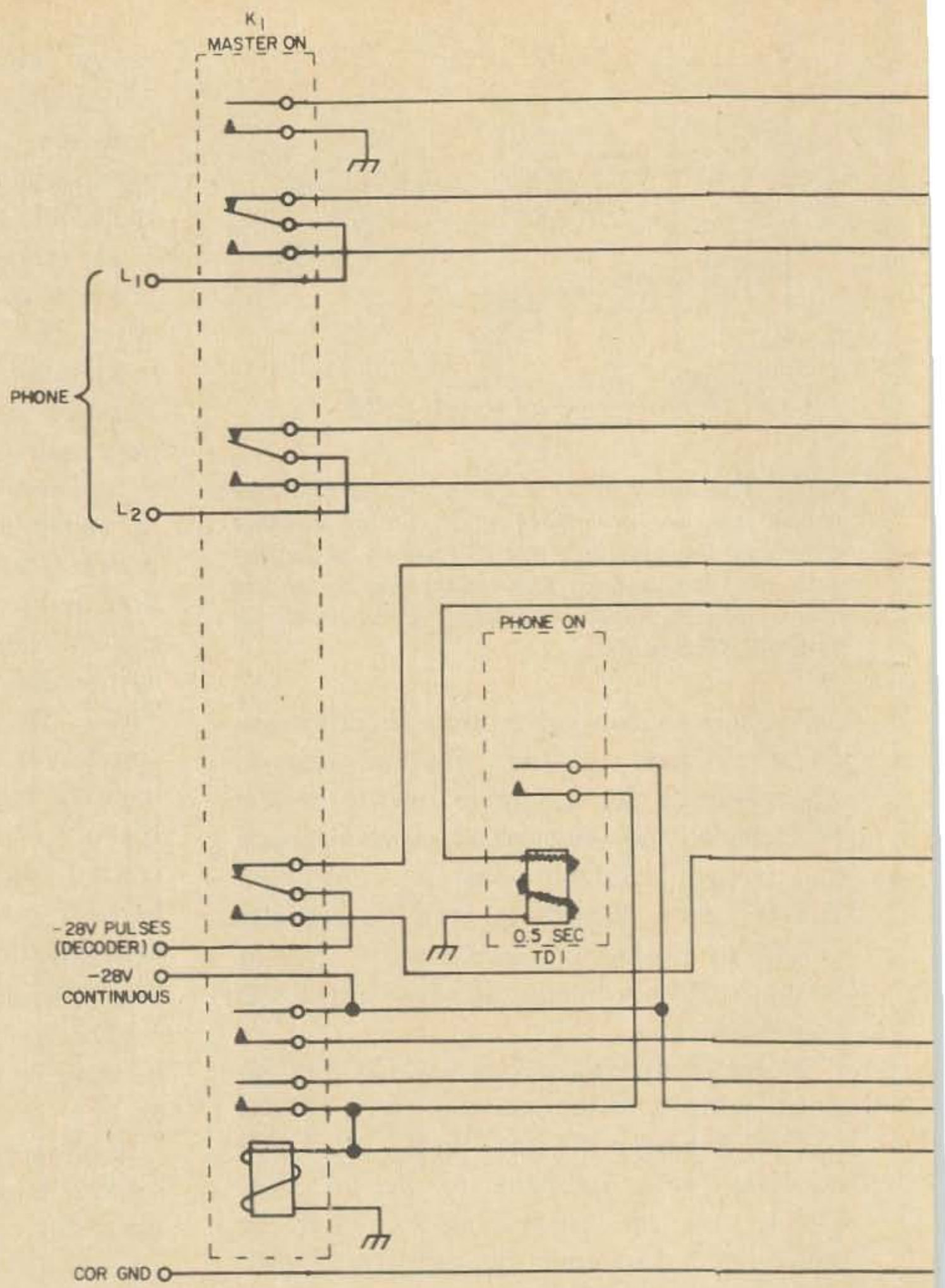


Fig. 2. This autopatch circuit has everything: timed on, timed off, autoanswer from units that are not tone equipped, and a number of built-in "failsafe" features to assure control even if you lose control.

existing telephone circuit. It should be noted that the autopatch can be integrated just as easily into a 2m repeater, though duplex operation would be next to impossible to achieve for the user mobiles because of frequency proximity and attenuation problems.

The autopatch itself performs the magic. Shown in Fig. 2, the circuit contains all the elements necessary to make it the "cadillac" of automatic patching devices. It does just about everything. In response to timed control tones transmitted by the control operator, it can "lift the receiver from the hook" and interconnect the phone patch with the repeater; or it can "replace the phone on the hook" and disengage the repeater. When the phone rings, the control operator knows he has an incoming call: the autopatch generates its own tone and turns on the repeater transmitter with each ring.

Without the need for tones, the control operator has the capability of allowing the phone patch to be engaged or not, as determined by the sequence by which he activates the carrier of the control point transmitter. And, as a final safety measure, the autopatch disengages from the repeater when there is no control signal immediately apparent. If, after the control operator engages the phone patch, he loses control or his transmitter drops off the air, the patch disengages itself in seconds, shutting off the repeater transmitter until control can be reestablished.

Ring Indication. Since the autopatch is likely to be incorporated into an already existing repeater setup, the circuit has been designed for full compatibility. The phone

line at the repeater site can be continuously monitored for incoming landline calls without disrupting the normal operation and control functions of the repeater. During normal repeater use, the phone line is sensed for the presence of an ac voltage (which would indicate that the phone is ringing). The two lines of the twisted pair are fed through a set of normally closed contacts on the main relay (K1) to a bridge rectifier circuit. The dc component of the line is isolated by placing 0.5 μF capacitors in series with the conductors. A sensitive plate relay on the output of the bridge pulls in when the telephone rings and keys the repeater transmitter for the duration of the ring. This momentary closure of the relay triggers a signaling device so that when the transmitter is thus keyed, a ring signal is generated also.

The ringer shown in the upper right corner of Fig. 2 is nothing more than a simple relaxation oscillator; it can be constructed in a few minutes with a couple of capacitors, a resistor, and a neon lamp. The device shown generates an unstable tone that is easily identifiable at the receiving end.

Timer Considerations. The "super autopatch" makes extensive use of timers for effective active and passive control. The timers used in my own autopatch are Agastat pneumatic delay devices made by Elastic Stop Nut Corporation (ESNA), of Elizabeth, N. J. If purchased new, these delays can be quite expensive. I bought mine at a bargain price of $1.50 each from "Pappy" Dow, a Southern California surplus mogul.

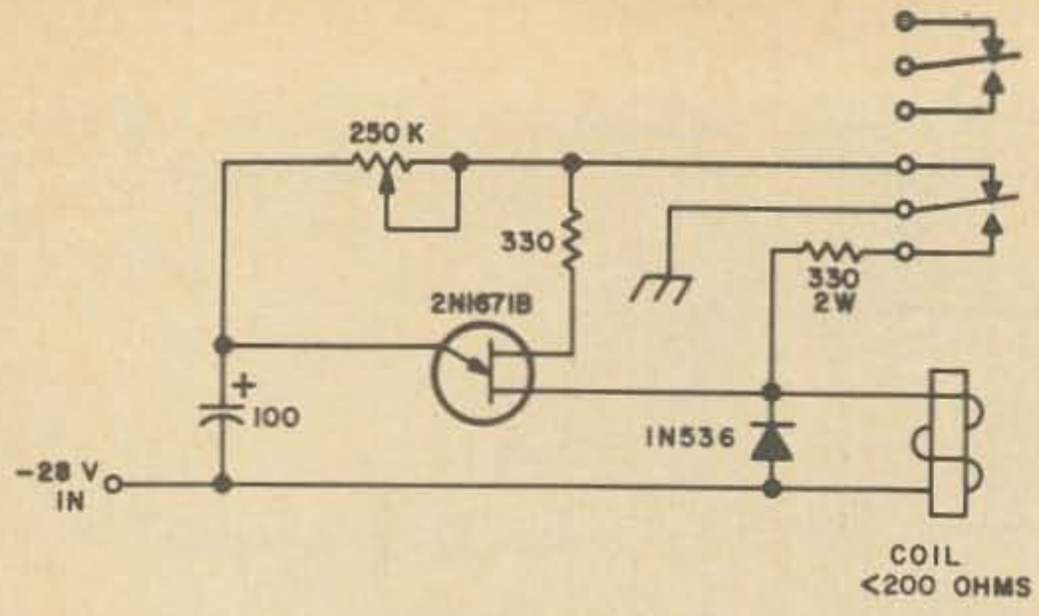


Fig. 3. This unijunction timer circuit offers a broad range of delay periods, from less than 0.5 second to more than 3 minutes. The delay is set by the 250 kΩ pot; each 10 kΩ of resistance gives a second or so of delay. In practice, of course, the pot would be replaced by the proper fixed resistor, because there would be no need for a variable time delay.

All-transistor timing and switching circuits work quite well, but their incorporation does make the schematic a bit more complicated because of the various polarity requirements. The cheapest way to miniaturize would be to compromise a bit by using hybrid timer circuits that employ miniature relays for switching in combination with unijunction timer circuits.

Figure 3 is an adaptation of a timer circuit that was published in GE's "Transistor Manual, Seventh Edition." This circuit is particularly versatile because it employs a low-cost semiconductor, relatively few parts, and an easy-to-find relay with a coil resistance of 150–200Ω.

The Phone Patch. The phone patch itself is an item that warrants some attention, but a great deal has been written on this subject in the past so I won't go into it in detail here. As references, I will cite the FM Repeater Handbook (Editors and Engineers, Ltd., Indianapolis, Indiana), FM Magazine (July 1968 and December 1968), FM Anthology, Volume II (73 Bookshop), and 73 Magazine ("VHF Operation by Remote Control," August 1968).

The most important point to remember when connecting a phone patch into an autopatch system is to leave a dc path through the patch primary. If a series capacitor is placed in the circuit, it should be shorted; otherwise telephone ringing and dialing cannot be effected automatically for remote operation.

"Desirable" characteristics for commercial phone patches are: (1) a high degree of signal isolation, (2) automatic compression circuitry, and (3) built-in preamplification for phone signals.

Autopatch Decoder Control

In the system described here, a high-frequency tone decoder is used to switch a −28V signal for control of the autopatch when a call is to be initiated. The decoder shown in Fig. 4 is ideal for this purpose, having stood the test of time and use. This unit, by the way, is a simplified version of Motorola's transistorized decoder (Part 9-SP022563), which is itself available from Spectronics, 1009 Garfield, Oak Park IL, for $40 postpaid.

The original Motorola circuit is not satisfactory for dial pulsing because it is slow-responding. The Motorola version is used as a "single-tone" controller, where a stable, continuous tone is needed. Removal of a few circuit elements, however, makes the Motorola decoder a natural for phone pulsing applications. (The circuit of Fig. 4 is a quick-pulsing decoder that responds easily to tone pulses of a 10 per second repetition rate.)

Tone Frequency. The decoder is set to respond to tone signals in the frequency range of 2200 to 2900 Hz. Adjustment of the frequency-sensitive elements permits the pinpointing of any 50–75 Hz bandwidth within that range.

Of course, any frequency between 600 and 3000 Hz can be used, but the lower frequencies have serious disadvantages in practical applications. At frequencies between 600 and 1000 Hz, for example, ordinary conversation causes decoder triggering, and the result is errant and inadvertent operation of the functions to be controlled. Frequencies from 1 to 1.5 kHz can also be triggered by occasional voice signals; and a playful repeater user can toy with the phone by simply whistling.

Things begin to get more secure as the frequency goes up. But at 3 kHz, the audio processing capability of the transmitting and receiving equipment may be exceeded, particularly if there is inherent audio distortion in the system. The range from 2.25 to 2.85 kHz should prove ideal: It's difficult to voice-trip, it resists whistle-on

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attempts, and it is well within the frequency-response limits of most commercial FM units.

Decoder Alignment. Since impedances are critical when making voltage measurements at the decoder input terminals, an electronic ac voltmeter (vtvm) will be required. With the voltmeter connected across the receiver's audio output leads, have one of the repeater users transmit a tone. With the tone on the incoming signal, adjust the 500Ω pot on the decoder input for a reading of 400 mV. If this is not obtainable, set the 500Ω pot to midposition and adjust the receiver audio gain control. (If the receiver "speaker" audio connects directly to the transmitter, repeater levels will have to be readjusted.)

Next, connect the voltmeter (ac range) from the wiper arm of the 500Ω pot to point A of the 50–100 mH inductor, then adjust the inductor for a peak indication on the meter.

Move the voltmeter lead at point A to the cathode of diode D1 (point B), then *slightly* adjust the 50–100 mH inductor for a *dip* indication.

Autopatch Operation

In operation, when the ham operator sends a note of the proper frequency from the remote control point, the decoder switch closes, applying a –28V signal to the phone patch "master on" relay (K1). Look now at Fig. 2, to see where the –28V decoder-pulse terminal is on the autopatch unit. During the time the operator sends a tone, the negative-voltage signal is applied through the normally closed contacts of K1 and the normally closed contacts of shutdown timer TD3 to the coil of "phone on" timer TD1. At the end of the period of TD1, exactly one-half second, the coil energizes to supply power to the coil of the "master on" relay, which latches in the energized position.

When K1 is latched on, the phone patch is in the circuit and the decoder output is connected to pulser K3. If the operator's tone generator is connected to a telephone dial so that tone pulses can be transmitted, K3 can be used to dial any number. Pulser K3 interrupts the dc circuit of the phone line to accomplish this. At the end of the phone conversation, transmittal by the operator of a continuous tone will hold pulser K3 in. A second set of contacts on K3 feeds the coil of a shutdown timer, which will pull in after a 2-second period to completely disengage the autopatch.

Malfunction Protection. An autopatch is a borderline thing with a respect to official sanctions; it thus behooves the builder to take every precaution possible to see that failsafe measures of every kind are included. The schematic of the autopatch shown here includes a feature that shuts down the patch if the remote operator does not transmit at least one brief signal

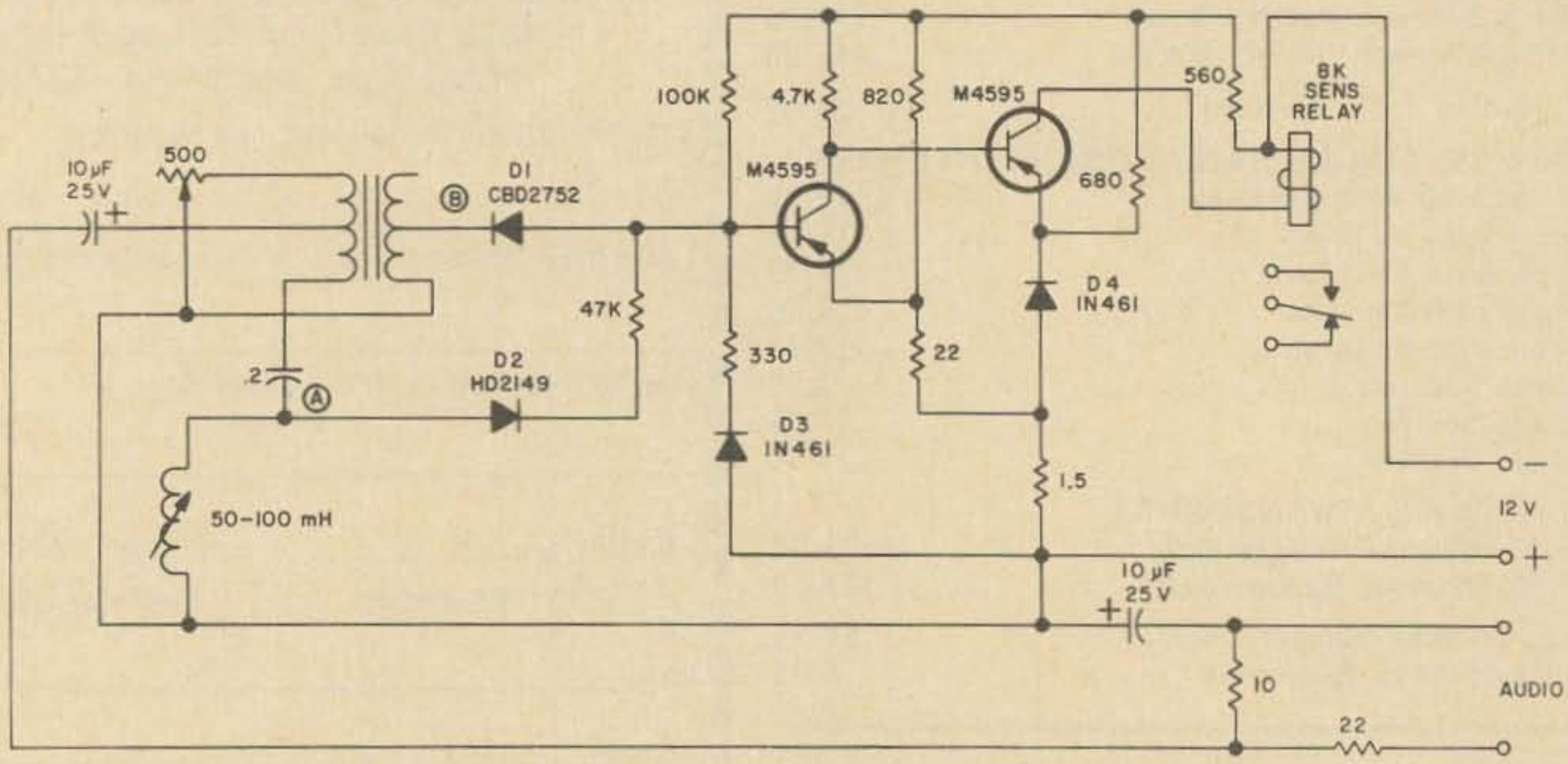

Fig. 4. This audio decoder responds to signals in the frequency range of 2200–2900 Hz. Precise setting is explained in the text. Although Motorola part numbers are shown, equivalent values may be substituted.

every 25 seconds or less. If more than 25 seconds goes by without an incoming radio signal, the shutdown timer (TD3), supplied through the normally closed contacts of the carrier-operated relay, will break the circuit supplying the latching voltage to the "master on" relay.

Most repeaters already are equipped with timers that shut down the repeater if a signal stays on too long, so none was included in this patch. The two schemes are perfectly compatible, and they do complement each other in such a way that when an operator cannot demonstrate that he has control, the phone patch will turn itself off automatically. To effectively demonstrate control, the operator must not talk – during any single transmission – longer than the safety timer of the repeater, and he must transmit a signal at intervals of 25 seconds or less.

Control Without Tones. To answer the phone quickly when it is ringing, the operator can engage the phone patch with the tone as described earlier. Or he can do it, without tones, by transmitting a carrier at a precise time. If he transmits the carrier too soon or too late, the phone will keep on ringing and will not be answered. The autoanswer feature is performed with ringer K2, the COR slave (K4), and autoanswer relay K5 (a delayed dropout relay with a period of 0.5 second).

When the phone rings, ringer K2 energizes only during the period of the ring. The closed contacts of K2 during the ring apply a –28V signal to the delayed dropout relay (K5) through the normally closed contacts of the carrier-operated relay. Thus, K5 is energized for one-half second beyond the ring (or beyond actuation of the carrier-operated relay). If, during the ring, a carrier is placed on the repeater input, a –28V signal is routed to the "master on" relay. The signal must go through the contacts of the ringer, the COR, and the delayed dropout relay; if all three are not energized at the same time, the telephone cannot be turned on without tone control.

If a repeater user is transmitting at the time the telephone starts to ring, the autopatch will not be engaged because the

Twin antennas mounted on the rear cowls keep the author's installation from looking junky. Inside the car, the only visible evidence of a rig is the "Princess" telephone, mounted to the console and modified to serve as a "control head."

COR cannot feed voltage to the delayed-dropout relay. If he waits until after the ring to transmit, the phone won't answer because the ringer contacts will be open. To answer, the operator must press his transmit key after the phone has started a ring but before the ring has stopped. This concept serves to prevent inadvertent telephone energization yet gives control of the phone to such non-tone-equipped units as handie-talkies.

On Convenience and Necessity

If you read 73's comments to the FCC's proposed rulemaking for repeaters, you probably saw a reference made to use of an amateur autopatch to save the life of a peace officer. The telephone system used was the one described in this article, and the operator was Don Milbury W6YAN. Don passed the scene of a tragedy involving a highway patrolman and telephoned the police and ambulance directly using his mobile amateur facility. A few miles further down the road, Don accepted a telephone call in his car. The police called him back to express appreciation for his early report and were happy to relate that the officer would live. It will take a lot of ugly towers and TVI complaints to water down at least this one city's opinion of amateur radio.

. . . K6MVH ■

Elliott S. Kanter W9KXJ
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Chicago IL 60645

How To Build A Keyer

(and retain your appliance operator status)

Many articles have been written on the subject of building a keyer mechanism for an electronic keyer. The common denominator in all of these projects is that two stationary terminals be placed in some manner and a flexible blade be moved from side to side to make contact with them to form the dots and dashes.

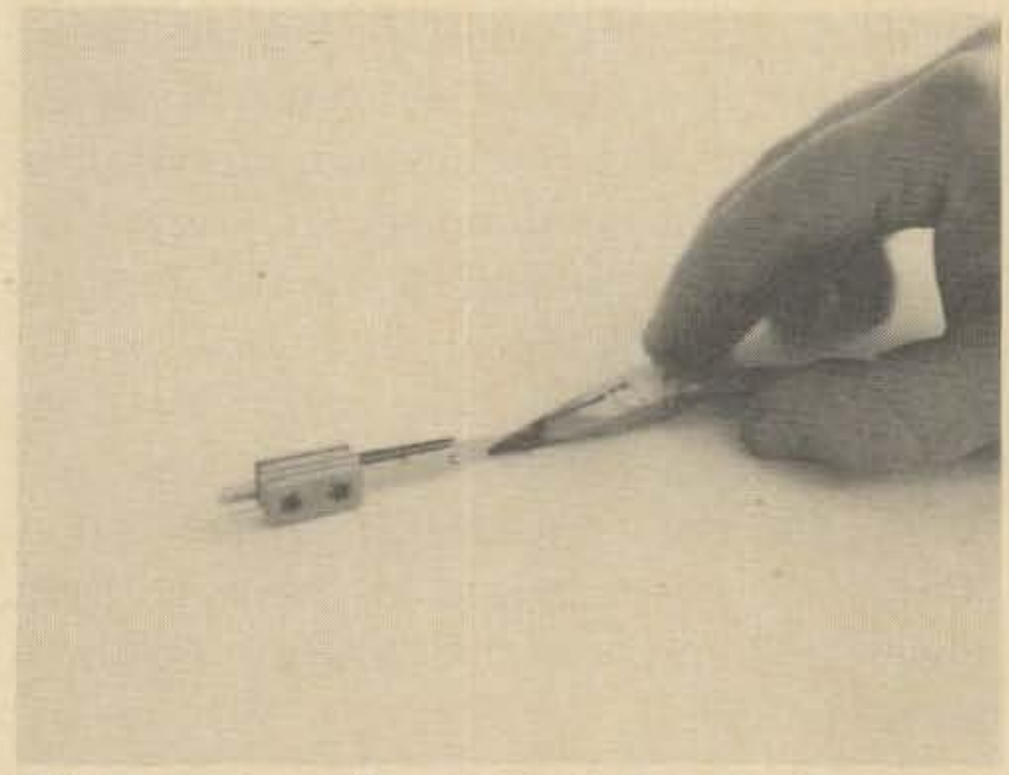
Each article I have reviewed calls for some complex machining operation or using a modified part from a surplus relay. Or a hacksaw blade or some other piece of scrap springy material. More often than not, the simple procurement of the part required costs more in time and energy than would a part specifically designed for the purpose.

There is, however, one commercially produced assembly which costs around a dollar, has contacts rated at 3A, and seems to be a natural for applications such as keyer mechanisms. The part, a switch stack, manufactured by Switchcraft Inc., is a formed-spring switch assembly complete with mounting lugs, solder lugs, and silver contact pads.

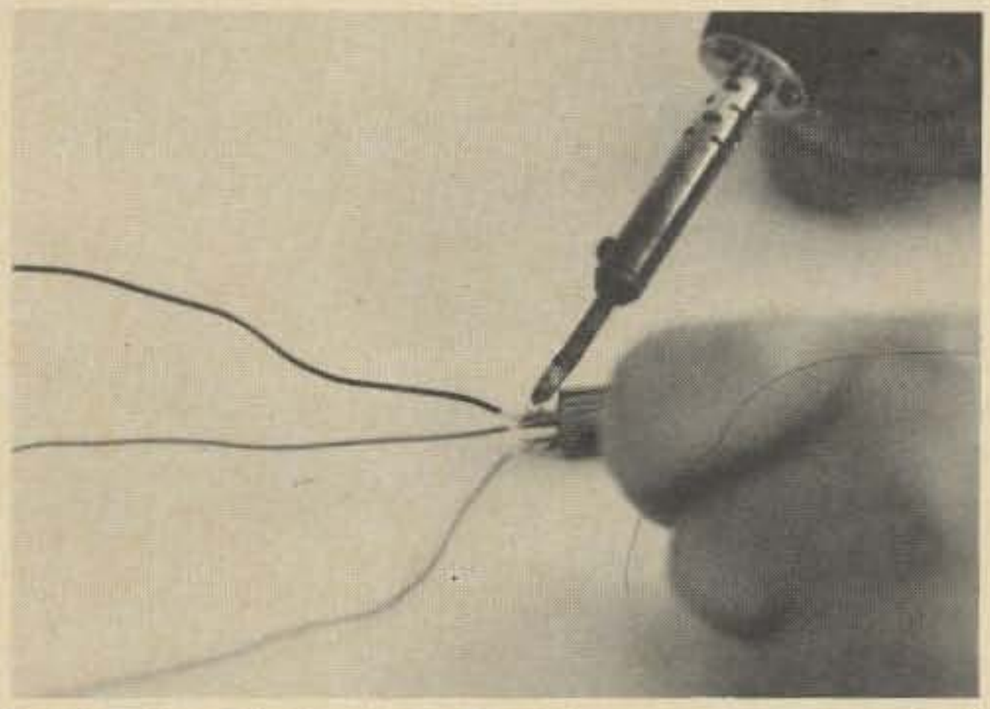
The photographs show the three simple steps required to make the Switchcraft part (AA03AA*) into a keyer mechanism.

The first step is to straighten out the middle spring and center it midway

*The Switchcraft stack switch assembly may be ordered for about one dollar from Allied Radio or Newark Electronics, Chicago, Ill.; consult their industrial catalogs for applicable part numbers.



The center spring section has to be spaced equidistant between the two contact points. A pair of long-nose pliers will do the job in a jiffy.



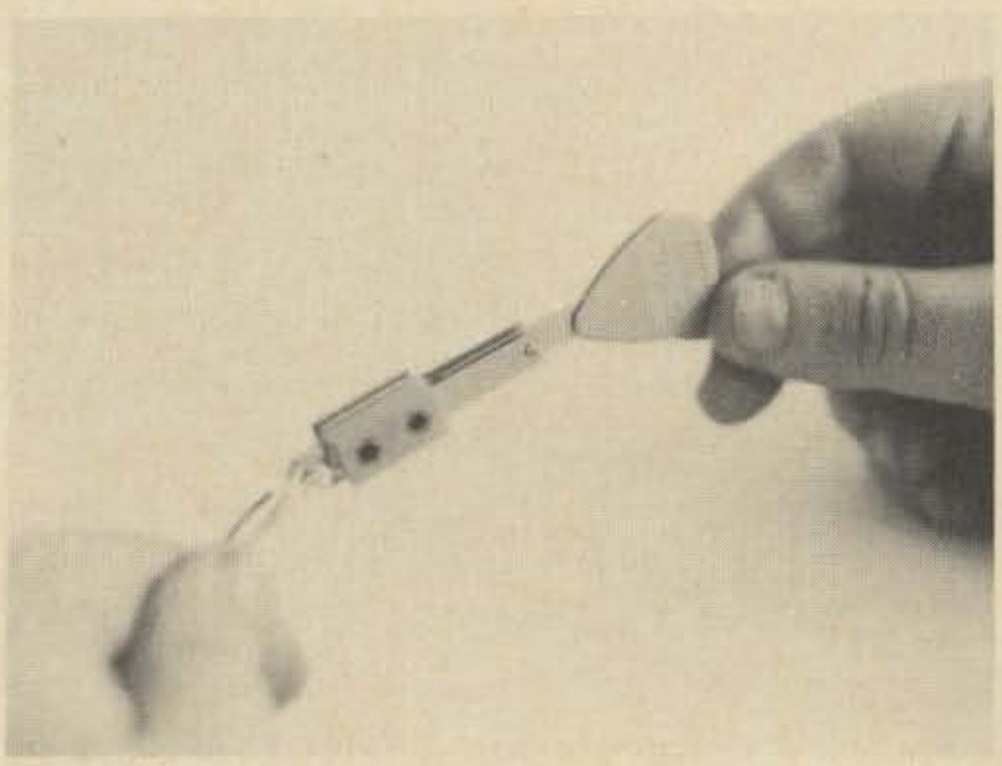
Solder flexible leads to the three contact terminal points so the switch assembly can be mounted without necessity for later access.

between the two outer springs. Long-nose pliers work fine for this job. Next, solder a length of flexible wire to each of the three solder lugs. Now mount the keyer assembly to your board case or what have you with a pair of L brackets made from some scrap metal; use the mounting holes on the assembly and regular screws. No special insulating precautions are required.

The final step is to epoxy two guitar picks to either side of the center spring; then you are ready to hook it to the keyer.

Actually, you will find that it took longer to read this article than to build your keyer. Not only have you become a homebrewer, but the silver contacts add professional reliability to your project. And that sense of "I did it myself" will certainly make this simple project worth all the more to you.

Elliott S. Kanter W9KXJ ■



When guitar picks are glued to the contact spring, the assembly really begins to look like a keyer.

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Glen Burnie MD 21061

a 2-Channel Search-Lock For FM Receivers

This simple gadget turns a two-channel rig into an automatic scanning type, and provides the added capability of locking on a channel where activity is sensed.

Many amateurs live in an area where the local repeater output is not on the same frequency as the simplex activity. Installation of a "search-lock" scanner will permit you to monitor both frequencies at the same time, on a conventional 2-channel receiver. Included is an optional active channel indicator that lights up to tell which channel is in use. It can be used with any tube-type receiver such as GE Progress Line, Motorola Sensicon series, or any other receiver that uses separate oscillators for each channel. It can be built into a fixed station or a mobile unit with little modification to the basic equipment.

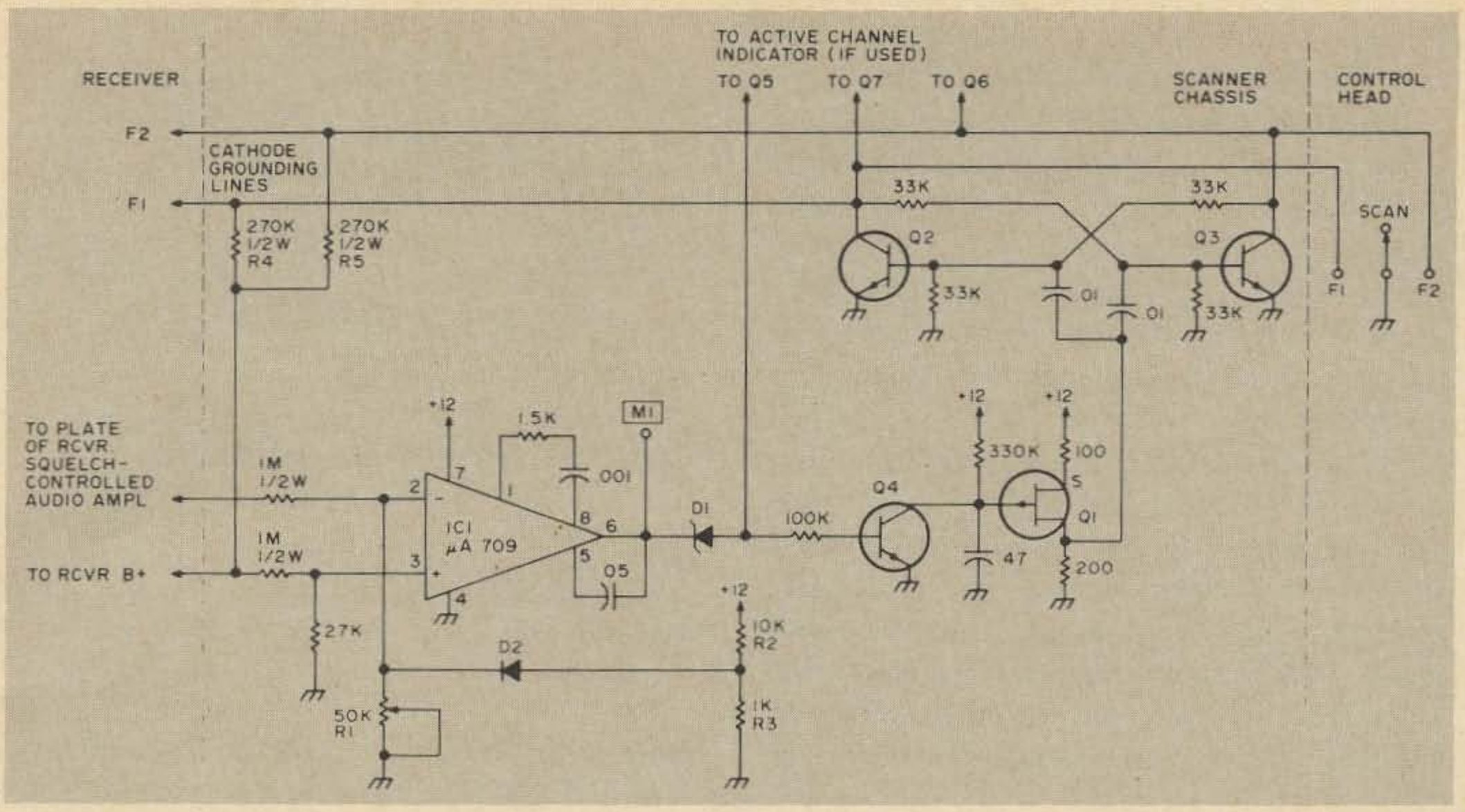

Fig. 1. Two-channel search-lock for FM receivers. The switch is mounted on the control head; everything else may be mounted inside the radio cabinet.

How it Works

The search-lock unit (Fig. 1) consists basically of a flip-flop (Q2 and Q3) with the outputs connected to the cathodes of the two crystal oscillator tubes. As the flip-flop operates, it alternately grounds the cathode of each crystal oscillator for a short time, thus sampling each frequency for a very short period. The flip-flop is triggered by pulses generated by unijunction transistor Q1, at about a 10 pulse-per-second rate. Therefore, each channel is sampled five times per second, for 100 ms each time. This sampling rate is fast enough that no information is lost at the beginning of any received transmission, yet slow enough to permit the crystal oscillators to turn on completely and come up to full output. It is also long enough to allow the squelch to open if a signal is present on one channel. I did not use a faster sampling rate because many crystal oscillators take up to 20 ms to reach full output, and it takes up to 40 ms for the squelch to open on some receivers when a signal is received.

When a signal appears at the receiver input and the squelch opens, the gate circuit will turn off the unijunction transistor pulse generator, and the receiver will stay locked on that channel as long as the signal is received. In this respect, the circuit is similar to that of a carrier-operated relay. The gating circuit consists of a squelch detector (IC1), and gate amplifier (Q4). IC1 is a type 709 operational amplifier wired as a differential switch. I used this circuit because it effectively prevents drift of the gate trigger level with changes in battery voltage when used in a mobile installation.

The positive input of the differential switch (IC1) is connected to receiver B+, and is the reference voltage. The negative input is connected to the plate of the squelch controlled audio amplifier tube.

When no signal is being received, the dc voltage on this plate is the same as B+. When a signal appears and the squelch opens, the dc voltage at this plate will drop. This voltage change is detected by the differential switch (IC1), is amplified by Q4, and switches pulse generator Q1 off.

Potentiometer R1 is the differential switch threshold adjustment. If B+ varies up or down due to a change in battery or line voltage, the differential switch will not operate because it is only sensitive to changes in the ratio of the two input

voltages (and not to changes in the absolute values of these two voltages).

Resistors R4 and R5 provide a "pullup" voltage on the cathodes of each oscillator (switching point in the receiver) to make certain that they go completely off when not grounded through their associated transistor in the flip-flop. They also absorb any leakage currents through either flip-flop transistor.

A switch on the control head is the only operating control needed. It is a three-position type (up, down, and center), and the center position is "on." In the center position, the search-lock operates normally. In either extreme position the associated cathode is grounded directly, and the search-lock is disabled. (See Fig. 2.)

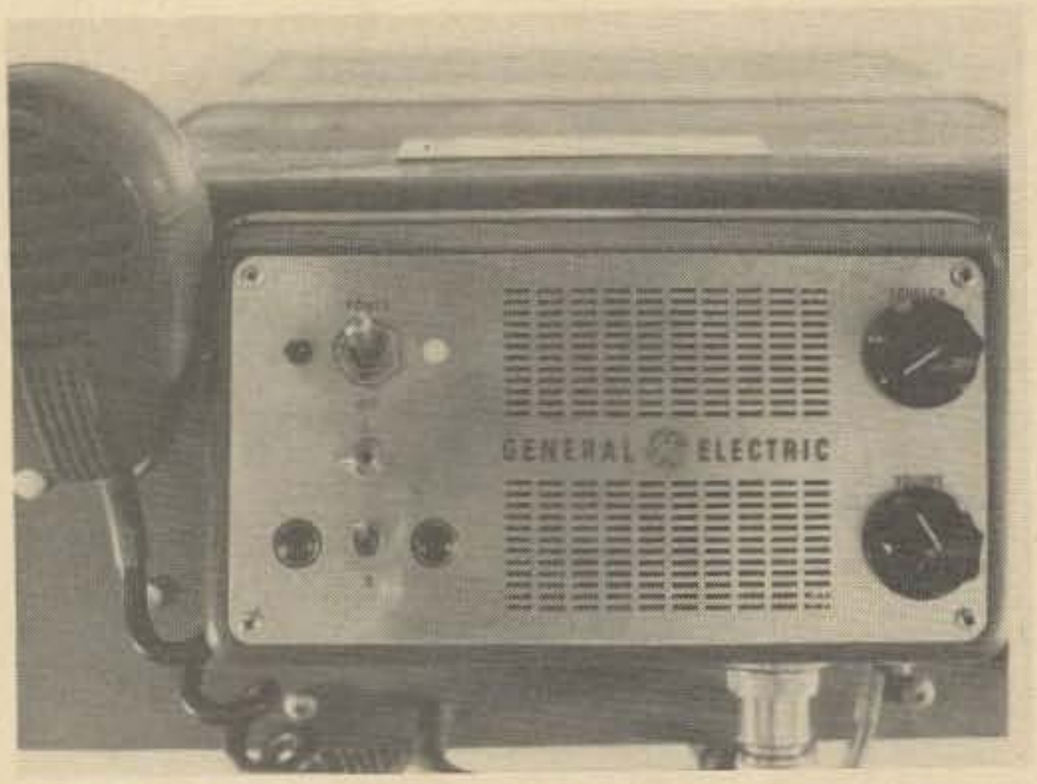

Fig. 2. Search-lock controls mounted on a GE Progress Line front-mount control head. Separate transmitter and receiver channel switches are used. The scan switch is the toggle mounted just under the main power switch. In the extreme left position, the receiver locks on frequency 1, and in the extreme right position, it locks on frequency 2. The center position allows the receiver to scan, thus locking itself on whichever channel becomes active first. The two lamps mounted adjacent to the lower toggle switch provide an indication as to which channel is being used.

The active channel lamp indicator circuit (Fig. 3) is an optional operating convenience that may or may not be included. Transistor pairs Q6 and Q8, and Q7 and Q9, are the lamp drivers. They are controlled by squelch gate amplifier Q5 and inputs from the flip-flop (Q2 and Q3).

When there is no signal present, the lamp drivers are gated off, and neither

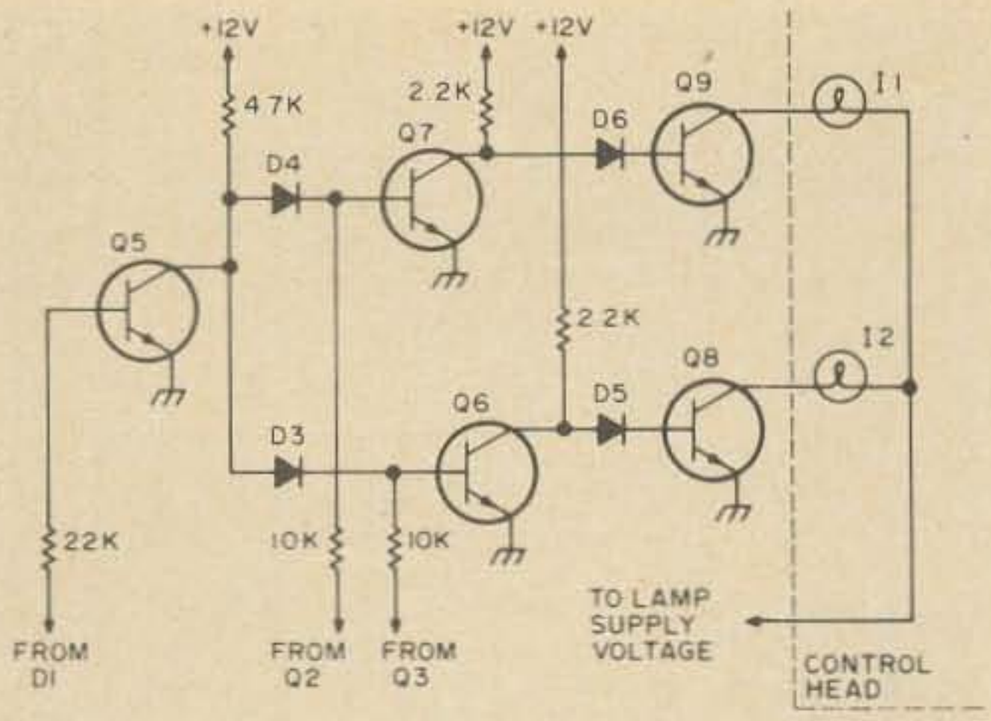

Fig. 3. Optional active channel lamp indicator circuit. The lamps are mounted on the control head.

lamp lights. This was done to eliminate any flashing lights which might be a distracting safety hazard while driving at night. When a signal appears, gate amplifier Q5 turns on, the appropriate lamp driver circuit is turned on, and the lamp lights. As soon as the signal disappears, the lamp goes out, and the search-lock resumes operation. Resistors R2 and R3 and diode D2 serve to keep the squelch gate circuit turned off when transmitting so the channel indicator lamps don't light.

If used in a mobile installation, the entire unit can be powered directly from the 12V battery line. If used in a fixed

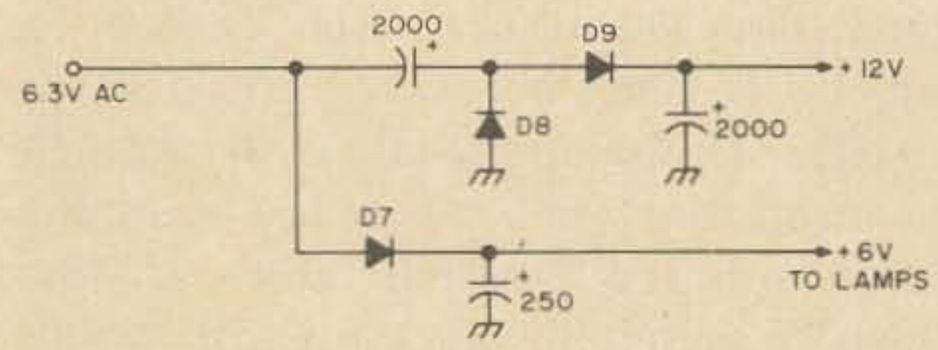

Fig. 4. The ac filament voltage typically available in a tube-type base station can be used to power the search-lock device if this simple rectifier circuit is built.

station, the rectifier power supply in Fig. 4 can be used to supply dc voltage from the filament line. In this case, 6V lamps should be used. (For mobile operation, 12V lamps should be used.)

Construction

Any form of construction may be used. I built my unit on small terminal strips and

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mounted them on a plug-in Vector board (Fig. 5). Parts layout is not critical. Small quarter-watt resistors may be used except where noted, and low-voltage capacitors are also satisfactory. Diode D1 is a 1N747, Motorola HEP-102, or similar low-power

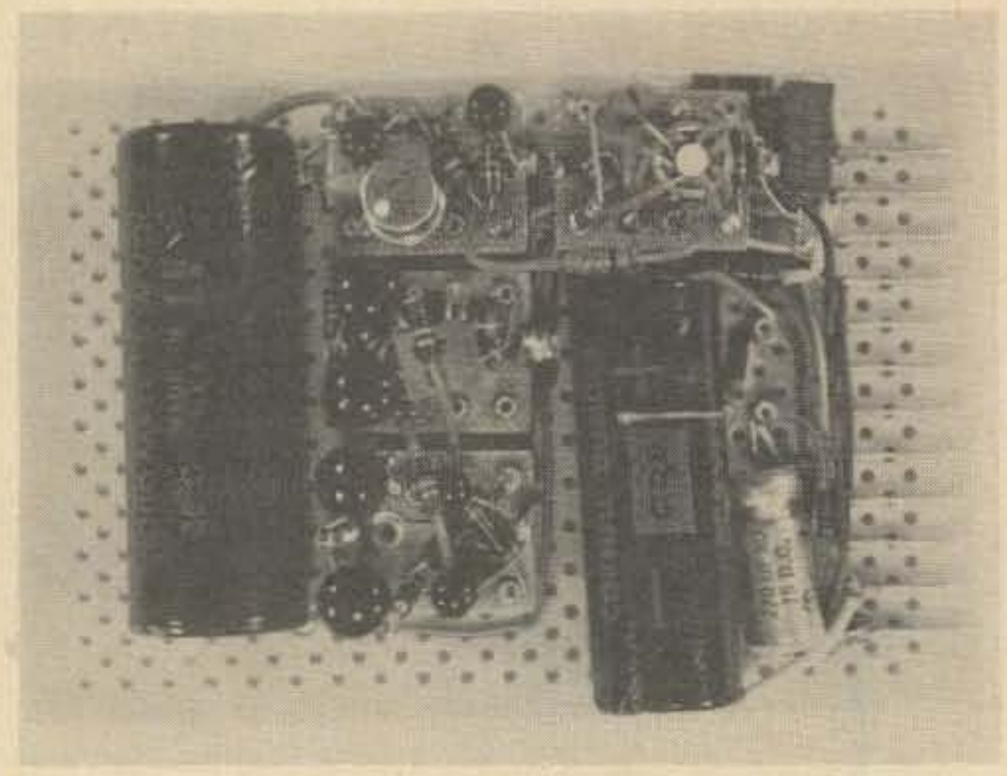

Fig. 5. All components for the search-lock are mounted on a plug-in Vector board.

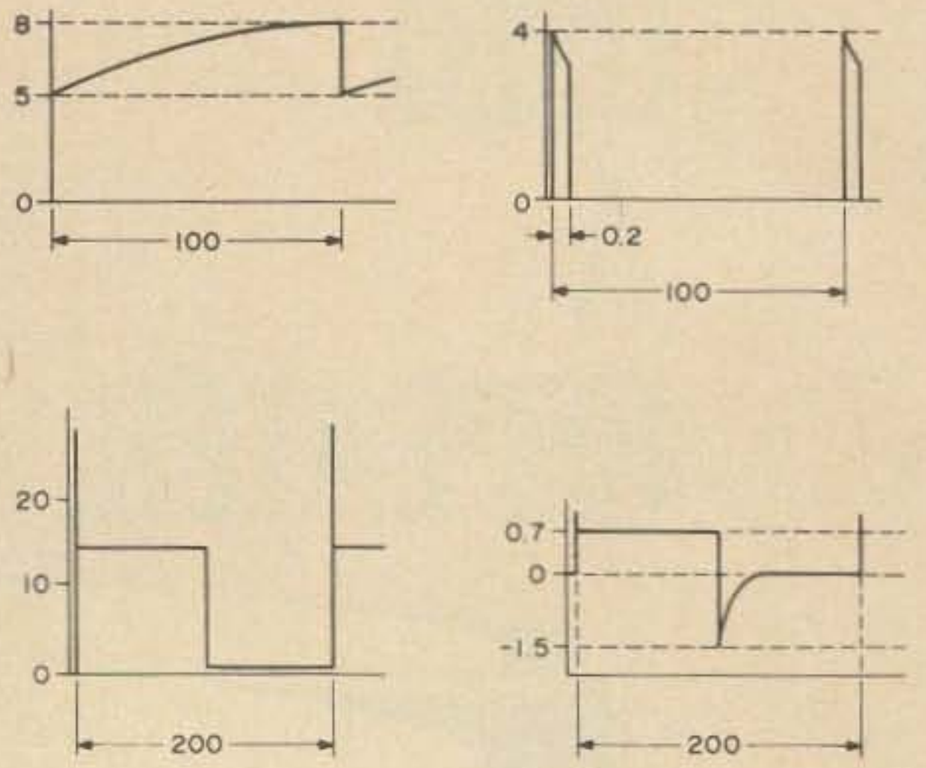

Fig. 6. Waveforms that may help troubleshooting. Waveforms represent a no-signal state, squelch closed. Vertical scale is dc volts; horizontal scale is time (milliseconds).

zener diode of 3–5V. Diodes D2 through D6 are low-power silicon computer diodes such as 1N629 or Motorola HEP-154. Diodes D7 through D9 are low-voltage, low-power silicon rectifiers such as 1N645, 1N2069, or Motorola HEP-154.

Unijunction transistor Q1 can be a 2N2160, 2N1671, GE X-10, or Motorola HEP-310. Integrated circuit IC1 is a type 709 operational amplifier. All the semiconductors can be purchased for about $10, including IC1, from Poly Paks in South Lynnfield, Mass. Transistors Q2, Q3, Q5, and Q6 can be 2N3641, 2N706, GE-17, Motorola HEP-50, or any similar type. Transistors Q4 through Q7 can be 2N3565, 2N3860, GE-17, Motorola MPS-6520 or HEP-55, or any similar type. The lamps should be low-power types that do not draw over 150 mA.

Take the usual precautions when soldering to avoid overheating the semiconductors.

Installation

The chassis can be installed inside the case of a mobile unit or anywhere in a fixed station. The only modifications necessary are to separate the receiver channel switching lines from the transmitter lines. Separate switches for transmitter and receiver should be mounted on the control head (Fig. 6). The transmitter switch can be any type with the proper number of positions required for the particular installation.

If you elect to include the active channel indicator lamp circuit, the two lamps will have to be mounted on the control head, and lines run to the search-lock chassis. If the existing control cable doesn't have enough conductors to handle the separate receive and transmit channel switching, plus the indicator lamps, another multiconductor cable can be run to accommodate these wires.

Adjustment

The only adjustment necessary is to set the squelch gate threshold pot (R1). This is done by reading the voltage at metering point M1, the output of IC1. With no signal at the input and with the squelch fully closed, adjust R1 until this voltage drops to just under 2V. Check to see that this voltage rises almost to the supply voltage when you open the squelch.

Troubleshooting

When operating normally, with no signal, metering point M1 should be under 2V, pulse generator Q1 should be generating short pulses at about 10 pps, the flip-flop should be operating, and the lamps, if used, should be out. When the squelch is opened, either manually or by a signal, metering point M1 should rise to near the supply voltage, pulse generator Q1 should not be operating, the flip-flop should be stopped with one side turned on and the other off, and one lamp should be lighted.

The voltages in Table I and the waveforms in Fig. 7 may help when troubleshooting.

Table I. Approximate Voltage Requirements.

	Q1		Q2		Q3		Q4	
	E	B#1	B	C	B	C	B	C
Squelch closed[1]	6.0	0.40	0.4	7.0	0.4	7.0	0.4	6.0
Squelch opened[2]	0.1	0.39	0.6	0.1	0.1	14.0	0.6	0.1

	Q5		Q6		Q7		Q8	
	B	C	B	C	B	C	B	C
Squelch closed[1]	0.4	1.2	0.7	0.6	0.7	0.6	0.4	12.0
Squelch opened[2]	0.6	0.7	0.7	0.6	0.4	1.3	0.4	12.0

	Q9	
	B	C
Squelch closed[1]	0.4	12.0
Squelch opened[2]	0.7	0.1

	IC1							
	1	2	3	4	5	6(M1)	7	8
Squelch closed[1]	–	3.0	2.9	0	–	1.1	12.0	–
Squelch opened[2]	–	2.7	2.9	0	–	11.0	12.0	–

[1] no signal
[2] squelch opened, channel 1 on, channel 2 off.
Some voltages in the upper row are averages of fluctuating readings while unit is searching.

Conclusion

I have been using this circuit in a GE Progress Line desktop station for over a year, and in a mobile rig for a couple of years with no problems. It greatly increases the convenience and pleasure of monitoring by knowing that I won't miss a call on one frequency because I'm monitoring another.

. . . W3DTN ■

A LOOK AT ALLIED'S Portable FM Receivers

Glen E. Zook K9STH/5
818 Brentwood Lane
Richardson TX 75080

In July 1969, Allied Radio introduced two hand-held transistorized FM receivers. Although these units were designed for monitoring of low- and high-band commercial FM stations, the coverage of the receivers include the 10, 6, and 2 meter amateur bands. The A-2586 receiver covers 27-50 MHz (actual coverage without retuning is 26.5 to 52.5 MHz) and the A-2587 receiver covers 146-175 MHz (actual coverage is 145.5 to 178 MHz).

Initial setup of the low-band A-2586 consisted of putting four penlight batteries (included!!) into the unit. A quick tune across the spectrum showed considerable activity on the CB frequencies, local police frequencies, and the low end of 6 meters. The audio output of the receiver was sufficient, but a little reserve might be desirable in noisy locations.

The receiver had no squelch circuit, but the background noise was very low. Only when a station was transmitting would the audio level increase. This gave the receiver the appearance of having squelch without the actual circuitry. An earpiece, included with the receiver, allows private listening.

The receiver is quite stable and is fairly selective. Two local police departments have frequencies separated only by 40 kHz. When tuned to one frequency, only slight splatter from the other was heard. Since Allied makes no claim as to the sensitivity of the receiver, a quick check was made with a calibrated attenuator. The receiver had a sensitivity of 1.5 μV for 20 dB of quieting. Although this is not extreme sensitivity, it is certainly adequate for use in areas where a repeater is operating.

The only deficiency found was the attached antenna, which proved too short for maximum sensitivity. A 6 ft length of wire plugged into the external antenna jack im-

proved the receiver performance considerably. It may be possible to base-load the existing antenna to improve performance; otherwise, the low-band receiver works fine. If complete coverage of the 6 meter band is desired, the receiver may be slightly retuned with only a small loss of 27 MHz coverage.

The high-band receiver arrived after the tests on the low-band receiver were complete. Upon arrival, the receiver was activated by placing the batteries into the proper holder. The Fort Worth 146.94 MHz repeater was immediately heard with a full-quieting signal. (This repeater is approximately 35 miles from my residence!) Tuning up the band provided many other signals, including taxi, mobile telephone, RCC, paging services, etc. The high-band receiver, incidentally, does not suffer from a too-short antenna. The attached whip can be set for a quarter wavelength for optimum performance. The A-2587 high-band receiver had considerably more audio output than the low-band version. Thus, the receiver did not act as if it had a built-in squelch circuit. However, the background noise is not objectionable. Since the receiver seemed fairly sensitive, checks were run on it to compare. The sensitivity ranged from 3.0 μV for 20 dB of quieting at the low end to 5.5 μV at the high end. (The usable, or threshold, sensitivity is actually much better than the "quieting" sensitivity, and is a more meaningful standard when no squelch is employed.)

Both receivers performed excellently with outside antennas. Because of their small size and low cost ($17.95) the receivers give the amateur portable coverage of the 6 and 2 meter FM frequencies as well as the 11 meter CB and 10 meter amateur frequencies. The construction is excellent. The serious FM'er may want to crystal control the receiver for signal-channel operation. There is sufficient room inside the case for an oscillator circuit.

If the receiver is to be used at a fixed location, it is desirable to obtain the ac adapter ($3.95) which simply plugs into each receiver.

All in all, the Allied A-2586 and A-2587 are well worth the small investment.

. . .K9STH ■

450 MHZ MIGHTY MITE

E.R. Davisson K9VXL
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Greenwood IN 46142

Have you ever wondered what kind of activity occurs on the ¾ meter band? I suppose you've been curious, like many others, but not sufficiently so to go to the trouble of whipping up a converter or receiver to find out. Well, here is an extremely simple circuit which will allow you to determine if you would like to go to the expense and trouble.

Figure 1 shows the schematic of a simple transistorized superregenerative receiver which will work easily at 420–450 MHz. This circuit provides exceptional sensitivity. If your hearing is good, you may connect a pair of earphones directly to the circuit, although the level of audio is quite low. The more ambitious may, of course, build up a small audio amplifier, borrow one from an old transistor radio, or use an RCA CA3020 integrated circuit audio amplifier.

The transistor used is a relatively new device from Fairchild – a 2N4916, which costs less than a dollar. This transistor is rearing its head as an excellent low-cost device featuring a beta of over 150 at 450 MHz.

No special parts have been used and the only problem area may be the choke in the audio output lead (RFC2). I used the secondary of a driver transformer from an old transistor radio. The value of inductance was around 160 mH. A choke closer to 30 mH would probably be better but doesn't appear to be too critical in this circuit.

Several liberties were taken with this circuit that may or may not appeal to you. Since I was interested in only one frequency, a "gimmick" capacitor (twisted leads) was used to tune the circuit to that

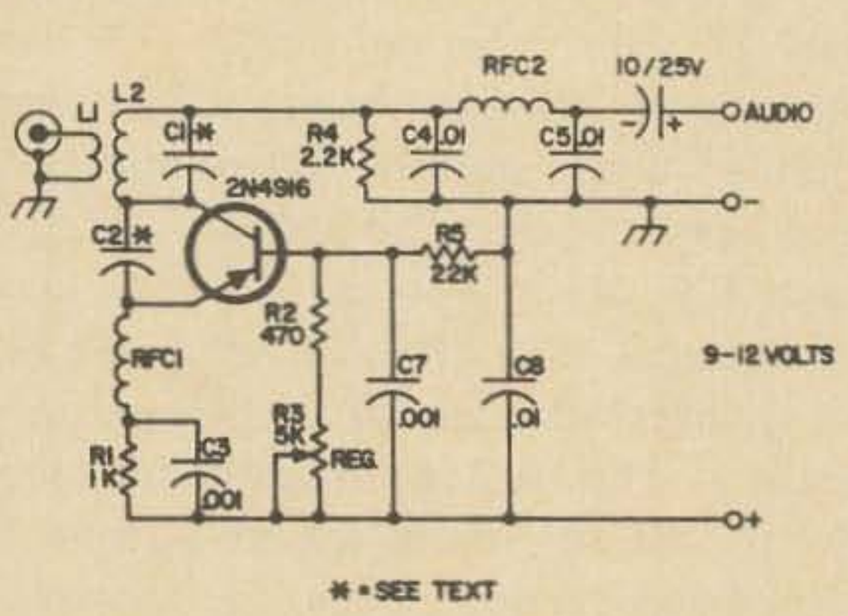


Fig. 1. Schematic diagram of the Mighty Mite *superregenerative receiver for the ¾ meter band.*

frequency. This also alleviated the work involved in providing an insulated shaft for a small variable capacitor. Other means are available for tuning this simple circuit, such as by shading L2. This would provide a means of covering a spread of frequencies but would make the receiver more complex mechanically; and since I wanted to keep it simple, no attempts were made along these lines.

Figure 2A shows the foil side of the printed circuit board and 2B shows the component side. The tank coil, L2, was made from printed circuit board and its size and shape is shown in 2C.

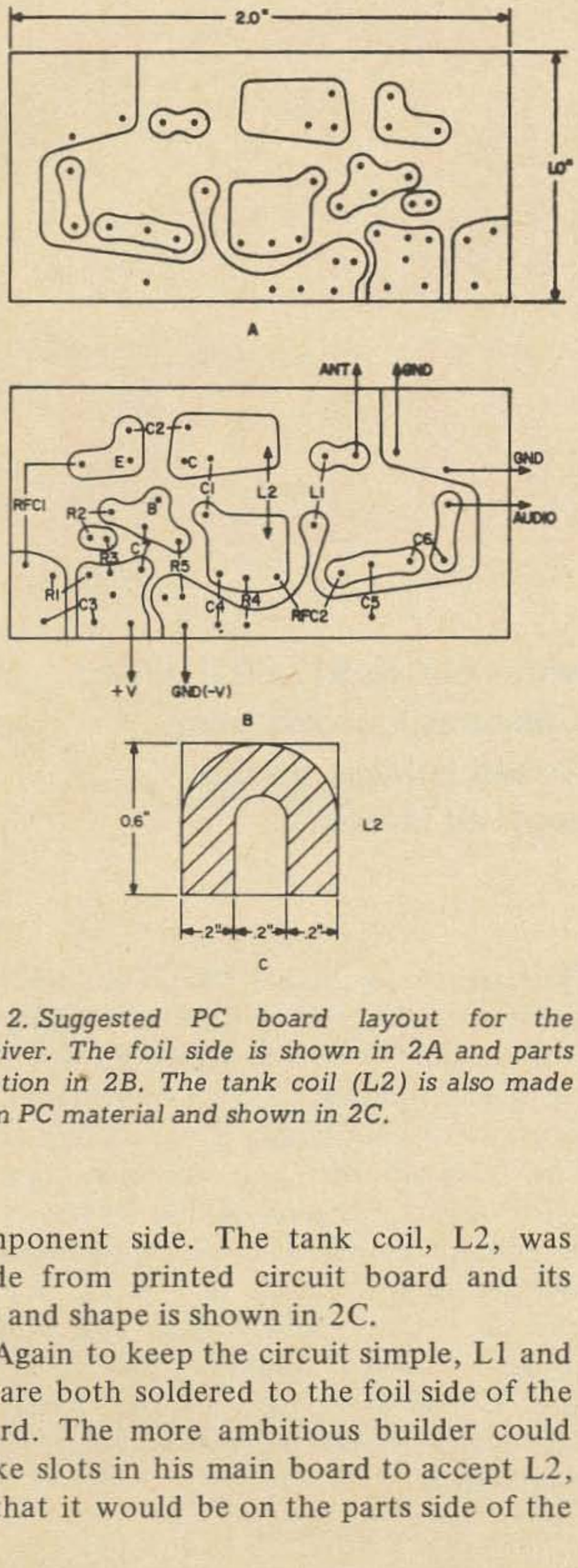


Fig. 2. Suggested PC board layout for the receiver. The foil side is shown in 2A and parts location in 2B. The tank coil (L2) is also made from PC material and shown in 2C.

Again to keep the circuit simple, L1 and L2 are both soldered to the foil side of the board. The more ambitious builder could make slots in his main board to accept L2, so that it would be on the parts side of the board. L2 is soldered perpendicular to the main board with the foil side facing L1.

L1 consists of 1½ turns of hookup wire (3/16 in. ID) spaced approximately ¼ in. from L2 and parallel with it.

C1 is a gimmick capacitor made from two ¾ in. lengths of hookup wire and twisted together. This provides sufficient capacity for oscillation, but is still small enough not to lower the frequency of the tank too far.

As mentioned previously, C2 is also a gimmick capacitor, only in this case it consisted of two 3½ in. lengths of hookup wire twisted to achieve the frequency of interest. If you take this approach, you might try shorter lengths (such as ½ in.) and try various fixed capacitors, starting at about 1 pF. The total capacity required depends on several items such as output capacity of the transistor used, feedback capacity, and closeness of L2 to the box used to mount the circuit board. In my case, no box was used, so this factor hasn't entered into the design as yet. If you do place this circuit in a box, just remember to make the box as large as possible to keep the sides away from L2.

RFC1 consists of 4½ turns of 16 AWG enamel wire wound on a ¼ in. slug using an AM oscillator coil from an old transistor radio.

After the circuit is built, connect a pair of earphones or an audio amplifier and apply power. If no hiss is heard, slowly adjust the potentiometer until the hiss is heard. The most sensitive position is where oscillations just occur. Try adjusting the spacing of L1 and L2 for sensitivity as well. On my version, a 10 μV signal could be easily detected with L1 about a foot away, so no trouble should be experienced in detecting a signal.

Due to the small size and relative ease of construction, this circuit could lend itself to a 432 MHz transceiver walkie-talkie.

Although this circuit won't give you the results of a multistage converter, at least you can now check to see what's happening with the ATV boys inexpensively and decide whether or not you want to spend more time and money to build something better. . . . K9VXL ■

Bill Hoisington K1CLL
Far Over Farm
Peterborough NH 03458

CHEAPIE 6-METER HALF-GALLON

It works out to $12.50 a quart, and features low-cost tubes, no screen voltage, no bias voltage, no blower.

This article describes a final rf amplifier for 6 meters that will put *out* nearly 400 watts on CW or FM telephony (or a good quarter kilowatt *out* on AM phone). In case you or your buddy haven't a pair of 811As lying around, you can buy them new for only $7.75 each. With only two of these tubes, a couple of two-gang balanced capacitors, a few knobs and jacks, and you're on the air. And it can't cost you over $25. For the amplifier, that is. Of course, if you don't have a husky power supply lying around the costs will start to mount a little.

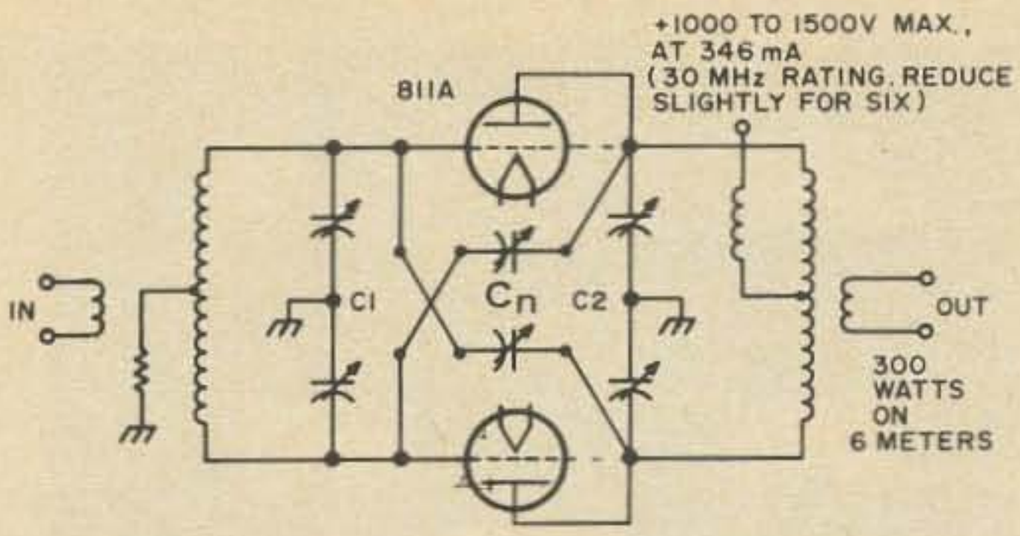


Fig. 1. There's nothing complicated about the half-gallon 6 meter rig as this simplified circuit diagram shows. Put 1000V on the centertap of the tank circuit and she'll draw almost 350 mA at resonance.

The Main Idea

Filling a "one-of-a-kind" contract recently involving construction of a "radio frequency power supply" which called for 5 kV (yes, five thousand volts) at 70 MHz to be used in ionization work, several things came to my mind for amateur homebrew work. Ruggedness, simplicity, smooth tuning, and low cost were among these thoughts, and when I finished, it looked and acted like something of considerable interest for 6 meter hams.

A lot of fine tubes have come out since the 811As appeared some 25 years ago; but which among them will give you nearly 400 watts of FM output for $15 a pair, *new*? Also, without screen voltage, bias, blower, or screen modulation?

As just one example of these hard-to-beat tubes still being used after 25 years, see the "1 kW Economy Linear Amplifier" in the Radio Handbook (Editors and Engineers, Ltd., Indianapolis, Ind.); it has four 811As in parallel.

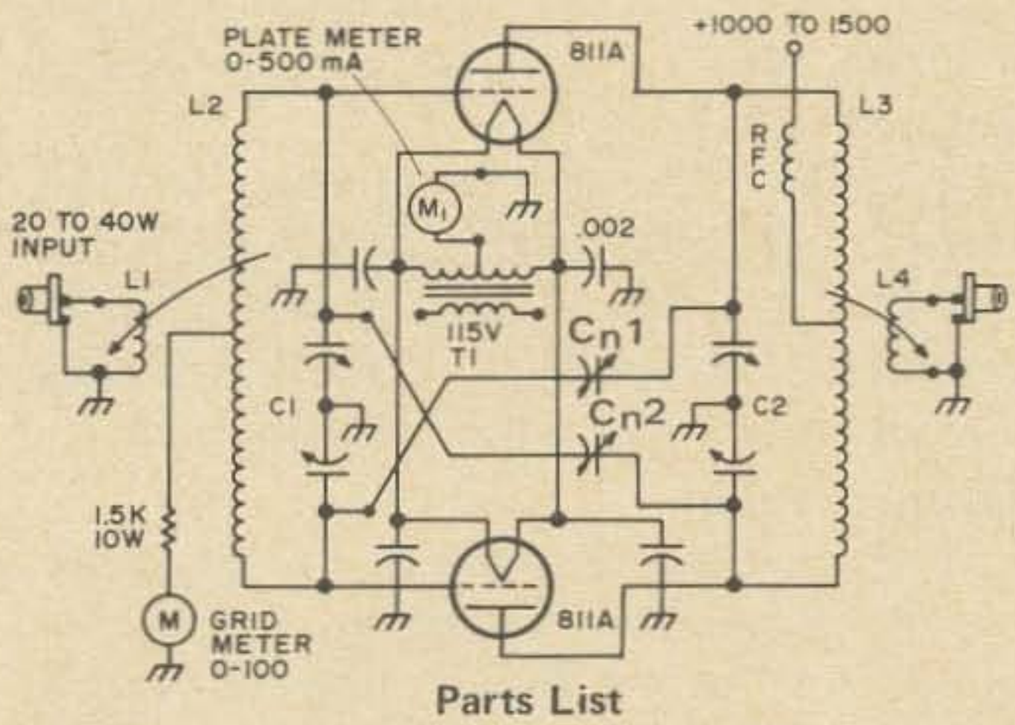
The Circuit

Figure 1 shows how standard and simplified the circuit is. Just take a few precautions as noted in this article, and refer to Fig. 2 for details. One of the advantages of push-pull circuitry concerns the almost complete absence of bypassing requirements (just C3, 4, 5, and 6 on the filament leads). You can bypass the grid and plate return but if L2 and L3 are really centertapped there will be no rf on those leads anyway.

Be sure to keep your fingers away when operating. Remember, they only use 1900V even at Sing Sing!

Neutralization

These 811A tubes are "old-fashioned" triodes but I notice a lot of circuits using them in the latest handbooks. They do require proper neutralization to work good as trouble-free amplifiers at 50 MHz – not critical though, just the proper kind. Since these are "zero-bias" tubes, you can apply 500 to 1000 volts on the plates with no external bias needed and, if not yet neutralized, and L2 and L3 are anywhere near in tune, they will take off and oscillate in great style with several hundred milliamps on the plate meter. This you *don't* want; so, using considerable care and a long, insulated handle, vary neutralizing capacitors C_n1 and C_n2 so that no oscillations occur when L2 and L3 are resonated back and forth across the band. The proper neutralizing capacity is not hard to find, but be sure and rock C1 and C2 *all* over the 6 meter band while adjusting the C_n capacitors. The grid-to-plate capacitance C_{gp} for the 811A is listed as 5.4 pF. I used high-voltage 10 pF capacitors, variable – and sure enough, the dial knobs (which are handy for logging the correct spot for neutralization) ended up near the middle of these scales. Once neutralized, the rig can tune all over the 6 meter band so smooth it seems like magic.



Parts List

C1, C2	Bud 1557, spaced 3/32 in.
C_n	Bud, 6-plate (≈10 pF)
T1	6V CT at 10A
C3, C4, C5, C6	.002, 1 kV
L1	1 or 2 turns coupled into L2
L2	6 turns (14 AWG), ¾ in. O.D.
L3	1/8 in. copper tube, 1½ in. O.D., 6 turns
L4	1 or 2 turns link (10 or 12 AWG)

Fig. 2. This complete schematic shows all the details for constructing the final, and gives the information necessary to include proper metering.

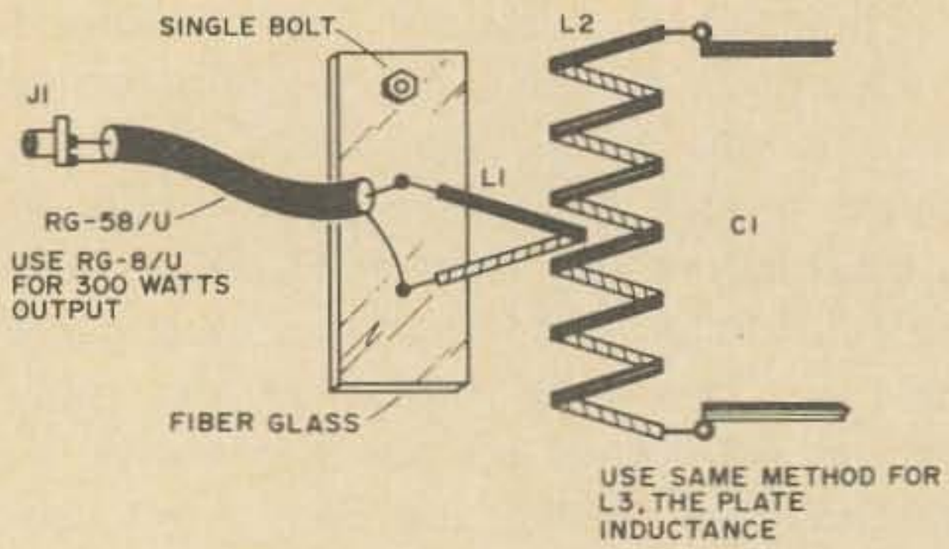


Fig. 3. An effective semifixed link coupling method can be obtained with the link mounted on a pivotable piece of fiber glass.

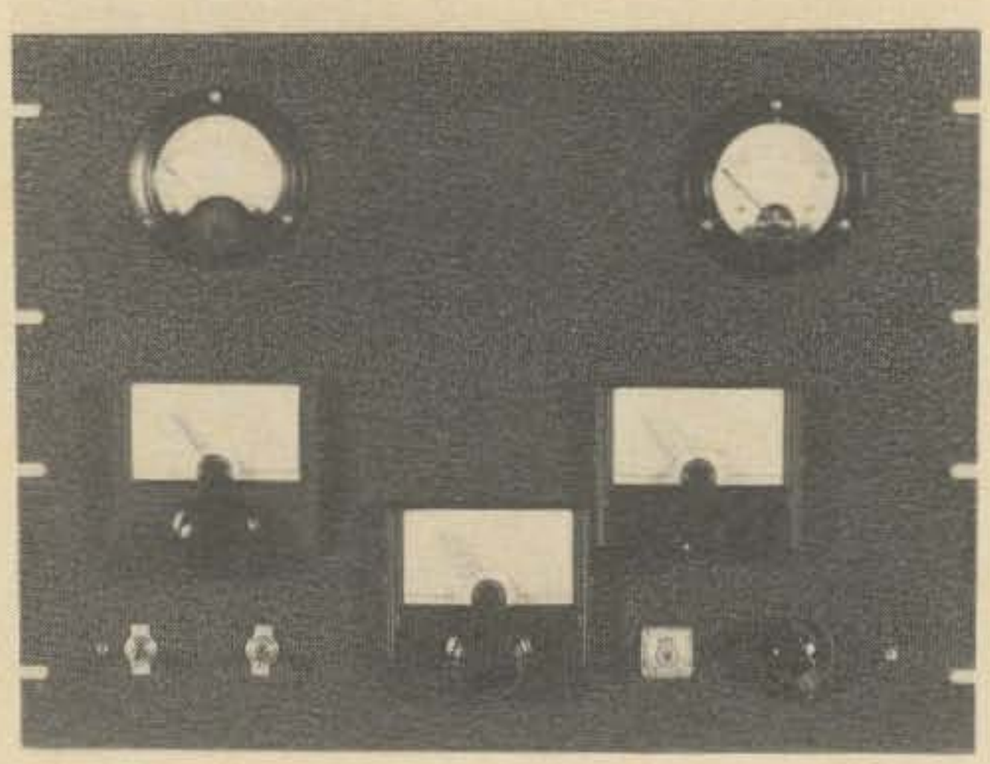


Fig. 4. This photo shows how a complete high-powered transmitter can be obtained using the simple two-triode final.

Layout

Being a fanatic about copper-clad Bakelite (or fiber glass if you're fussy), for baseboard use in experimental work with transistors, I tried one here and the results were equally good. The lead photo shows the layout used, which works fine, either by itself or bolted on a chassis when finished and in a cabinet with dials, input and output jacks, etc. Be sure and use short copper leads for all the rf connectors – especially for the neutralizing circuits and plate tuning components C2 and L3.

Actually, with push-pull circuitry you hardly need a metallic baseboard, but it does allow for easy construction and grounding. And when finished you can bolt it down onto a chassis without change in its operation.

The two flexible couplings on the variable capacitor shafts can be seen in the lead photo. These allow easy placement of the shafts into the back of the Millen dials and take any strain out of misalignment.

Filament Leads

I used 10-gage here because I like plenty of voltage on the filaments. Be sure to mount T1, which should have at least a 10A current rating, as close as possible to the sockets. Each 811A draws 4A, which is one of the reasons they work so well. There is nothing like plenty of electron emission for action! You can even light a 20W bulb at J2 just from electrons going over to the plate through the grid with the B+ lead *open!* You'll also find up to –400V at that point, due to those same electrons landing there.

When you do apply the regular dc plate voltage of some 1000 to 1200V a 200W bulb should light up at J2, but good.

Link Coupling

As usual, with good tuned circuits, not much coupling is needed. One or two turns about halfway in will do the job when loaded into a good tuned-up beam antenna. Both the C1–L2 and the C2–L3 circuits handle very well, with no jumps or odd spots. You will find that overcoupling to L2 shows up with two-peak tuning. Move L1 further out of L2 and good single-peak smooth tuning will be restored. And, once again, be sure and keep your cotton-pickin' fingers off those coils. We don't like to lose readers.

Semifixed coupling links can be used, as shown in Fig. 3. The two terminals can be mounted on a movable piece of linen-based or fiber glass insulating sheet, and fastened with a single bolt to the baseboard for easy adjustment in and out of tuned circuits L2 and L3.

The lead photo shows two bolts for mounting L1 and L4. Suit yourself on that. L4 should use fiber glass insulating tubing, or air spacing. Don't forget there's plenty of fire in L3! Adjust rf output link L4 for a slight dip in plate current at resonance, which should coincide with maximum rf output. If you apply the old-fashioned pencil test to L3 when unloaded, be sure to fasten the pencil to a long wooden handle first. You're dealing with over half a horsepower there! The photo of Fig. 4 shows the front panel used on my job. The

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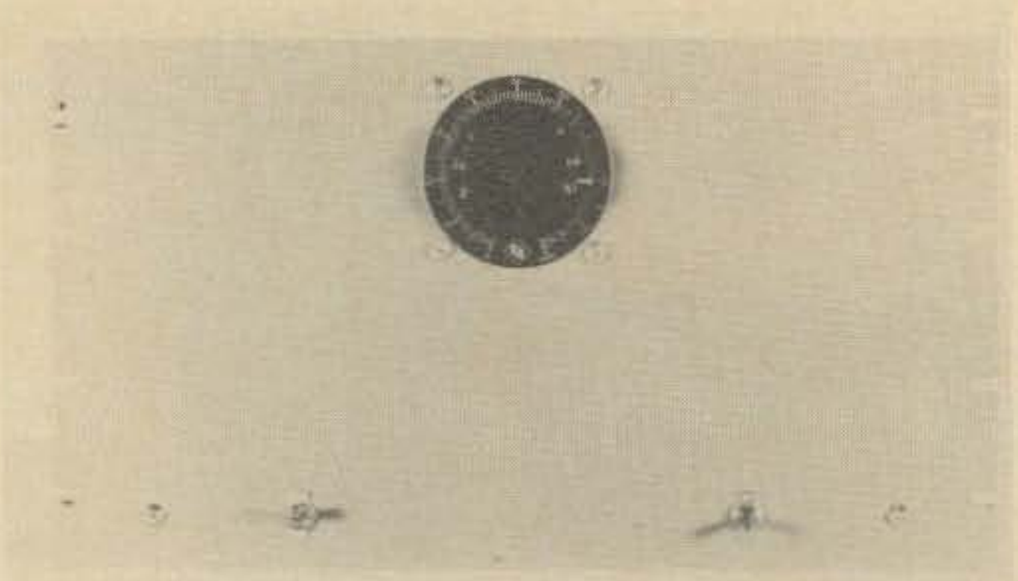

Fig. 5. A Powerstat control on the power supply for the author's rig permits variable voltage delivery from 0 to 1.2 kV.

three Millen dials are used for logging purposes; two of them tune the grid and plate, and the third is for the 70 to 80 MHz oscillator (which, of course, is unnecessary for a straight rf amplifier as described in this article).

Power Supply

Inasmuch as the 811As are 25 years old, I had to dig way back into the cellar to come up with a collection of power transformers, chokes, 866 rectifiers, etc. dating from my 2 meter kilowatt days in the 1946–1949 era. Most of these items have *increased* in value during this time, and they still did a very good job in delivering some 400 watts for the 811As. All you need, basically, is the type 21 Powerstat knob and two toggle switches on the front panel, as shown in the photo of Fig. 5. The Powerstat controls the 0–1.2 kV of the high voltage supply.

If you need to build such a high voltage supply you will have to dig quite a bit through handbooks and mail order catalogs. RCA's invaluable "Transistor, Thyristor, and Diode Manual" is the best help I found.

In the bridge rectifier department, the RCA manual has the "direct replacement for 866 rectifier tubes" in the CR 275 stack, and going back to the Allied catalog you can find its price, which is $22. Or you can string your own diodes together if you want some savings here.

There is a lot of talk in some handbooks about "TV replacement transformers" for use in HV supplies and with the silicon rectifier stack in mind I spent quite a bit more time browsing through the catalogs, again with only medium results. Prices for anything approaching 500W run from a low of $18 to up around $50 for transformers that will give 1500V at 400 to 500 mA. Most manufacturers seem unable to decide on what they do want to offer to customers. Guess I'll have to make an investigation into this matter.

The New Look In Power Supplies

This trend seems to me a mixture of striving for less weight, size, and cost, and at the same time trying to keep "within reason" on the side of reliability and safety. You will have to be your own judge as to the results.

For example, voltage doublers are used to get 2 kV from a 1 kV transformer and you are flatly invited to "try the transformer out and see if the center windings to core insulation breaks down" under the not-designed-for high voltage. At least you are warned! Further, six electrolytic capacitors are strung in series to make up a 2.5 kV capacitor, and the bleeder resistors are composed of the series balancing resistors used across each capacitor in this lethal device. This one can really buy the farm for you with its *10-second* discharge time! Once again, however, you are warned about it.

Modulation

The amplifier shown here can be set up for any of four modulation methods: AM, linear, FM, and SSB. There aren't any screens to worry about and the tubes are zero bias, so it's easy to plan for. Once again, suit yourself on the mode used. Oh yes, it works great on CW also.

Homebrew Power Considerations

As a parting comment, I would say that this whole question of rf power, dc power, and cost to produce them needs looking into. Even more so on 2 meters because of the tubes, the 811As, not being recommended on 144 MHz. There is a tremendous shortage of low-cost, high power triodes for 2 meters! The 4X250s work good and put out real fire, but you start in with $35 and then have to set up a continuous blower and "chimney," a fancy socket, a screen supply, and a bias supply.

. . . K1CLL ■

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Gary V. Fay KØECF/7
Motorola Semiconductor Products Inc.
Phoenix AZ

Introduction

The function of a dc voltage regulator is to maintain a ripple-free output voltage that remains constant in value, independent of changes in input voltage, load impedance, and temperature. A complex circuit must be used in order to construct a regulator that provides excellent regulation, fast response time, low output ripple, low output impedance, transient-free output, remote voltage sensing, and current limiting. Also, the number of components necessary makes the constructed circuit occupy a relatively large volume if discrete components are used. However, a complex regulator exhibiting good regulation can be constructed as an inexpensive integrated circuit and assembled into a package that occupies a very small space. The Motorola MC1460R monolithic voltage regulator is such a circuit; it is packaged in a single 9-pin TO-66 case, yet can supply an output current of 500 mA with no external semiconductors. This device can reduce the parts count and the volume required for a regulator while maintaining excellent operating characteristics and low cost ($5.25 to $8.25).

The MC1460R can be combined with a small etched circuit board to form a complete, well regulated power supply that can be built in a space not much larger than that required for the power transformer and filter alone. The MCR1460R is designed for input voltages up to 20V; for higher voltages, the MC1461R is identical except that it is useful up to 35V.

Circuit Operation

The MC1460R is basically a series-pass regulator with access to the internal amplifiers. A discrete representation of the MC1460R circuit is shown in Fig. 1, with a complete regulating circuit shown in Fig.2. The series-pass transistor is the output device of a Darlington circuit driven by the control differential amplifier. The dc refer-

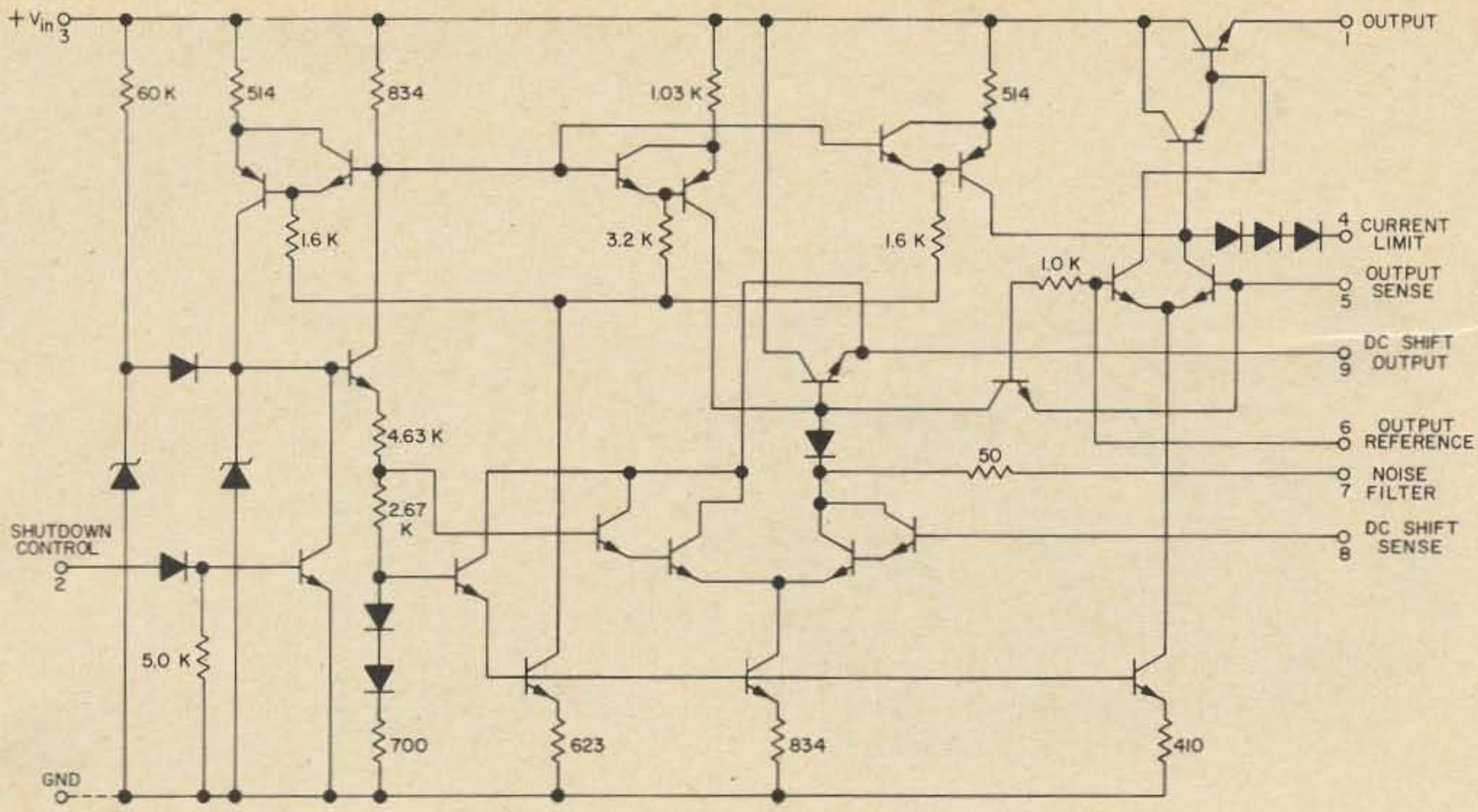
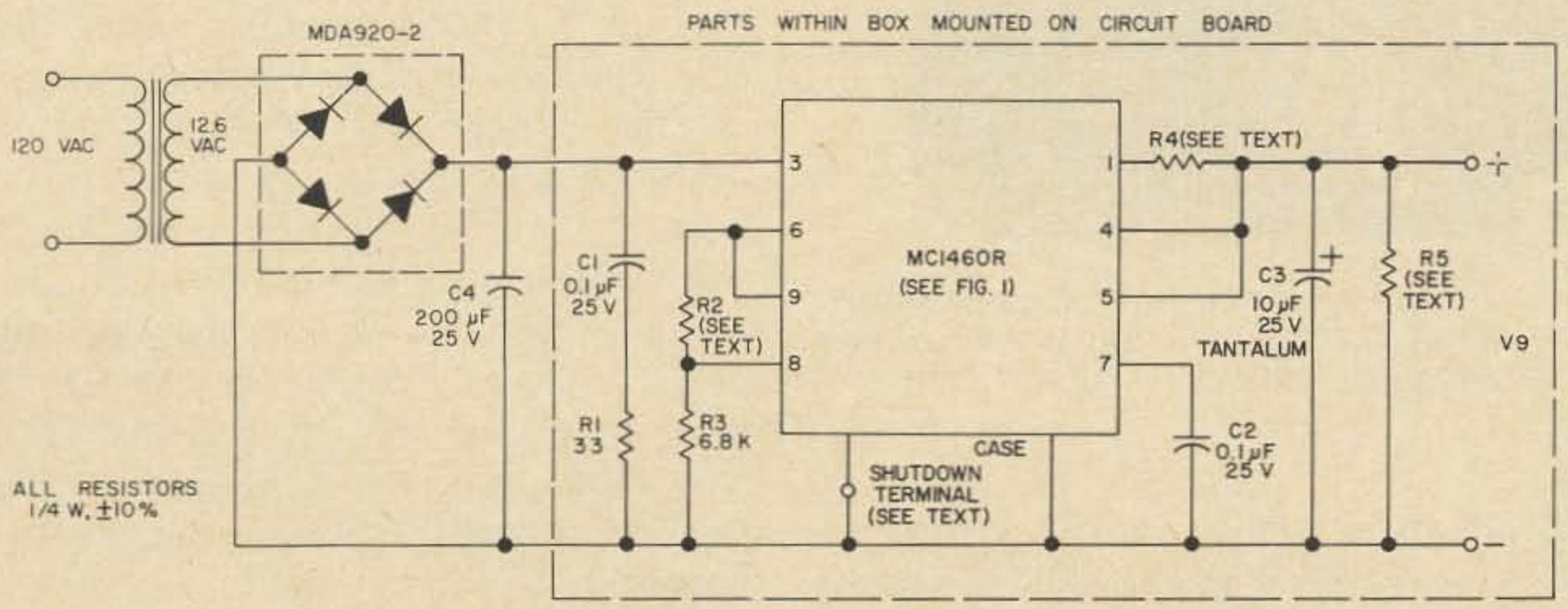


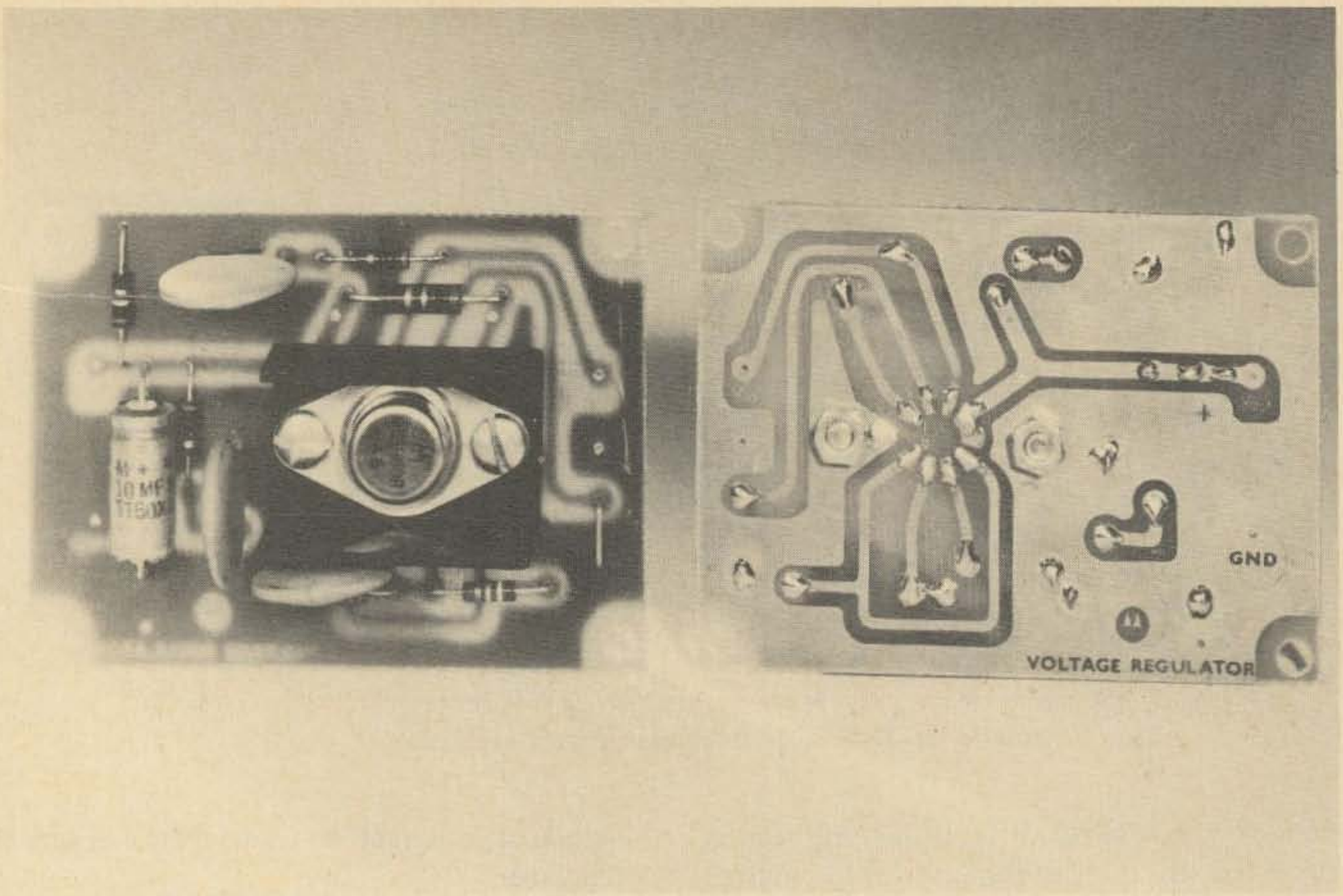
Fig. 1 Schematic of MC1460R integrated-circuit regulator.

ence to the control differential amplifier is provided by an internal series regulator. The reference input to the internal regulator is derived from a zener which is buffered by a transistor amplifier. This voltage is divided by a series resistor–diode string. The output voltage of the internal regulator, which appears at pin 9, is determined by resistors R2 and R3 (Fig.2), connected between pins 9 and 8, and pin 8 and ground. Pin 9 is then connected to pin 6 to provide a reference to the control differential amplifier. The other input to the control differential amplifier (pin 5) is tied directly to the output. Thus the main control amplifier is operated with unity gain to provide optimum ac and dc performance and the output voltage of the main regulator is equal to that of the internal regulator.

By connecting a resistor from pin 1 to pin 4 (in series with the load), the output current can be sensed and limited. This occurs when the voltage across R4 is large enough to forward-bias the internal diode string. Since two of the diodes compensate for the base–emitter drops of the output transistors, a voltage equal to one diode drop is sufficient for this to occur. When this happens, base current drive to the output Darlington transistors is diverted through the diodes. An equilibrium is reached which provides just enough base current to forward bias the diode string. Due to the large amount of feedback used in the main control amplifier, the tran-

Fig. 2 Regulated power supply using intergrated circuit voltage regulator.





Front and back views of etchedcircuit board used for IC regulator.

sition from voltage regulation to current limitation is very sharp.

Construction

All of the parts for the regulator in Fig. 2 except the power transformer, bridge rectifier, and filter capacitor can be placed on the etched circuit board shown in Fig.3.

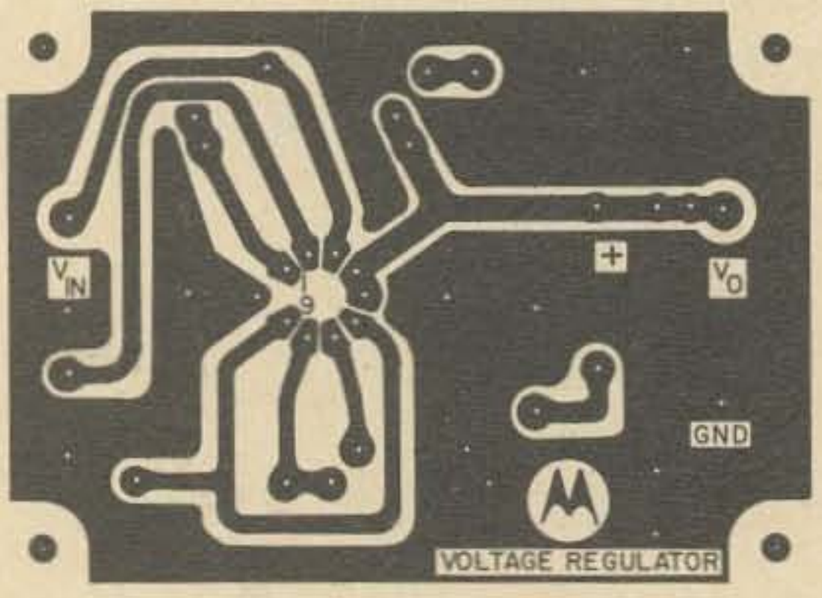


Fig. 3. Etched-circuit board used for regulator. Available for $1.25 from Project Supply Co., P.O. Box 555, Tempe AZ 85281.

The board is available for $1.25 from Project Supply Co., P.O. Box 555, Tempe AZ 85821. This provides a convenient way to construct an operating circuit and also controls the lead dress used in construction. This will minimize possible parasitic oscillations that may occur due to phase shift from reactive elements. The high gain and wide frequency response of the monolithic regulator makes this a problem at frequencies up to 60 MHz, so even stray wiring capacitance can cause oscillation. Thus, high frequency construction practices are necessary to prevent oscillation possibilities.

The MC1460R must be mounted on a heatsink for high power dissipation. In this case, the passive components are mounted on the copper side of the board. The heatsink must be spaced away from the board to prevent shorting to the leads of the components which project through the board. A suitable sink is the Thermalloy 6168. Silicone grease should be used between the IC and the heatsink for best heat dissipation, and insulation should be used on all leads to prevent shorting to the heatsink.

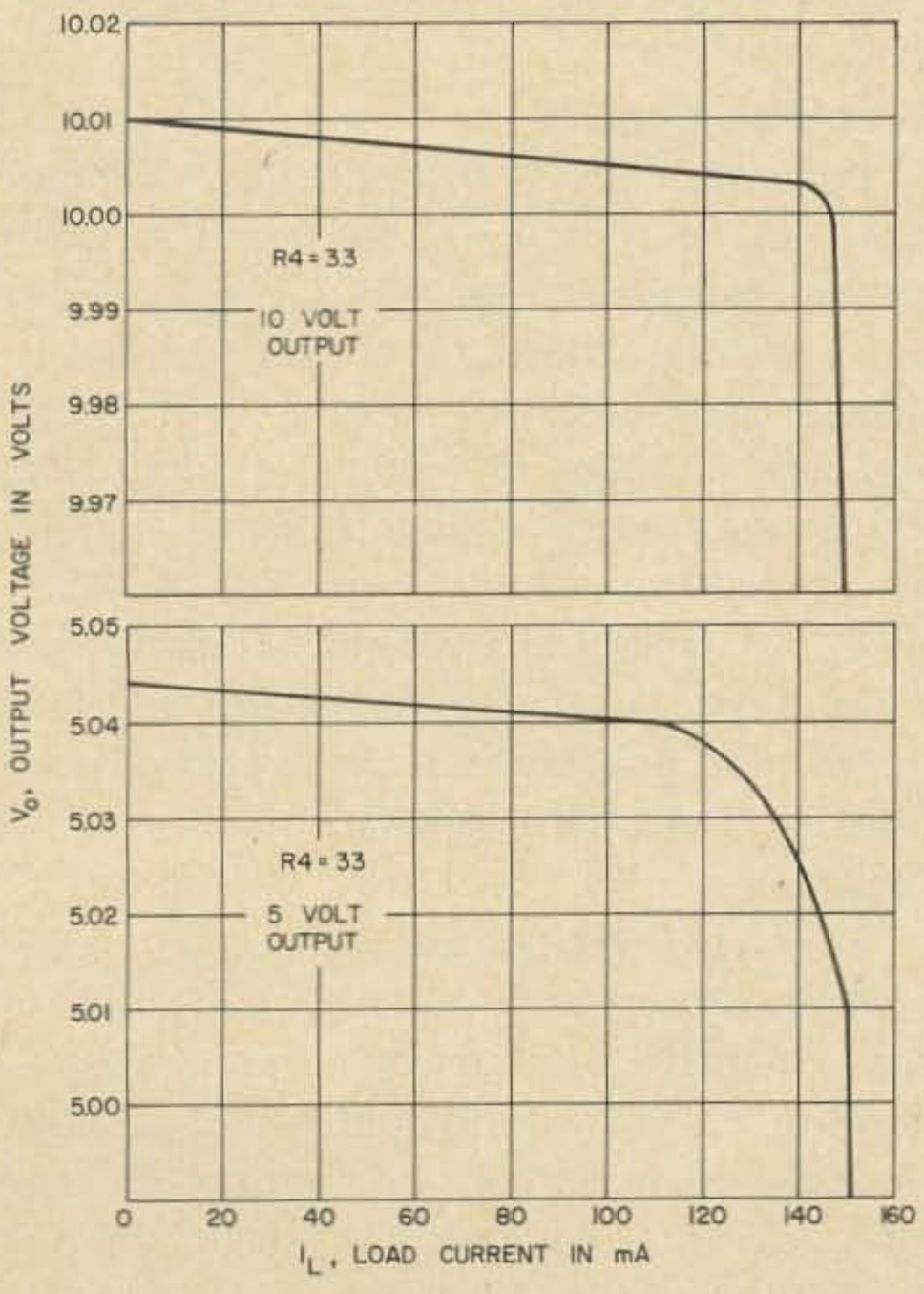


Fig. 4. Output voltage vs load current at 20V input.

Output Regulation

The curves of Fig.4 show that excellent voltage or current regulation can be obtained with the assembled circuit. No heatsink was used for these curves. For the regulator used, the output voltage varied only 2 mV for the 5V setting from 1 to 120 mA of load current, which corresponds to a load regulation of 0.04%. Less than 10 mV of change in the output voltage could be observed for the 10V output with up to 130 mA output current, which is less than 0.1% load regulation. This performance results from the combined effects of output impedance and junction heating. The effect of output impedance tends to make the output voltage fall while junction heating effects from increasing load current tend to make the output voltage rise.

The high gain of the MC1460R makes the transition region between the voltage- and current-regulating modes very small and the current-limiting region very sharp. Thus, from 9.99 to 0V output, the current

varies by only 3 mA from its limiting value of 150 mA.

Input Regulation

The dc input regulation characteristics are shown in Fig. 5 for load currents of 1, 50, and 100 mA for both 10 and 5V output. Again junction heating effects are present and result in the 0.01%/V regulation shown. The ac input regulation, although not shown, is typically 0.003%/V.

The minimum input–output voltage differential for the MC1460 is 3V. Thus, when the output is set for 10V, the required input is 10V plus 3.0V, or 13.0V. For 5V output, the minimum input–output voltage requirement would give an input voltage of 8.0V. However, the minimum input voltage for proper operation of the MC1460R is 8.5V, and this would be the required input voltage for anything less than 5.5V output.

Power Dissipation Limitations

When the input voltage is at the maximum rated input of 20V and the output is shorted, the regulator must withstand this voltage and supply the short-circuit current I_{SC}, which is itself set by R4 according to the following formula:

$$R4 = \frac{0.5V}{\text{max output current}}$$

For example, with an R4 of 3.3Ω, I_{SC} will be 150 mA. For 20V in, 0V out, this gives a power dissipation of 3W. Therefore, the package would have to be mounted on a heatsink. The amount of heatsink area required depends on the ambient temperature and in this example would have to be enough to keep the case below a temperature of 127°C.

Output Voltage Adjustment

The output voltage is set by the values of resistors R2 and R3. The voltage at pin 8 is typically 3.5V. To minimize the loading effect due to base current on the voltage at pin 8, a current of about 0.5 mA is required through resistor R3; thus, its value should be about 6.8 kΩ. Although a low temperature coefficient is not required for these resistors, the *same* temperature coefficient is necessary to keep the ratio independent of temperature so that the output voltage is constant over temperature.

Shutdown Control

Both the MC1460R and the load current can be turned off (or "shut down") via the shutdown control at pin 2. Under this condition the output voltage drops to almost zero, allowing only a few microamperes to pass through the load. The shutdown control voltage can be provided by any saturated logic such as DTL, RTL, TTL, etc. If shutdown is not necessary, pin 2 should be grounded to prevent spurious signals and inadvertent connections from shutting down the regulator.

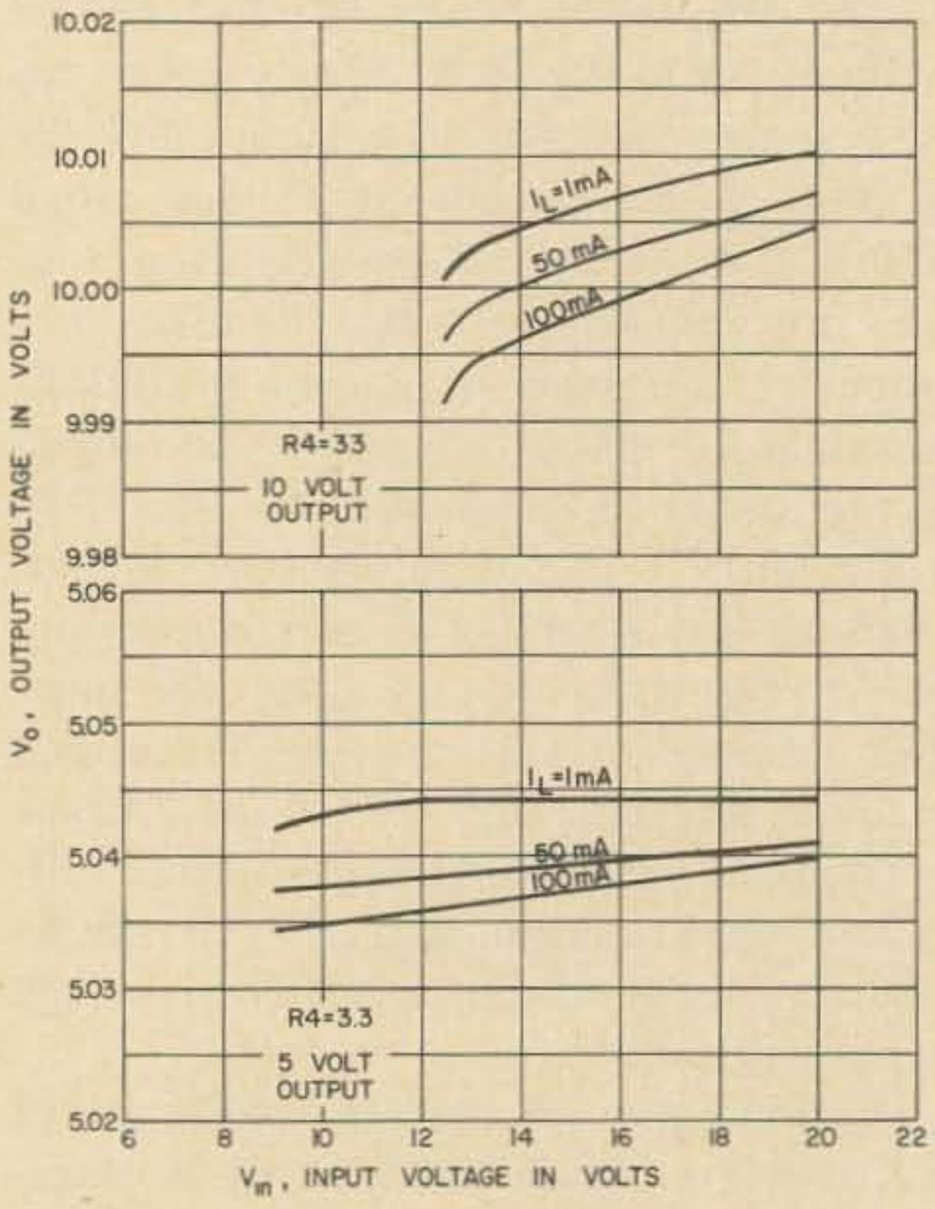


Fig. 5. Output voltage vs input voltage at various load currents.

Conclusion

The basic MC1460R integrated circuit voltage regulator is seen to be a useful component which operates with a minimum of external components and without the need for external semiconductors. The outstanding performance achieved by the regulator can be obtained at a relatively low cost.

. . .KØECF/7 ■

A Soldering Gun Tip...

Steve Harrison WB6PKA
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Palos Verdes Peninsula CA 90274

73 Magazine carried a little tip in the July 1969 issue for prolonging the life of the standard soldering gun tip (no pun intended). The method described involved heating a regular copper tip with a propane torch and tinning the copper tip with silver solder. This method is good, but it seems to be a heck of a lot of work to prolong the life of a little piece of copper wire. Most of us have found that a little piece of 14-gage common copper housewire will replace the half-dollar tip for the guns that are bought. Why not go one step further and, instead of using copper wire, use the silver-plated grid tuning lines from the final of the common surplus 522 VHF transceiver? Many of us experimenters have such units kicking around in the basement that have been cannibalized for parts, and if the grid lines are still there, they can be put to immediate and good use.

Other sources of silver-plated wire probably come to your mind as you think of the 522, and as long as the wire will fit into the gun, the wire will work. If you will just take it easy and let your gun cool off a little now and then, the gun just *might* last as long as your new tip!

. . . WB6PKA ■

Reference:

Make Your Soldering Gun Tip Last Longer, by William P. Turner, WAØABI, 73 Mag, July 1969, Page 127.

Latham Island

Garth Hamilton 5H3LV
Box 717 STN "Q"
Toronto 290 Canada

As some of the world's DX population know there have been many attempts to get permission to operate from Zanzibar and its islands. Zanzibar is composed of Latham Is. or Fungu Kizimkazi, a bird sanctuary southeast of the main island of Zanzibar and Pemba Island to the north-northeast of the main island of Zanzibar; also included are the islands of the Zanzibar Channel from Pemba in the north to Kizimkazi or Latham in the south.

There has been a long pursuit for permission to operate, which started in January 1969 and proved fruitless as no replies or acknowledgment to any correspondence were ever received. In Sept. 1969 I approached Bill 5H3KJ, on the matter as we had been friends for about a year and I had by this time also learned the intricacies of procedure of the country and its people. So, after several discussions I decided to write to the office of the first vice president which is also the office of the president of Zanzibar. (To be noted: Zanzibar is completely autonomous within the union of Tanzania.) Once again the long wait began. Early in 1970 I learned that people were asking friends about me so I figured another security check was being made similar to the to the initial one upon my first request to operate in Tanzania in July 1968. It was this which prompted me to start things moving again, knowing that in six to eight weeks I would have an answer. So Bill and I started planning the final details in late January, projecting the operation for the last weekend in February. I chose Latham or Kizimkazi after research showed it to be a bird sanctuary (with no habitation, which

meant no customs and immigration formalities). Bill made arrangements for a friend to use his boat and service; as skipper in return for cost and fuel for the boat – he also arranged the rental of the Honda E300 and E800 generators which we used. Also from Bill came the mast stays, and stacks for the TA33jr. As my transceiver was in poor shape due to weak tubes, I started scrounging for new ones. K3RLY supplied the tubes and W5KUC provided the vertical, with WA5REU paying the air freight out. So by mid-February everything was moving smoothly. The tubes arrived and G3RIR helped Bill and I get his rig realigned along with our own as all three rigs would be going on the trip (but not G3RIR, as he hadn't a license yet).

On schedule nine days before we were to go came the long-awaited letter giving permission to operate from Zanzibar *provided the East African Posts and Telecoms had licensed us.* I went to Nairobi where 5Z4KL and LW had revived the East African Radio Society's TA33jr from a pile of junk into a serviceable antenna once again. Equipment used and from whom supplied was as follows: W5KUC – 14 AVQ; RSEA – TA3jr; G3RIR – HW100; 5H3KJ – SB100, SB200 generators, masts, and gasoline; and 5H3LV modified HW100, provided camping equipment, packing containers, and misc.

Thanks to our QSL managers, W7VRO for 5H3KJ, CanaD-X VE3ODX for 5H3LV for their continued help in this field. The CanaD-X group are partly if not wholly accredited with getting my HW100 and myself on the air on SSB during my leave

Garth (5H3LV) and Bill (5H3KJ) pose in the uniform of the day of Fungu Kizimkazi, a Zanzibar bird sanctuary isle northeast of the main island, the site of their DXpedition.

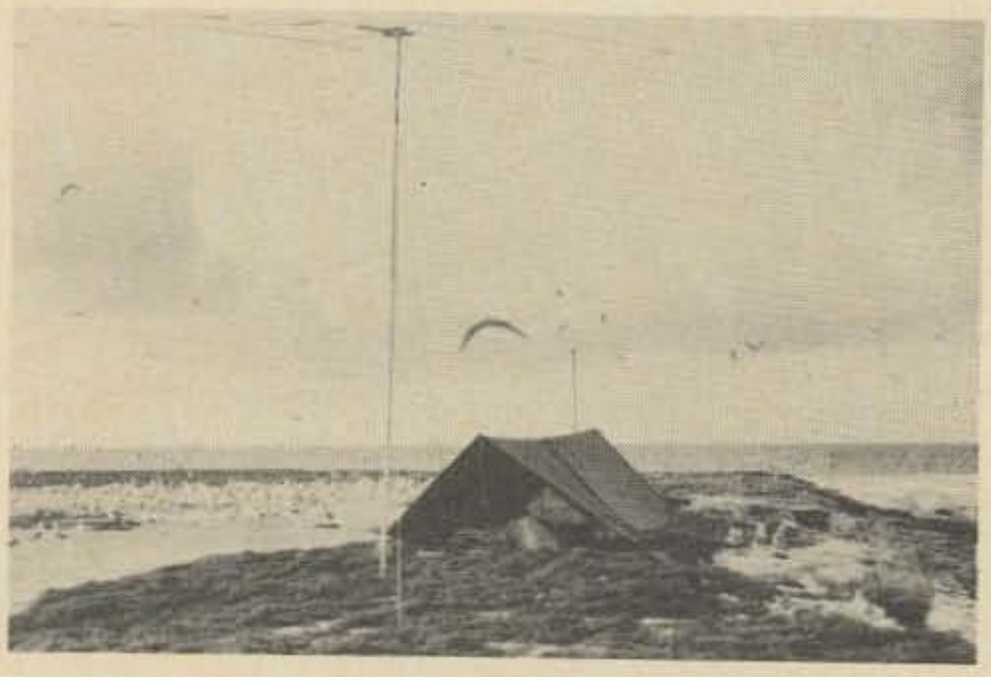
DXpedition

Bill's first attempt to operate 10 and 15 meters had to be abandoned because of watersoaked components in the rig.

period in Canada last May. Such hams as VE3PQ (exVE3CKW), VE3DLC, VE3ACD, VE3NE, VE3HJ, and many others across Canada, whose calls I cannot recall, became responsible indirectly for this operation from Zanzibar. Also W5RBO for his encouragement and financial support.

Now to the more active part which everyone witnessed. We left Bill's at about 9:30 a.m. with all the gear on the VW roof and back seat for the customs jetty where we were to depart at 0700 (GMT). However, the boat was not ready and it was not until 10:45 a.m. that we got the boat to the wharf and loaded it. By 0800 we were under way in the harbor and our passage proved very quiet and comfortable on a smooth sea.

It became apparent early that we were not making the speed the boat was capable of and were informed that this was due to the weight we were carrying. We arrived at Kizimkazi at 1200 already two hours late.



With the large number of birds on the island, the tent served as protection from more than merely falling rain.

By 1320 we had all equipment ashore. One minor mishap occurred during the first landing when Bill and I were not quick enough in getting the boat out of the surf; one wave broke over our stern, getting one packing box wet. On preliminary inspection the equipment seemed to have escaped harm; however, later we learned that the circuit boards in my modified HW100 had gotten wet. This put our second split-frequency rig out of commission before we started.

By 1400 the beam was up and Bill was arranging the operating positions while I got the vertical up. At about 1430 we had a quick snack and Bill came on the air on 15 meters. This is where I discovered the water! When I got the other HW100 out and found the power cord from the dry rig wouldn't fit the water-logged one and vice

Garth roughs it by setting up the station outdoors.

versa, we were in trouble. I informed Bill who QSY'd to 20m at 1450, and I started splicing power cables to get the station going. By 1600 I was ready and Bill went up to 15m again; and I finally started operating transceive on 20m.

It was bad right from the start as I could hear stations from every continent calling and not pausing long enough to hear who I had replied to. I was finally forced to work from lists with stations on each continent taking a list to hold for me. I started with the W6s with 5Z4KL serving as "list master." A DJ started a list for Europe, but by 1630 I closed down. I checked the frequency again 45 minutes later – the racket was still over the S9 mark. How they expected to work me under those conditions I don't know.

I believe the action of closing the station may have helped Bill out when he later volunteered to reopen on 15m at 1800, at which time I started operating split-frequency on 20m and stayed there until the band shut down at 0530. Maybe the fact that the 15m band at this time was not open to so many places at once made it a bit easier for Bill to control the frequency. But his technique of frequently moving and his expert handling of contacts served to prove what a first-class operator he is. Bill operated 15m until 0230 when the band closed an unprecedented 3 hours after that band's longest recorded opening previously in East Africa.

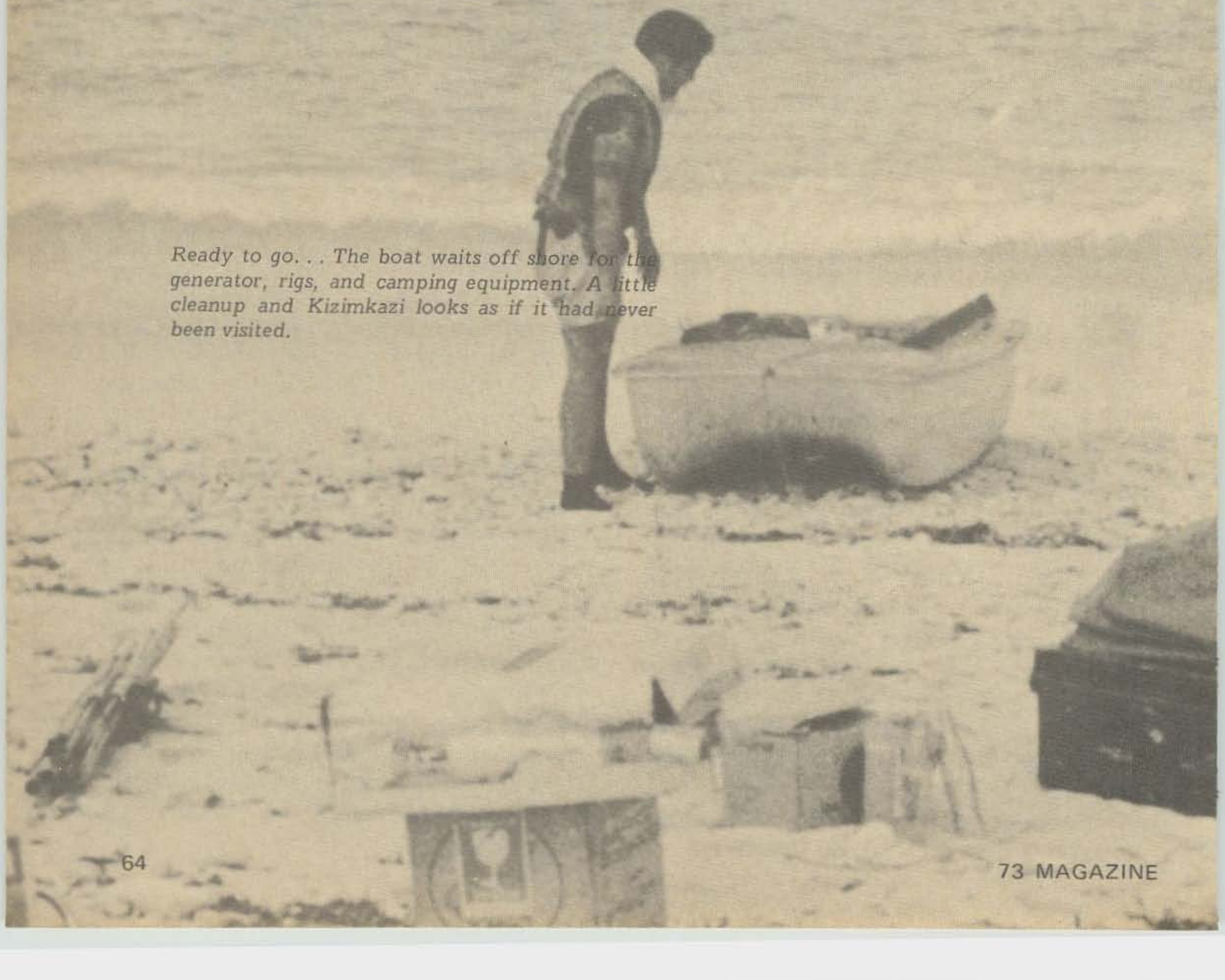
Bill took a nap while I made the final run to the finish. It was interrupted when my generator ran out of petrol at 0530.

A few people felt the brunt of our strife to maintain control of our operating fre-

quencies when they refused to heed warnings about tailending – a deplorable yet increasingly common practice – and calling out of turn. I trust these people now realize that such tactics don't endear them to a DX station and least of all a DXpedition. Some of these practices showed up from stations I least expected to hear them from.

Some very sharp teenage hams using 180W rigs got through using some very diligent operating by listening to ascertain just how much of the band I was spanning in relation to what I said I was covering (which was more by 10 kHz on the top side) and then finding a clear spot to transmit and waiting until I started to span near their frequency. These fellows usually got through within three calls while some of the 2 kW wide-spaced monobanders didn't because they staged a howling contest on the bottom few kHz of the band.

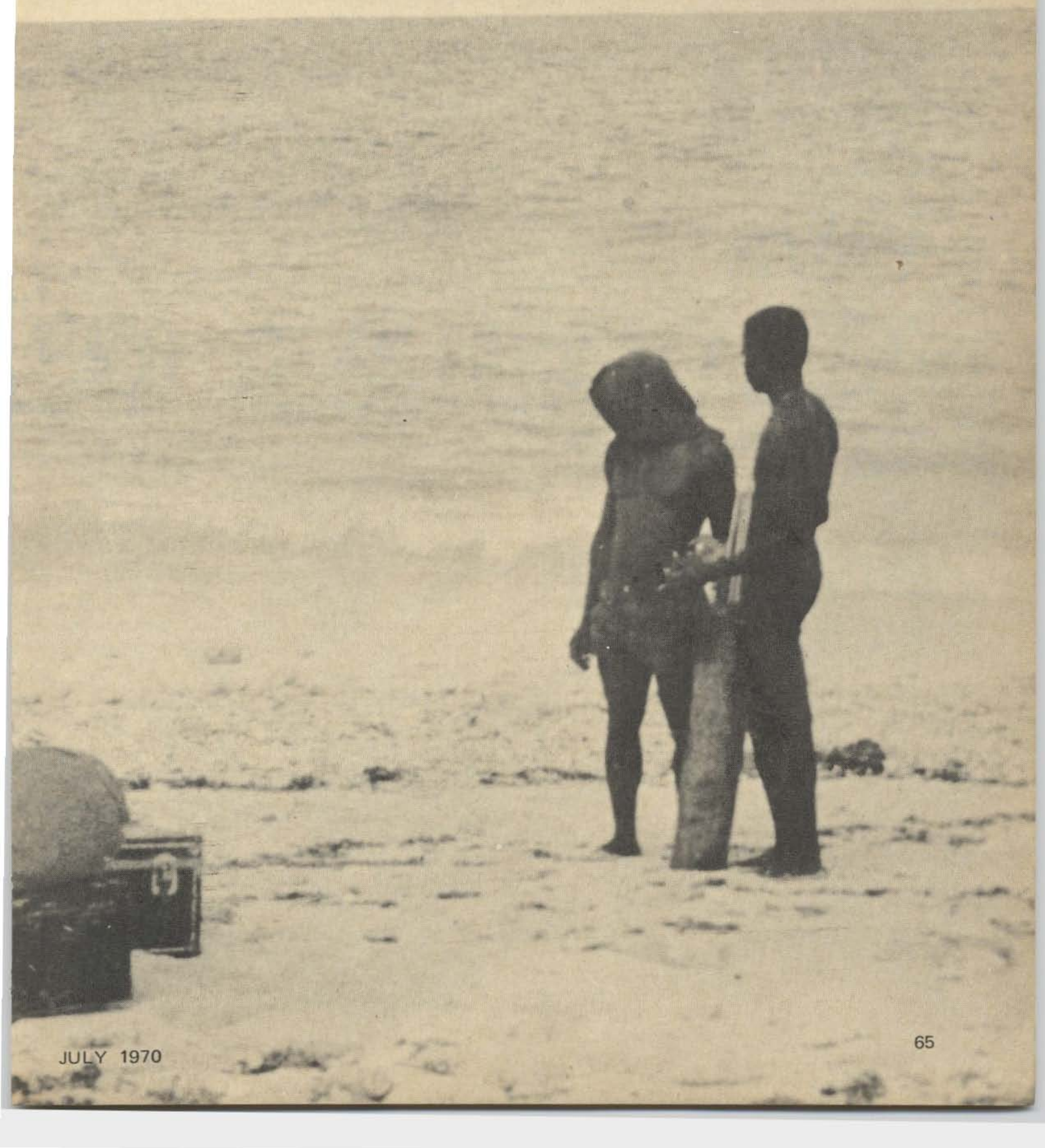
The transceiver operators also had a few tricks up their sleeves. They made short



Ready to go. . . The boat waits off shore for the generator, rigs, and camping equipment. A little cleanup and Kizimkazi looks as if it had never been visited.

calls, gave their reports, and mentioned they were transceive. So I gave them an extra second to find me again before I gave their report.

As some of you may know, Bill (5H3KJ) is now QRT and will be heard again as LA6GF. Bill has been a very active ham with over 270 countries to his credit in four years of operating here. He was first licensed in 1956 as LA5GF. I (5H3LV) have been QRT since May 1 this year, after 10 months activity on SSB, having worked 235 countries. I will reappear as VE3EUP on the bands. There is a chance I'll return to this DX spot for a further two years but that is not definite at this time. Since I am the last remaining DXer from here, I shall look forward to the possibility with the added incentive of being the only authorized operator for Zanzibar at this time. If I should return I'll be looking for a rotator for my station quad and an SB200 to boost the signal some more. I shall also endeavor to have an 18AVQ operating at about 50 ft to see if I can do something with the 40 and 80 meter bands. ... 5H3LV ■



STUDY GUIDE FOR YOUR GENERAL CL

PART ONE: A STARTING POINT

Following up the tradition we've established in our two previous study courses on the Advanced Class license and the Extra Class license, we've found that it's now time to tackle the General/Technician classes. Since the technical knowledge required for both the General and the Technician class ticket is the same, only one course is necessary.

In case you missed the earlier courses (and if you did, contact the publisher immediately with cash in order to get the collected and bound versions for your reference shelf), here is how we go about it:

Unlike other "Q&A" publications which provide concise answers to the specific questions which the FCC includes on its published "study list" for each class of amateur license, we try to go *behind* the study-list questions and examine the principles on which each question is based.

This makes it much more difficult to simply memorize our answers before taking the exam, but we believe the advantages outweigh this disadvantage (if it really is one). If you study our courses, you'll find that you can still answer the exam questions even if the Commission throws you a curve (as it has been known to do) and includes questions on the real exam which apparently were not even hinted at on the study list. The memorization method won't let you do this.

Because we go so much deeper than most into the theory behind the questions, we must handle the study list in smaller bites. In the past, we've averaged about 5 questions from the FCC study list each month, and the course lasts for as many months as are necessary to cover the material adequately.

In this course, though, we don't expect to average much more than 3 questions each month – because we cannot expect a student working for his General or Technician ticket to have as much technical

background as would someone already eligible to apply for the Advanced or Extra Class ticket. Some months we may take more, and some months less – it all depends upon the questions, and the amount of background necessary.

In this initial installment, we've got to establish a starting point upon which to build all the rest. We'll do so by discussing the theory behind questions 27, 35, 36, and 37 from the FCC study list.

The questions, as published in FCC Bulletin 1035C, are:

27. Define Ohm's Law. How does it relate to resistive and reactive impedance?
35. How do resistors combine in parallel and in series to give total resistance? Capacitors? Inductors?
36. How does voltage division occur across series connected resistors? Capacitors? Inductors?
37. What does it mean to connect circuit elements in series? In parallel?

ASS LICENSE

As we have done in the previous license study courses, we'll re-phrase these questions into new ones which expand to cover the theory behind the FCC's examples.

Our first question, which is ambitious enough in itself to fill a book (and many have been filled with not-too-informative answers to it), will be "What Are Current and Voltage?" In finding answers to that, we'll endeavor to give an accurate definition of not only current and voltage, but what fields and waves amount to and how electricity is propagated.

And in doing so, we'll follow our long-time rule and ban all higher mathematics. To paraphrase Tom Jefferson et al, we hold this truth to be self-evident: That any concept formed by a human mind can be understood by any other human mind, provided only that the concept is framed in terms of other ideas the student already holds. In other words, you don't have to be a genius to understand the ideas a genius has developed, if we can explain them adequately in simple enough terms. To do so, we must rule out any math more complicated than arithmetic and from time to time a touch of the simpler parts of algebra.

When we complete this seemingly-impossible answer, we'll move on to ask "What About Alternating Current?". This will give us an opportunity to look at different ways of connecting elements in a circuit, as well as at the different types of elements themselves.

Think we can do it? Let's dive in and find out.

What Are Current and Voltage? To find out what current, voltage, and the like are, let's go all the way back to the beginning of man's studies of this strange thing called "electricity."

Since ancient times, men have known that some materials such as amber and later glass have the ability to attract light objects to themselves under some conditions. The magnet's discovery is also lost in the mists of prehistory. But until the middle of the 18th Century, both "electricity" and "magnetism" smacked of magic. Little was really known about either.

In 1800, though, an Italian scientist named Volta invented a chemical cell or "voltaic pile" which provided a constant source of electrical energy. Once a laboratory source of electricity was available, many investigators turned their attention to electricity and magnetism – and during the decade from 1820 to 1830 most of the basic laws of electricity were discovered.

Among these was Oersted's observation, in 1820, that any flow of electricity was accompanied by a magnetic field. This observation led the French physicist Andre Ampere to study the forces which resulted from flowing electricity, and Ampere as a result classified electrical effects into "electrostatic" force and "electrodynamic" motion, which he also called "electric

tension" and "electric current." "Electric tension" (now called voltage, for Volta, in this country, but still called "tension" in Great Britain) is a measure of electrostatic force. Electric current, measured in "amperes" (after Ampere), is a measure of electrodynamic motion.

Michael Faraday discovered, in 1831, that motion of a magnetic field would "induce" a flow of electric current in a stationary conductor. This completed the symmetry of electrical and magnetic effects, but the actual manner in which electricity and magnetism were related remained unknown.

Many ideas were put forth, but none could be proved to actually be true. The most lasting, probably, of these ideas involved the "line of magnetic flux." This "line" survives today as a part of basic theory as taught in engineering courses – but most authorities now believe the line to be imaginary, rather than an actual thing.

Since the work of Oersted, Ampere, and Faraday (as well as others less well-remembered) had made the relationships between electricity and magnetism obvious, many investigators attempted to express the rules of the relationships. None succeeded until James Clerk Maxwell, in 1865, published his "Dynamical Theory of the Electromagnetic Field." While the theory itself has not yet been (and probably cannot ever be) proven beyond doubt, it *has* successfully predicted, and continues to predict, all electromagnetic actions within its intended range, and is today accepted as a true working theory

Maxwell's Equations, which define the theory mathematically, are required knowledge for any electrical engineer, and once they are understood they provide adequate explanation of all electromagnetic effects yet observed.

The actual equations are not simple. Maxwell himself required 20 separate equations in 20 variables to express them. Their reduction by later workers to the four Equations taught today has added a requirement for knowledge of integral calculus, differential equations, and vector analysis, since these were the tools used to reduce the equations.

The theory, taken apart from the Equations, is elegantly simple, though, and not too difficult to understand provided we don't ask a few critical questions which it cannot give us answers for. It begins with a single assumption – that the space around electric or magnetic objects contains (to quote Maxwell) "matter in motion, by which the observed electromagnetic phenomena are produced."

From this assumption, Maxwell went on to define "the electromagnetic field" as being "that part of space which contains and surrounds bodies in electric or magnetic conditions." He was careful to point out that this could be as complete a vacuum as could be obtained anywhere, but that there would always be "enough of matter left to 'receive and transmit the undulations of light and heat."

Because the transmission of light and heat was not greatly changed when transparent objects such as glass were substituted for the best available vacuum, he concluded that the "undulations" must be occurring in some form of matter which was not directly observable. He called this unknown form of matter "an aethereal substance," which later workers shortened to "the aether" or "the ether"; the question whether "the aether" exists is one which Maxwell's theory cannot answer, because the assumption that it *does* exist is the basis on which the theory is founded.

Later experiments by Michelson and Morley cast doubts upon the existence of the aether, and for many years now the label "aether" has been out of style. Today, we know this unknown medium as "the space-time continuum," but for our purposes here the change is more one of name than of basic concept. Therefore we will temporarily ignore the work of Michelson, Morley, and Einstein, and for the moment think only in terms of Maxwell's "aethereal substance." By doing so, we can get an adequate – and accurate – picture of how voltage, current, and charge operate.

"Now the energy communicated," wrote Maxwell, "must have formerly existed in the moving medium." He based this conclusion on the observed fact that a detectable time delay exists between the energy's departure from its source and its arrival at its destination. He then borrowed knowledge from studies of the familiar motion of objects, to conclude that while the energy was in the unknown medium, it must have been "half in the form of motion of the medium, and half in the form of elastic resilence."

From this chain of reasoning, he drew the conclusion that the parts of the unknown medium "must be so connected that the motion of one part depends somehow upon the motion of all the rest," and at the same time "the connections between the parts must be capable of elastic yielding" of some sort, because otherwise the communication of motion from one part to any other would not require any time – and both heat and light, though fast, do not travel instantaneously.

Maxwell then reworded this conclusion into a description of the significant properties of his unknown aethereal medium; he said that it was "capable of receiving and storing up two kinds of energy, namely, the 'actual' energy depending on the motion of its parts, and 'potential' energy, consisting of the work which the medium will do in recovering from displacement in virtue of its elasticity."

These two kinds of energy, "actual" and "potential," correspond exactly to the "kinetic energy" and "potential energy" of ordinary objects. They also, as it happens, correspond exactly to the "electrodynamic" and the "electrostatic" effects named by Ampere.

The equations Maxwell developed provide the actual descriptions of these properties, based on the observations reported by earlier investigators. Engineers need them. They are not necessary for an understanding of "how" voltage, current, and charge work.

According to the theory as developed by Maxwell, the induction of current in a stationary conductor by a moving magnet, or in a conductor moving past a stationary

magnet, is a result of the same force involved in transmission of motion from one part of the medium to another. It is, then, an effect of "actual" energy as contrasted to "potential" energy.

If the conductor does not form a complete circuit, no current can flow. Instead, a voltage or potential appears across the ends of the circuit. Should the circuit be completed, current will flow and the voltage will vanish – but so long as the circuit remains open, current will be zero and the voltage will be present.

This voltage or potential represents a transformation of energy from its "actual" state of motion into the "potential" state of storage.

This transformation of energy from "actual" to "potential" is a cornerstone of Maxwell's idea, and his summation of it is the feature which gives his theory its great power to explain and predict all electromagnetic effects.

"The propagation," he wrote, referring to the propagation of light and heat through his undefined medium, "consists in the continual transformation of one of these forms of energy into the other, alternately."

That is, he conceived of the transmission of electromagnetic energy as an endless process of transforming energy from a state of motion to a state of storage, and back to motion.

Figure 1 shows how you can illustrate this principle with a row of pennies or other coins, by lining them up in a straight line so that each touches its neighbor on either side. If you strike the penny on one end with another coin, and if the motion of the "striker" coin is in line with the other coins, the penny at the other end will fly off the line but none of those in between will move visibly.

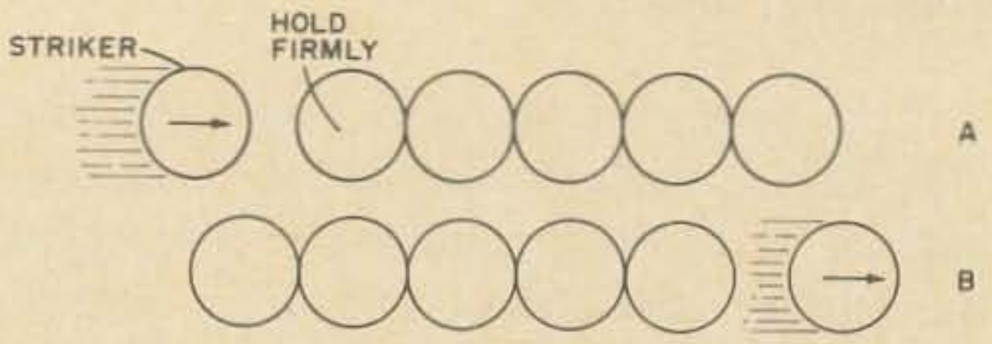


Fig. 1. Simple experiment with rows of coins illustrates motion-compression-motion cycle which is basis of both electric current and magnetic effects. If coins are lined up as shown at A, with one held or clamped firmly, and line is struck end-on by another coin, coin at far end of line will move off of line but those in between will not move visibly. Text explains why.

What actually happens in this demonstration is this: The energy of motion of the "striker" coin compressed the first penny by a microscopic amount at the moment of impact. As soon as the impact force had all been transformed into a compression, then nothing was holding the first penny compressed, so it sprang back into its original shape. This motion of rebound, in its turn, compressed the penny next to it, and so the motion was carried down the line of coins, one penny at a time, by an alternate series of motions and compressions.

Exactly the same sort of thing, said Maxwell, goes on to produce the propagation of electromagnetic energy. And since by his theory every "electric or magnetic body" is surrounded by his aethereal medium, and present theories hold that all physical matter is electric in nature, it follows that electromagnetic energy can be propagated in this matter throughout all parts of space which are occupied by any kind of physical matter.

Actual physical matter divides into two broad classes known as "conductors" and "insulators"; the defining property which separates these classes is that conductors permit the flow of electric current within themselves, and insulators do not.

It is generally believed that the difference depends upon molecular and crystalline structure, and that conductors contain electrons which are free to move anywhere within the boundary of the conductor without restraint, while insulators have few or no "free" electrons. It is important to keep in mind that these "free" electrons which are involved in the flow of electric current are a part of the conducting material, and are *not* associated with the "aethereal substance" which provides a means for propagation of electromagnetic energy.

What happens, according the present theories, is that the energy transformations going on in the "aethereal substance"

impart some of their energy to the free electrons. The exchange is two-way in nature, so that free electrons in motion lose some of their energy to the unknown medium. We say that such energy is "lost by radiation" and the whole point of a radio transmitter is to "lose" as much energy as possible by radiation, in order to communicate over long distances.

When the free electrons of a conductor receive excess energy, they move in the direction indicated by the energy. Their motion is, as we shall soon see, by definition the flow of an electric current.

If the conductor forms a complete circuit, the free electrons can move indefinitely in the same direction as long as they maintain their energy. The energy is gradually lost, however, by being released back to "the electromagnetic field" and by collision with "bound" electrons and other atomic particles in the conductor.

When a free electron approaches a bound electron, the bound electron is repelled and attempts to get out of the way. The bound electron, though, is an integral part of an atom, which in its turn is fixed into place in a molecule, and it cannot get out of the way unless the whole molecule moves. To move a molecule takes energy, and molecular motion is also known by the more common name "heat."

This transformation of electrical energy of motion into the molecular motion of heat is called "resistance," and all normal conductors have resistance in varying amounts.

If the circuit is not complete, the electrons can move only a limited distance before they reach a boundary which stops their motion. The motion-compression-motion cycles must then halt in a state of compression or "storage."

The "storage" of energy occurs not in the conductor, but in the insulating medium which keeps the circuit open. Although the electron theory of matter was still several decades in the future when Maxwell developed his theory of fields, he considered that "the electricity" in each molecule of the insulator was forced to one side or "displaced" from its normal position by the "potential" energy, and re-

mained there until either the removal of the potential energy, or the completion of a conducting circuit around the insulator, permitted the displaced electricity to resume its normal position.

This "displacement" of the internal structure of an insulator under pressure of applied voltage is what we now call "charge." Since the electron theory was developed, we consider that the displacement occurs by a bunching of the electrons within the insulating material, and, if necessary, a physical distortion of the material's molecules to align most of the electrons on one side.

We measure "charge" by a unit called the "coulomb," which is approximately equal to the displacement of 6,280,000,000,000,000,000 electrons. An insulator which has one coulomb of charge has that astronomical number of electrons displaced to one boundary, we believe. (But no one has yet counted them, because the electron is too small to see and we cannot locate its position accurately by any means.)

When a conductor permits the potential energy of the charge to convert itself back to actual energy of motion, all of these electrons return to their normal positions, and we call the resulting flow of electrons a "current." The unit of current is the ampere, and one definition of an ampere is a flow of one coulomb of charge in a time of one second. time. Current is an electroDYNAMIC effect, while charge can exist without motion, and so is electroSTATIC in nature.

Charge is a measure of quantity, similar in many ways to the "pint" or "gallon" of liquid measure. A given amount of charge may, if released from its static state, produce any amount of current, depending upon how long the flow lasts – in exactly the same way that a gallon of water may drip through a tiny hole over a period of hours, or may be emptied by overturning the bucket in a matter of a fraction of a second.

The other fundamental electric unit, the volt, is a measure of potential, tension, or pressure. Though the volt is a static unit, it is like the ampere in that one coulomb of charge may be stored at any voltage.

What determines the voltage for any given quantity of charge is the electrical capacity of the insulator in which the charge is stored. "Electrical" capacity is not quite like "physical" capacity; the thicker the insulator, all other things remaining equal, the smaller its electrical capacity, but the greater the surface area the larger the electrical capacity will be. This comes about because charge is stored *only* at the boundaries between the insulating material and the conductors. The farther apart these boundaries are, the more pressure is required to keep all electrons displaced; the larger the area of each boundary, the more room for charge.

To distinguish between physical capacity and electrical capacity, we call electrical capacity by the special name "capacitance". The voltage associated with any particular amount of charge depends not only on the amount of charge, but upon the capacitance in which the charge is stored. The unit of capacitance is the "farad", for Faraday, and one definition of a farad is that capacitance which will store one coulomb of charge at a potential of one volt.

Other definitions make use of specified measurements for area, separation of the surfaces, and kind of insulating material, so that we can reverse this definition of a farad and make it a definition for the volt – that pressure (or the potential energy) of one coulomb of charge stored in a one-farad capacitor. Two coulombs of charge in the same capacitor would produce a potential of two volts, and so forth.

The units of "charge" and "potential," then, as well as that of "capacitance," describe electrostatic effects or "static electricity," while the unit of "current" describes an electrodynamic effect. When a circuit includes either a chemical cell or a generator which converts motion to electrical energy, the electrostatic units of potential and capacitance may still take part in the circuit, but the flow of current is the essential item.

In today's world, most authorities don't use Maxwell's own names of "actual

energy" and "potential energy" to describe the motion-storage-motion cycles. Instead, the component which Maxwell called "actual" and which is the "motion" part of the cycle is called "the magnetic field" and the component which Maxwell called "potential" and which is the "storage" or "displacement" part of the cycle is known as "the electric field."

Either of these fields can, apparently, exist apart from the other so long as no motion is introduced. A permanent magnet has its own magnetic field, but if it is at rest no electric field surrounds it. Similarly, a charged capacitor contains an electric field, but if no current is permitted to flow no magnetic field is associated with it.

Introduction of motion, whether it is the physical motion of the field with respect to its surroundings, the physical motion of the surroundings with respect to the field, or the electromagnetic motion produced by providing a complete circuit and thus permitting discharge of an electric field, results in the presence of both kinds of fields. Whether the motion causes the field to exist, or the field causes the motion, is not really a matter worth worrying about. Sometimes it seems to be one way, sometimes the other, and in many cases nobody can determine which is cause and which is effect.

At this point, we have defined "charge" as the displacement of a specific number of electrons, "capacitance" in terms of physical distances, "current" in terms of change and time, and "potential" in terms of charge and capacitance.

While we still have no knowledge of the nature of that "aethereal medium" which is known as "the electromagnetic field" – in fact, no one has much more knowledge of its nature than that set forth by Maxwell in his original description, when he wrote that the electromagnetic field is "that part of space which contains and surrounds bodies in electric or magnetic conditions" – we *do* have an explanation of a possible means by which voltage and current are produced and propagated.

And, as it turns out, that's all we really need in order to do anything we desire in electronics.

Now that we know more than we really wanted to about charge, voltage, current, and capacitance, let's look at some other factors involved in the flow of charge or "electricity."

Just before we began examining the nature of voltage, we saw in passing that a given amount of charge may, upon being permitted to flow from a static state, produce any amount of current depending upon how long the flow lasts.

At that time, we compared it to the tiny drip of a gallon of water which might take hours, and to the sudden overturning of a gallon bucket. We did not, however, look for the factor which controls how long a flow of current may last, starting from a given amount of charge.

Such a factor does exist, of course, and we've already made its acquaintance. It's "resistance," caused by interaction between free and bound electrons in any normal conductor.

The unit of resistance is the "ohm," for Georg Simon Ohm, who first formulated the law which relates voltage, current, and resistance. Ohm's Law is of such fundamental importance to all electrical work that it comes as something of a surprise to discover that Ohm formulated the rule simply as a by-product of his studies into the effects of heat upon resistance, and in his original description, did not express the law in the formula which today bears his name. The familiar formula is the invention of Maxwell, who included the law as one of his 20 equations.

We saw, when looking at the qualities which separate conducting materials from insulators, that conduction is accomplished by "free" electrons, which are free to migrate from place to place as contrasted to "bound" electrons which are held firmly in place in an atomic structure. We also saw in that study that free electrons always lose some of their energy as heat, because of interaction between free and bound electrons.

This interaction within any normal conductor is the major factor limiting current flow within that material. It, in turn, depends upon the number of free electrons within the material, which is determined by both the material itself and by the physical size of the conductor. Different materials have different ratios of free to bound electrons, and the larger the conductor the more free electrons will be available within any one cross-section of it.

The more free electrons a material contains, the better that material is as a conductor. We say it has low resistance. Silver has the lowest resistance of any normal conductor, but copper is almost as good a conductor and costs considerably less. For this reason, copper is the most widely used conductor.

Some materials have few free electrons, although still enough to be classed as conductors rather than as insulators. The resistance of such materials is high. One such material is carbon. Another is the nickel-chromium alloy known as "nichrome".

True resistance, or "pure" resistance to use a jargon term, is the conversion of electrical energy to heat. Many effects other than true resistance can also cause energy to be "lost" from a circuit, though, and most usually these effects are also known as "resistances." One example is the radiation of energy from a circuit such as a transmitting antenna.

The difference between true resistance and these other effects which may also be labelled as "resistances" is that true resistance produces heat while "imitation" resistance does not. The "radiation resistance" of an antenna, for instance, has no heat associated with it; the energy is radiated instead.

In a complete circuit with steady current flow – a "direct current" or "DC" circuit – the potential, current, and resistance are all related by Ohm's Law, which states that the potential in volts is equal to the product of the current in amperes multiplied by the resistance in ohms. Stated in its most familiar form, E = IR, where E is voltage, I is current in amperes, and R is resistance in ohms.

If we know any two of these three quantities, the third is determined by Ohm's Law. Using high school algebra we can rearrange the formula to find resistance if voltage and current are known (R = E/I),

or current if voltage and resistance are known (I = E/R).

A number of memory aids have been developed to help students remember Ohm's Law. One used by our staff is the simple word "ear," which is what comes out if you try to pronounce "E-IR" and consider the "=" to be silent. If you're handy at algebra this is all you need, because it's not difficult to turn the formula around into the other two versions.

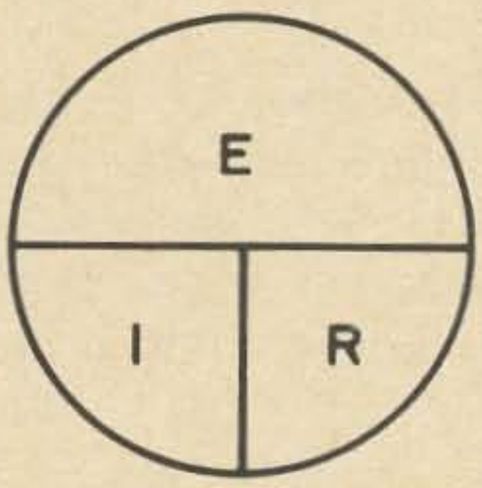


Fig. 2. This simple picture may help you remember Ohm's Law. E stands for voltage, I for current, and R for resistance. To get formula for calculating any one if you know the other two, cover the unknown and the picture shows you the right formula. For instance, covering R gives E/I.

Another involves an Eagle, an Indian, and a Rabbit. The Eagle flying above the prairie sees both the Indian and the Rabbit below him, so E = IR. To the Indian, the Eagle is above the Rabbit; I = E/R. To the Rabbit, the Eagle is above the Indian; R = E/I. Figure 2 shows still another which uses a circle divided into one half and two quarters to provide the same illustration.

Although these simple versions of Ohm's Law are those most widely used, it's necessary to keep in mind that they apply only to DC circuits. If the current is changing, modifications become necessary. A chemical battery provides DC. A simple generator, however, produces current of quite another kind which we will take up a little later.

With voltage, current, charge, resistance, and capacitance all defined, we have completed answering our question. There's still one more major electromagnetic effect, but it does not apply when current flow is steady – so we will wait a bit to study it.

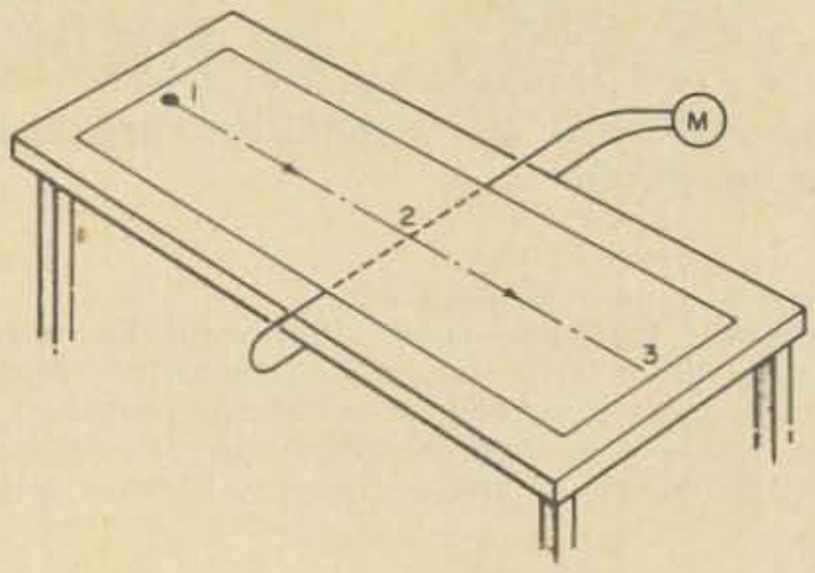


Fig. 3. Principles of converting motion to electric current are shown here. Magnet at 1 is moved along line shown, crossing wire. Motion of magnet induces flow of current in wire. See text for more detail.

What About AC? Just a couple of paragraphs back we mentioned that while a chemical battery provided DC, a simple generator gives current of quite another kind. Let's look into this a little deeper.

We saw earlier that according to Maxwell's theory, a flow of current is associated with any motion of a conductor within a magnetic field.

Assuming that the magnetic field is of constant strength, then the faster the motion the greater the current. If the polarity of the field is reversed, the direction of current flow will also reverse.

These facts provide a method for converting mechanical motion into electrical energy, by using a magnet and a conductor, one of which remains stationary while the other is moved.

Figure 3 shows an impractical example to illustrate the idea, before we go on to more practical techniques. Let's assume that we have a wire conductor stretched flat on a large table-top and covered with a thin sheet of paper to provide a smooth surface. Let's assume also that we have a small, powerful permanent magnet, which we are free to move across the table.

Let's start at Point 1, well away from the wire, and move the magnet at a constant speed up to and across the wire at Point 2, continuing on away from it to Point 3, and at all times measuring current in the wire.

As we do so, we find that the instant the magnet begins to move a small amount of current flows. At the beginning, the flow increases rather slowly, because during any tiny fraction of a second the distance from magnet to wire undergoes little change so long as the distance is large.

For example, if Point 1 is 100 in. from the wire, then if the magnet moves at a steady rate of one inch per second, it will move the 1/10 inch from 100 to 99.9 inches in the first 1/10 second. The change in distance is only about 1/10 of 1%. Since "speed" is a measure of distance moved in a given time, the effective speed is low.

But when the magnet is only 10 inches from the wire, then in the next 1/10 second it will move the 1/10 inch from 10.0 to 9.9 inches, which is 1% of the distance or 10 times as much relative motion as at point 1. The effective speed is thus 10 times greater than at the start, and current will also be 10 times greater.

When the distance is down to only ½ inch, the 1/10 inch moved in 1/10 second is such a large part of the total distanct that it's difficult to decide just how much faster the effective speed is, but it must be at least 20 times greater than at the 10-inch distance or 200 times greater than at the start.

Current flow, likewise, is great. In fact, the current intensity reaches its peak as the magnet passes over the wire. Once the magnet has passed Point 2, it's moving away from the wire rather than toward it,

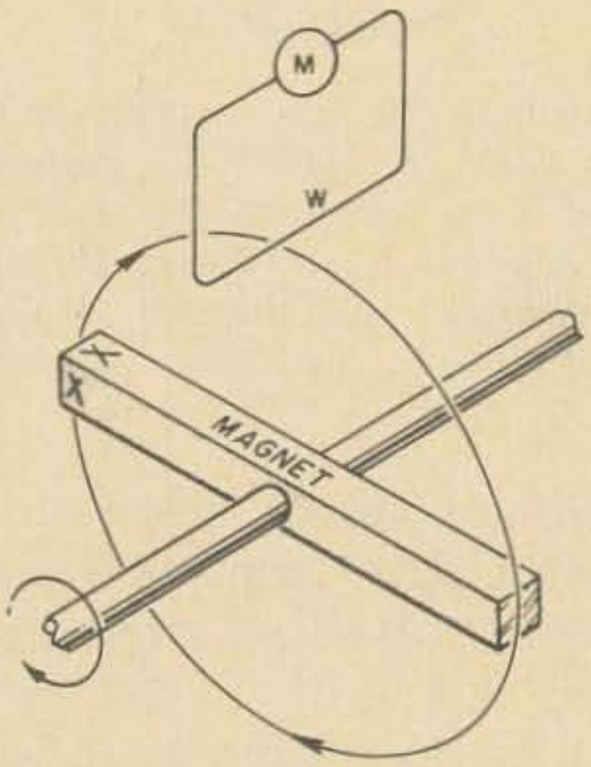


Fig. 4. This sketch shows the simplified generator we use to illustrate the nature of ac and how it gets that way. It's just a bar magnet on a rotating shaft, with one wire just outside the path of the magnet poles. As magnet rotates, currents are induced in wire. Intensity of current depends upon shaft position at each instant as discussed in text.

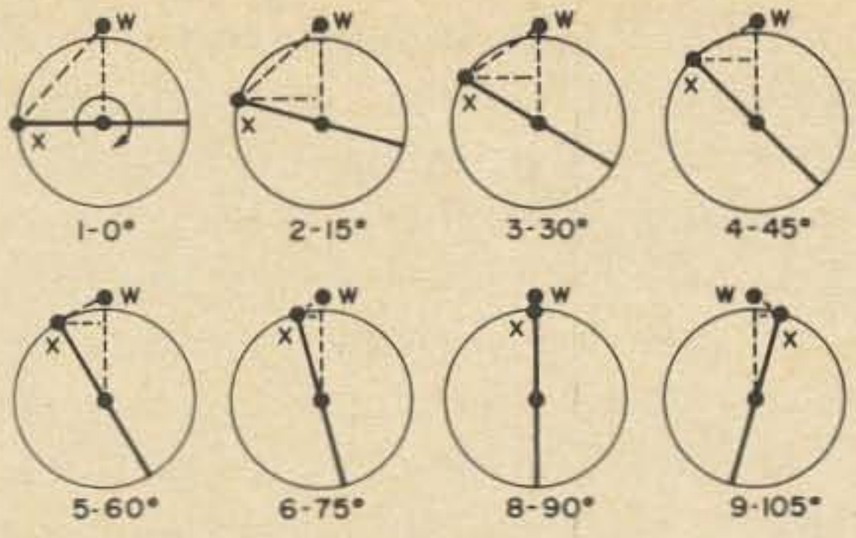


Fig. 5. "Snapshot" sketches of our simplified generator, seen end-on, as it would appear at eight points from 0° to 105° of rotation. All rotation here is clockwise. Key factor is distance from nearer pole tip to our wire, indicated as distance XW. Triangles (dotted lines) help us to calculate this distance for each position of magnet.

and so the "effective motion" is becoming smaller at exactly the same rate that it increased during the approach. This means that effective speed is decreasing, and so must be the current flow.

The straight-line or "linear" motion we've used in this example isn't very practical for normal use. Rotary motion is much simpler to handle in actual machinery. Practical generators put either the magnet or the conductor on a rotating shaft, and the other half goes on a stationary frame known as the "field" close by.

For our illustration, let's put the magnet on the shaft, and keep a single wire just outside the circle described by the rotating tip of the magnet. We'll use a bar magnet, with its two opposite poles, to make the illustration a bit more practical. Figure 4 shows the arrangement.

When we change from "linear" to "rotary" motion, the way in which effective motion varies with time undergoes a few changes of its own. Let's try to see just what happens; to do so, we'll have to use a little geometry – but very little. All we have to accept from the geometers is the rule for determining the length of one side of a triangle, if we know the other two sides.

Figure 5 shows several successive "snapshot" sketches of our generator, seen end-on, as the shaft turns through a little more than ¼ of a full revolution. Starting at a point which we arbitrarily called "0°," the snapshots show the relation between mag-

net and wire at 15-degree intervals as the shaft rotates.

You can see that the distance "XW" from magnet to wire is the "effective distance," and the "effective motion" during any period of time must be the change in this distance. "Effective speed" must be related to the effective motion.

If the total length of the magnet is 20 inches, then the radius of its circle of rotation will be 10 inches. At the time of our first snapshot, the magnet pole is as far from the wire as it can get without the other pole being nearer. This happens when the magnet and the line from wire to shaft form a right angle. Because of this, distance XW is the hypotenuse of a right triangle, and each of the other sides is 10 inches long. Applying the geometry at this point, we find that distance XW is 14.142 inches.

At the second snapshot time, XW has become shorter. It's down to about 12.1752 inches. By the third, it's down to 10 inches, and by the fourth, to about 7.65 inches.

That is, during the time between the first and the second points the effective motion was 1.97 inches, between the second and the third the motion was 2.18 inches, between the third and the fourth, 2.35 inches, and so on. Just as in the case of linear motion, the motion during a fixed period of time becomes larger and points X and W approach each other.

The change in effective *speed* is also important, though, and this is where much of the difference comes in. Unlike the change in effective motion, the change in speed is greatest when X and W are furthest apart.

The calculations to determine this are much too much arithmetic to go into here (in fact, they are so much arithmetic that we fudged and gave the problem to a computer – Fig. 6 is the table of results it gave us back), but when we do them we find that the relative change in speed between snapshots 2 and 3, for instance, is 0.2083, while from 3 to 4 it is only 0.1711 and from 4 to 5 it's down to 0.1310. The change becomes smaller until X passes W, then gets larger again.

In Fig. 6, the column headed "SPEED CHANGE" shows the continual change of effective speed as the shaft is rotated.

Students who have been exposed to trigonometry may recognize the triangles dotted into Fig. 5 as bearing some resemblance to the "unit circles" used to define and illustrate the various trig functions.

As it happens, the resemblance is so great that it turns out that effective speed is related to the sine function of the angle through which the shaft is turned.

Now that we've seen how the effective motion changes with changes in shaft position, let's perch ourselves right on that wire at Point W and watch the magnet poles as we rotate the shaft.

When the shaft rotates, each pole in turn "rises" over the "horizon" formed by the rim of the circle, as in snapshot 1 of Fig. 5. It moves rather slowly at first, but picks up speed rapidly.

As the pole approaches us, its effective speed continues to increase, but the

Angle	Distance XW	Effective Motion	Speed Change
*0	14.1421	0.000000	0.000000
5	13.5118	0.630331	0.630331
10	12.8558	0.656051	0.025720
*15	12.1752	0.680523	0.024472
20	11.4715	0.703699	0.023176
25	10.7460	0.725536	0.021837
*30	10.0000	0.745991	0.020456
35	9.2350	0.765027	0.019036
40	8.4524	0.782606	0.017579
*45	7.6537	0.798696	0.016090
50	6.8404	0.813265	0.014569
55	6.0141	0.826286	0.013021
*60	5.1764	0.837734	0.011448
65	4.3288	0.847588	0.009854
70	3.4730	0.855828	0.008240
*75	2.6105	0.862439	0.006611
80	1.7431	0.867408	0.004969
85	0.8724	0.870726	0.003318
*90	0.00001**	0.872387	0.001661
95	0.8724	0.872360**	0.000000**
100	1.7431	0.870726	0.001634**
*105	2.6105	0.867408	0.003318

* – Points used for "snapshot" calculations (Fig. 5)

** – Results affected by accumulated tiny error in computer.

Fig. 6. Calculations of Distance XW, effective motion, and change in speed, as produced by computer. See text for discussion.

acceleration slows down. During the final part of the approach, its speed is great but almost constant. It passes us at a rather rapid rate, and immediately begins to slow down as it curves away.

The deceleration is slow at first, but as speed becomes less and distance increases, the rate of deceleration increases in an exact mirror of the acceleration rate during the approach. Finally this pole disappears over the "far horizon" just as the opposite pole "rises." This succession of pole-passages continues so long as the shaft is rotating.

The result, in the circuit of which our wire is a part, is a continual reversal of current flow as one pole "sets" and the other "rises." At these instants, current flow in the wire is zero because the opposing magnetic fields of each pole "cancel out." In between these "zero" points, the nearer pole's field takes over, and current flow either rises to a positive peak or falls to a negative peak, as each pole in turn flashes past the wire.

Because the effective speed of the magnetic field, and the resulting intensity of current flow, is associated with the sine of the angle through which the shaft has turned, we call the resulting current a "sine wave."

Because the current alternates in direction twice during each full revolution of the shaft, as the two opposite poles pass, we also call it "alternating current" or "ac."

Early experimenters had no practical use for ac; the reversals of polarity cancelled out many of the effects in which they were most interested. To get rid of it, they put a rotating switch called a "commutator" on the shafts of their generators, to reverse the connections between the conductor and the outside circuit whenever the current direction reversed and thus cancel out the effect of the current reversal.

They also used many windings, rather than just one conductor, so that at any one instant they were taking current only from the conductors which were at that time generating peak current.

Only recently has the "alternator," or simple generator such as we've described here, come into popularity. In a practical alternator, the magnetic field is produced by a field coil rather than by a permanent magnet, and a multi-turn output winding rather than a single conductor is used, but the principles remain the same.

One important factor necessary to talk about ac, which was not required with dc, is a measure of the number of times each second that the current changes direction. The older standard for this was the "cycle per second," with one cycle being the result of one full revolution of the shaft in our simplified generator, That is, one cycle includes a positive peak, a negative peak, and two zero crossings (one in each direction). A cycle may begin at any point on the waveform, and when that point has been reached the next time from the same direction, the cycle is complete.

Recently, the U. S. adopted an international standard of frequency called the "hertz" in honor of Heinrich Hertz, who was the first person to test Maxwell's theory by transmitting and detecting radio waves. One hertz is the same as one cycle per second.

Whether measured in hertz, or in cycles per second, the quantity so measured is called "frequency" because it is a count of the frequency with which the current alternates.

Closely allied to "frequency," but not identical, is the term "wavelength." A wavelength is the distance travelled by the energy during the course of one cycle, to put it roughly.

If the current flow moves at the speed of light, then wavelength in meters is equal to 300,000,000/frequency in hertz. This comes about because the accepted figure for the velocity of light is 300,000,000 meters per second. If, for example, an ac wave is alternating at a frequency of 50,000,000 hertz, then in one second it will undergo 50,000,000 cycles, and these 50 million cycles will be able to travel for 300 million meters in that time. Each of them, then, must stretch over a distance of 300/50, or 6, meters, so the length of each wave, or wavelength, is 6 meters.

If frequency is expressed in megahertz or megacycles, the conversion is simplified and becomes wavelength in meters = 300/f where f is frequency in Mc.

In dealing with any ac circuit, it's essential to remember that what makes it ac is the fact that the current's direction reverses as time passes (which requires current intensity to change with time, as well). This fact makes ac behave very differently from dc in many instances. One of the differences shows up when we try to measure ac voltage or current, and we'll look at that in a little while. Another difference brings us back to that one remaining major electromagnetic effect, which we postponed looking at in the previous discussion. It's time, now.

We have seen, with the help of Maxwell's theory, how a flow of current is always associated with a magnetic field, and have also learned that a magnetic field in motion is always associated with either a current (if a complete circuit is present) or a charge (if no complete circuit is available). It follows, with a little thought, that if a current is flowing in a circuit and anything changes the flow of the current, the associated magnetic field must change – and this resulting change must, in and of itself, be associated with a "secondary" or "self-induced" current which is completely different from the original current.

As it happens, this "self-induced" current is of such a polarity as to oppose the change of original current which called it into being in the first place, which means that electric current flow has a property very similar to that called "inertia" in ordinary moving objects. This property tends to keep any current flow constant, and opposes any change.

Because it is produced by "self-induced" currents, this inertia-like property is called "inductance," and it is measured in a unit known as the "henry." The usual definition of inductance involves the "line of magnetic flux" which we saw much earlier is probably imaginary rather than real. By this conventional definition, inductance is a measure of the number of lines of flux which encircle the total

current ("linkages"), per ampere of current. The henry is defined in this manner as the number of linkages divided by current in hundred-millionths of an ampere.

Although this definition leads to some complicated mental corkscrews, when one attempts to figure out how to count the number of imaginary lines in an unbounded region of space, it's probably as good as any other. In actual practice, inductance is measurable only by its effect in a circuit.

The "true" inductance of any specific inductor depends not only upon the material, shape, and size of the inductor, but also upon the amount of current flowing in it, the rapidity with which current flow changes, the number, size,. conductivity, shape, and proximity of all surrounding objects, and several other factors.

With so many uncontrolled variables in the picture, any measurement or calculation which claims to give "true" inductance is more than somewhat open to doubt!

The most important fact to keep in mind about inductance is that it represents an effect which impedes any change of current flow in a circuit. The more rapid the change, the greater the effect. Similarly, the greater the absolute flow, the greater the effect. Once a current flow becomes steady, however, its associated magnetic field is fixed and does not move. As a result, the "self-induced" current disappears, and inductance is no longer a factor.

Thus inductance applies to dc circuits only during the small periods of time when current flow is changing. Since current flow in an ac circuit is continually in a state of change, inductance is an important factor in the functioning of ac circuits.

Now let's look at some of the differences in measurement between dc and ac.

In most dc circuits, measuring voltage or current is relatively simple. Both voltage and current are steady as time passes, and all we must do is determine the intensity.

But in an ac circuit, current is constantly reversing its direction and voltage follows right along (though in some ac

circuits there may be a time delay between current and voltage). If we want to determine intensity, we must also determine just when to take the measurement.

Because the current is zero at two points in the cycle, at a positive peak at one point, at a corresponding negative peak at another point, and at all other points is balanced by a corresponding value of opposite polarity, if we simply take the average intensity over a complete cycle, both current and voltage will average out to zero regardless of the peak values of either.

This is exactly what happens when we try to measure ac with a dc meter. The meter faithfully averages values over complete cycles and indicates zero, even though the actual energy may be enough to burn the meter out.

One way of measuring ac might be to look only at half of the cycle, and take the average over that half-cycle. Then we could multiply the reading by two to account for the other half-cycle, or simply ignore it. This kind of measurement is sometimes made, and it's called the "average" value.

Unfortunately, the voltage and current readings we get by "average" measurement of ac don't correspond very well in practice to dc readings. We expect a 110-volt light bulb to have the same brightness on 110 volts of ac that it does on 110 volts of dc. If our 110 volts of ac is based on an "average" reading, the bulb will be much brighter on the ac.

It would be nicer to have a method of measuring ac which would give readings directly comparable to dc values. Such a method exists; we can measure the amount of heat generated by ac in a resistor, and find out how much dc is necessary to produce the same amount of heat.

Such a value is known as the "effective" value of the ac, and also as the "rms" value. The "rms" stands for "root mean square," and refers to a mathematical technique used to convert other kinds of measurements to effective values.

When ac voltage or current is not labelled as being in some other method, the effective or rms value is understood. Thus the 115 volts of the ordinary wall plug is 115 volts rms; the "average" voltage of this same plug is just under 103.

Sometimes the easiest way to measure ac is to measure intensity from zero to either peak. This is known as "peak" voltage, and its value is 1.414 times the rms value for the same signal. "Peak" voltage of 115-volt household power is about 163 volts, which is why some simple power supplies produce about 150 volts of dc from a "115-volt" input. It's "peak" voltage that you feel when you touch a defective appliance and get shocked.

In a few cases the most meaningful measurement is from one peak to the other, or "peak to peak" readings. With a sine wave signal, this is 2.83 times the rms value or twice the peak reading; with other ac waveforms there may be no way to relate readings. Peak-to-peak values are important because they represent the maximum pressure or potential impressed by the signal upon any insulators.

In an ac circuit, voltage, current, and resistance are not related so simply as they are in a dc circuit. This means that in order to handle ac, we must make some minor modifications in Ohm's Law. Unfortunately, our space for each installment of this course is somewhat limited, and so we must delay any discussion of the modification until next time when we will go on to examine more effects of ac. Now we must go on to see just what makes a circuit.

What Makes A Circuit? All the way through this installment, we've been taking the word "circuit" for granted in order to build some basic ideas. Now let's find out just what makes a circuit a circuit.

One of the standard textbooks used to introduce engineering students to radio defines an electric circuit as "the path taken by an electric current from its source through all of the components of the circuit and back to the source."

The only thing wrong with this definition is that it uses the idea of "circuit" to define "circuit." Let's modify it just a bit, and call a circuit "a continuous path through which an electric current may travel." That's not completely accurate

either, but by taking the two definitions together we can proceed.

For now, let's look only at dc circuits. We'll go into ac circuits in the next installment. We'll assume that a battery is our source of electric current during the rest of this discussion.

The simplest circuit, using our definition rather than the textbook version, would be merely a length of wire connected from one pole of the battery to the other. Current would flow, but not much else would happen.

In order to do anything useful, we must include "components" in our circuit, and that brings us to the textbook's definition.

The most common qualities affecting simple electric circuits are resistance, capacitance, and inductance. Of these, capacitance and inductance are effective only when current flow is changing, so we'll consider only components which produce resistance when they're included in our circuit. Such components are called resistors.

Each component in a circuit is known as a "circuit element." The connecting wire is not usually considered to be an element if the circuit contains anything else.

Circuits are divided into three major categories, known as "simple," "series," and "parallel" circuits. "Simple" circuits are those which contain only one circuit element, such as the one shown as A in Fig. 7.

"Series" circuits contain two or more elements connected end to end, so that the current will pass first through one element, then through the next, and so forth until the current has passed all the way around the circuit. A series circuit of two resistors is shown as B in Fig. 7. Elements of a series circuit are said to be connected "in series."

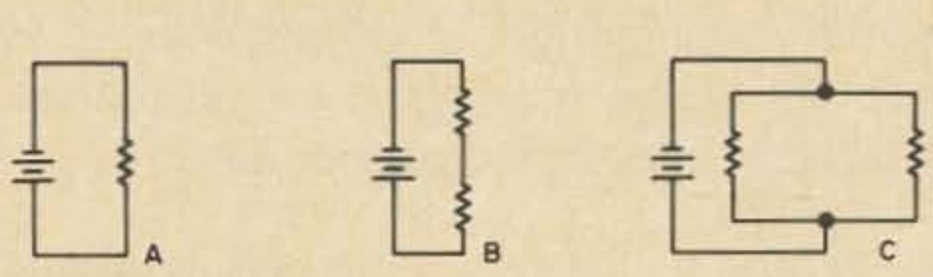


Fig. 7. These are, respectively, "simple" circuit (A), "series" circuit (B), and "parallel" circuit (C). Number of circuit elements (resistors here) and division of current flow are factors determining which type is which.

"Parallel" circuits contain two or more elements, none of which are connected in series. Each element is connected directly to the power source, so that current which flows through one element does not flow through any of the others. A parallel circuit of two resistors is shown as C in Fig. 7. Elements of a parallel circuit are said to be connected "in parallel."

The major difference between "series" and "parallel" circuits is that in a series circuit, all the circuit current flows through each element in turn, while in a parallel circuit, that current which flows through one element returns directly to the source and does not flow through any other elements in the circuit.

From this difference, we can determine how resistors combine in both series and parallel connections to give total resistance. If two resistors are connected in series, all the circuit current must flow through each. In the first, a part of the energy will be converted to heat, leaving less for the second. In the second, the remaining energy will be converted to heat, so that none remains to return to the source.

Let's use the circuit of Fig. 7B, and assume that one of the resistors has a resistance of 5 ohms and the other is a 10-ohm unit. Let's assume also that we measure total circuit current and find it to be 2 amperes.

By the rule set forth in Ohm's Law, the voltage across the first resistor must be 2 x 5 or 10 volts (E=IR). Across the second, it's 2 x 10 or 20 volts. Total voltage of the battery, then, must be 10 + 20 or 30 volts.

Now we apply Ohm's Law again, using the 30-volt value we just calculated for battery voltage, and the 2-ampere measurement of circuit current. Resistance must be 30/2 or 15 ohms (R=E/I). In a series circuit of resistors, then, total resistance must be the sum of the individual resistances.

Let's try it again with the same two resistors connected in parallel (Fig. 7C) and using the same battery. We know now that the battery's voltage is 30. We can use Ohm's Law to calculate current through each resistor individually. Through the 5-ohm resistor, it's 30/5 or 6 amperes (I=E/R), and through the 10-ohm unit it's

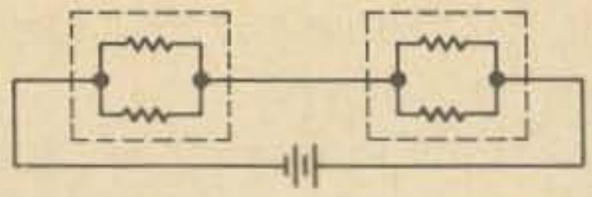


Fig. 8. Not all circuits are as simple as plain "series" or "parallel" connections. Subcircuits shown in dotted boxes are paralled connections, but subcircuits themselves are in series. Total circuit is called "series–parallel" but it could be reversed to "parallel–series" without changing components or connections simply by re-drawing dotted boxes. Most real circuits are like this, only more so.

30/10 or 3 amperes. Since none of the 6 amperes going through the 5-ohm resistor flows through the 10-ohm unit, the total circuit current must be the sum of 6 and 3 or 9 amperes.

With a 30-volt source and 9 amperes circuit current, we return to Ohm's Law and calculate total resistance as 30/9 or 3.333 ohms (R=E/I) – less than that of either resistor alone.

Effective values of resistors in parallel can be calculated in other ways, too, and some are much simpler. The way we've done it here, though, shows *why* resistance is lower, and is the basis for all the others. We'll meet the other ways next time around when we go into the manner in which other circuit elements combine in series and in parallel.

Incomplete circuits, which are complete except for their power source, can themselves be considered as a sort of circuit element in a larger circuit. Figure 8 shows a larger circuit with two such "subcircuits" in it, each outlined by dotted lines. Each subcircuit is a parallel circuit, but the two are connected in series. Such an arrangement is known as a "series-parallel" circuit.

Most actual working circuits are even more complex than Fig. 8. The science of electrical engineering is largely devoted to determining how circuit elements are combined to form circuits, and using this knowledge to design new circuits.

Next Time

We've reached the end of our space for this installment, and still have not answered all the details of the FCC questions we chose for this round. This happened because the FCC questions mix

together some relatively simple ideas which are true in dc circuits, and some much more difficult concepts which apply only to ac circuits. This time, we've had to establish the foundation for ac circuits – but we haven't had space in which to build on it.

Next month, we'll go more deeply into ac circuits and complete the answers to this month's FCC questions, as well as to several more involving finer points of ac circuit theory. From there, we'll be in position to tackle more advanced problems.

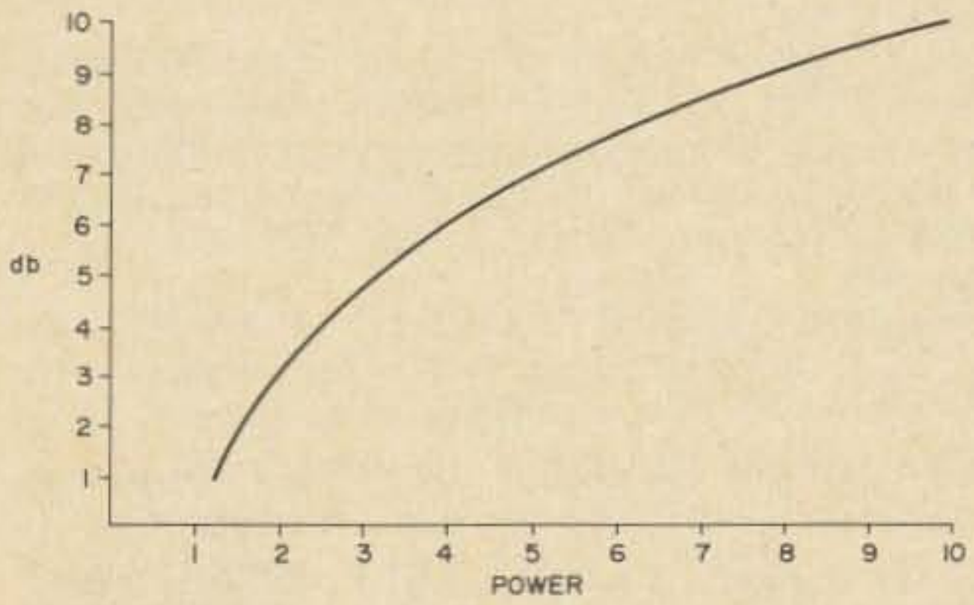
If you want to study elsewhere while waiting, there are few texts available which follow the manner in which we're developing basic theory. If you can obtain a copy of "A Source Book in Physics" (by W.F. Magie, Harvard University Press, Cambridge, Mass., 1935, 10th printing 1969) it will give you the original reports of most of the leading scientists in electricity and radio up to 1900.

. . . Staff ■

DB to Power

Here is a chart for changing decibels to power gain. Examples:

If an exciter runs 100 watts and it is fed into a 500 watt linear amplifier, the power gain would be five times and, by using the chart, the decibel gain would be 7 dB.



If 100 watts is fed to an antenna and the feedline has 3 dB loss, by using the chart, half of the power is delivered to the antenna.

Higher values of dB can be calculated by multiplying both co-ordinates by ten, by a hundred, etc.

Doug Pongrance WA3JBN ■

Technical Aid Group

Please refer any questions of a technical nature to one of the following members of 73's Technical Aid Group. These are dedicated amateurs who really want to be of help and do so without compensation. Be sure to state your problem clearly and enclose a S.A.S.E. for a reply.

John Allen K1FWF, high school student, 51 Pine Plain Road, Wellesley, **MA** 02181. HF and vhf antennas, vhf transmitters and converters, AM, SSB, product data, and surplus.

Stix Borok WB2PFY, high school student, 209-25 18 Avenue, Bayside, **NY** 11360. Novice help.

Joseph W. Botwinick K2EJI, 131-60 231 Street, Laurelton, **NY** 1141. Technical information required for Novice, General and other licenses.

J. Bradley K6HPR/4, BSEE, 3011 Fairmont Street, Falls Church, **VA** 22042 General.

Michael Burns Jr. K9KOI, 700 East Virginia Avenue, Peoria, **IL** 61603. AM, SSB, receivers, transmitters, digital techniques, novice help, general.

Glen H. Chapin W6GBL, 3701 Trieste Drive, Carlsbad, **CA** 92008. HF and vhf antennas, novice transmitters and receivers, vhf converters, semiconductors, receivers AM, SSB, general, surplus.

Ted Cohen W4UMF, BS, MS, PhD. 6631 Wakefield Drive, Apt. 708, Alexandria, **VA** 22307. Amateur TV, both conventional and slow scan.

Bruce Creighton WA5JVL, 8704 Belfast Street, New Orleans **LA** 70118. Novice help and general questions.

George T. Daughters WB6AIG, BS, MS, 1560 Klamath Drive, Sunnyvale, **CA** 94807. Semiconductors, vhf converters, test equipment, general.

Gary De Palma WA2GCV/9, P.O. Box 1205, Evanston, **IL** 60204. Help with AM, Novice transmitters and receivers, vhf converters, semiconductors, test equipment, digital techniques and all general ham questions.

Steve Diamond WB6UOV, college student, P.O. Box 1684, Oakland, **CA** 94604. Repeaters and problems regarding legality of control methods. Also TV, novice transmitters and receivers, vhf antennas and converters, receivers, semiconductors, and product data.

Frank M. Dick WA9JWL, 921 Isabelle Dr., Anderson, **IN** 46013. Will answer queries on RTTY, hf antennas, vhf antennas, vhf converters, semiconductors, mobile, general, and microwave.

Willy P. Everaert ON4WM, Park ten Hove, 97, 9230 Melle, **Belgium**. SSTV (test tapes available), weather satellite picture decoding systems, and digital circuits. Appreciates IRC's for return postage on inquiries.

David D. Felt WB6ALF, 79 East Highland Ave., Sierra Madre, **CA** 91024. Semiconductors, IC's, television, test equipment, product data.

Louis E. Frenzel, Jr., BAS, 11287 Columbia Pike, Silver Spring, **MD** 20901. Electronic keyers, digital electronics, IC's commercial equipment and modifications, novice problems, filters and selectivity, audio.

Paul Gorrell, high school student, P.O. Box 228, Mashpee, **MA** 02649. Novice transmitters and receivers, hf equipments, CB to ham gear conversion. Marine to ham gear conversion, Civil Air Patrol Communications, all aspects.

Orris Grefsheim WA6UYD, 1427 West Park, Lodi, **CA** 95240. TV, hf antennas, SSB, vhf antennas and converters receivers, semiconductors, and general questions.

Bob Groh WA2CKY, BSEE, 123 Anthony Street, Rochester, **NY** 14619. Specializes in vhf/uhf solid-state power amplifiers, but will be glad to make comments on any subject.

D. E. Hausman VE3BUE, 54 Walter Street, Kitchener, Ontario, **Canada**. Would like primarily to help Canadians get their licenses. Would be able to help with Novice transmitters and receivers.

Charles Hill WA7LQO, 237 Bridge St., Baker, **OR** 97814. Slow scan TV.

Sgt. Michael Hoff WA8TLX, Box 571, 6937th Comm. Gp., APO **NY** 09665. Help with all types of RTTY both commercial and military. Also data techniques. Covers conversion of military RTTY equipment.

Iota Tau Kappa Radio Fraternity W7YG, Multnomah College, 1022 SW Salmon St., Portland, **OR** 97205. This group of radio amateurs will answer any technical questions in the field of electronics.

Douglas Jensen W5OG/K4DAD, BA, BS, 2505 Broadway, #1704, Houston, **TX** 77012. Digital techniques, digital and linear IC's and their applications.

Jim Jindrick WA9QYC, 801 Florence Avenue, Racine, **WI** 53402. Novice transmitters and receivers, general.

Ira Kavaler WA2ZIR, BSEE, 671 East 78 Street, Brooklyn, **NY** 11236. SSB transmitting, color TV, computer programming and systems, digital radio and remote control, rf transmission lines, dipole design, audio amplifiers, linear and class C rf amplifiers.

Ronald King K8OEY, Box 227, APO **NY**09240. AM, SSB, novice transmitters and receivers, hf receivers, RTTY, TV, test equipment, general.

Ken Knecht K8VNT/2, Box 39, Clintondale, **NY** 12515. Novice help and general questions.

G. H. Krauss WA2GFP, BSEE, MSEE, 70-15 175 Street, Flushing, **NY** 11365. Will answer any questions, dc to microwave, state-of-the-art in all areas of communications circuit design, analysis and use. Offers help in TV, AM, SSB, novice transmitters and receivers, vhf antennas and converters, receivers, semiconductors, test equipment, digital techniques and product data.

Tom Laffin W1FJE, Hillsboro, **NH** 03244. Authoritative information on ham radio's fundamental beginning works. Documentary info on

the historical scientific period 1887 to 1954. References include but not limited to The Annual Report of the Smithsonian Institution, electrical engineering texts, National Electrical Codes, the hard-to-find data.

Bert Littlehale WA1FXS, 47 Cranston Drive, Groton, **CT** 06340. Novice transceivers, test equipment and homebrew projects gone wrong.

J. J. Marold WB2TZK, 279 Farmers Ave., Lindenhurst, **NY** 11757. General.

Wayne Malone W4SRR, BSEE, 8624 Sylvan Drive, Melbourne, **FL** 32901. General.

Charles Marvin W8WEM, 3112 Latimer Road, RFD 1, Rock Creek, **OH** 44084. Will help with any general amateur problems.

Carl Miller WA6ZHT, 621 St. Francis Drive, Petaluma, **CA** 94952. Double sideband.

Fred Moore W3WZU, broadcast engineer, 4357 Buckfield Terrace, Trevose, **PA** 19047. Novice transmitters and receivers, hf and vhf antennas, vhf converters, receivers AM, SSB, semiconductors, mobile test equipment, general, product data, pulse techniques, radio astronomy, bio-medical electronics.

Eduardo Noguera M. HK1NL, EE. RE, P.O. Box Aereo 774, Barranquilla, Columbia, **South America**, antennas, transmission lines, past experience in tropical radio communications and maintenance, hf antennas, AM, transmitters and receivers, vhf antennas, test equipment and general amateur problems. Can answer questions in Spanish or English.

Tom O'Hara W6ORG, 10253 East Nadine Temple City, **CA** 91780. ATV, vhf converters, semiconductors, general questions.

John Perhay WAØDGW/WAØRVE, RR #4 Owatonna, **MN** 55060. AM, SSB, novice transmitters and receivers, hf receivers, vhf converters, semiconductors, mobile, product data, general. Has access to full specifications on almost all standard components presently catalogued by American manufacturers.

Arthur J. Prutzman K3DTL, 31 Maplewood, Dallas, **PA** 18612. All phases of ham radio. Can assist with procurement of parts, diagrams, etc.

Howard Pyle W7OE, 3434 7th Avenue, S.E., Mercer Island, **WA** 98040. Novice help.

Robert Scott, 3147 East Road, Grand Junction, **CO** 81501. Basic electronics, measurements.

Pfc Grady Sexton Jr. RA11461755, WA1GTT/DL4, Hedmstedt Spt. Detachment, APO **NY** 09742. Help with current military gear, information from government Technical Manuals.

Walter Simciak W4HXP, BSEE, 1307 Baltimore Drive, Orlando, **FL** 32810. AM, SSB, Novice transmitters and receivers, vhf converters, receivers, semiconductors, mobile, test-equipment, general.

Richard Tashner WB2TCC, high school student, 163-34 21 Road, Whitestone, **NY** 11357. General.

Roger Taylor K9ALD, BSEE, 2811 West Williams, Champaign, **IL** 61820. Antennas, transistors, general.

Jon Teich WB2JAE, 22 Olden Road, Ediron, **NJ** 08817. General assistance and problems with rigs.

James Venable K4YZE, MS, LLB, LLM, 119 Yancey Drive, Marietta, **GA** AM, SSB, novice gear, vhf, semiconductors, and test equipment.

Hugh Wells W6WTU, BA, MA, 1411 18th Street, Manhattan Beach, **CA** 90266. AM-FM receivers, mobile test equipment, surplus, amateur repeaters, general.

William G. Welsh W6DDB, 2814 Empire Ave., Burbank, **CA** 91504. Club licensing classes and Novice problems.

Michael Winter DJ4GA/W8, MSEE, 718 Plum Street, Miamisburg, **OH** 45342. HF antennas, AM, SSB, novice gear, semiconductors.

Joseph Zaroff WN3NEQ, RR 1, Washington Crossing, **PA** 18977. Novice gear, antennas, vacuum tube circuits, construction of homebrew projects.

Protection for Grid Dipper Coils

All who have used one will agree that a grid dip meter is indispensable to the active homebrewer. It will insure that your tripler will triple rather than double. It will double as a wavemeter or signal generator and in general is one of the most useful test instruments for the builder.

As a result of the multiple uses to which they are put, the average grid dipper soon becomes rather dog-eared. The coils especially are subjected to abuse above and beyond the call of duty. Some coils have the protection of an outside coil form which keeps the coil proper in good condition; however, more often the coil is wound on the outside of the form and covered with a thin layer of coil dope or shrinkable tubing. Either of these soon loses its effectiveness and mechanical problems set in.

Having experienced the above problem with my dipper, I have tried several cures. The one to be described answers every requirement. I bought a bottle of "Clear-Cast" casting plastic from a local handicraft supply store along with the required small bottle of catalyst. Mix a small portion (3 to 4 ounces) according to the directions on the bottle. Remove any loose coil dope or tubing and dip the coil into the plastic up to the terminals. Remove the coil and let it drip a few moments, then suspend it, terminals up until dry. Repeat with each coil. A second coat may be added after the first is dry, but the mixture is thick enough that it really isn't necessary.

Tests before and after processing indicate no change in coil characteristics. With this tough coating the life of your coil should be extended to the life of the terminals.

William P. Turner, WAØABI

Turner M+2

A microphone with a built-in compressor/amplifier that can give you 20 dB more talk power on sideband.

With sideband transceivers getting more plentiful on the used market and the very reasonable price on the Heath single banders and the WRL Duo Bander, many of us have gone mobile and more are giving it serious thought.

The big disadvantage is the inefficiency of the antenna system. A 100 ampere alternator with the Heath Kompact KW linear will help overcome the antenna losses. But so will fully modulating the transceiver by adding a speech compressor.

The Turner M+2 microphone has a silicon transistor compressor built in, complete with a 7-volt battery that will last under normal conditions up to twelve months. There is an output control on the back of the mike.

Perhaps you will be interested in the results I've had using the M+2 microphone with my Heath HW-12A and Kompact KW combination. I first used the Turner 350-C, the one that Heath sells for mobile use, and got signal strength reports from several local stations. Then I switched off the linear and changed to the M+2 and found that the signal reports were exactly the same as before!

Using both the M+2 and the Kompact KW with the HW-12 results in a tremendous mobile signal.

You should use a scope to properly set the gain controls on the mike and on your rig since the output of the M+2 is very strong; as great as -30 dB to 1 megohm load. With this much talk power you can very easily overmodulate or flat-top. I run the mike volume control at 9 and the mike gain on the rig at about 2 o'clock.

The price of $23.70 is probably the least you will ever pay for 20 dB gain. Good luck with your BIG mobile signal.

. . . Ralph Compton WA5JVQ ■

YOUTH FORUM REVISITED

With all the turmoil among our young people today it's almost dangerous to entitle a column youth forum. Relax; I'm not going to urge anybody to seize the administration building at the ARRL or any such nonsense. The purpose of this column is to promote interest in ham radio in our teenagers.

The problem is not to get them to get their Novice licenses; it's so easy that anybody can do it in a month or less. The problem is to get them to go for their General or Advanced. Many Novices never go on to get their higher class license. The most common excuse is that they "lost interest." I can see where they would. Let's face it – the Novice band is crowded, there's very little DX, and no voice operation. You can work just about as much DX on Citizens' Band as on the Novice band – and you can use voice.

While talking to one of the local Novices, I noticed that his interest was beginning to drop. I invited him over to the shack after supper to try and boost his morale. I had the transceiver running when he came in and invited him to tune around 20 meters to get the feel of it. The results were amazing. He went wild when he heard a few DX stations. I worked a couple to impress him a little more. For the clincher, I went down to 75 and let him listen to some of the European gang coming in. This left him numb. His best DX on 80 had been a WN9. The last time I saw him he was hitting the books hard and I believe he's going to make it now that he has an idea of what ham radio is really like.

Many more people would be willing to work for a ham license if they had a good idea of what ham radio is like. Many of the magazines which are aimed at electronics in general (PE, EI) look at ham radio from a Novice point of view. The ham magazines are incomprehensible to a non-ham.

So if you know someone who has expressed an interest in ham radio, invite him to the shack and show him why it's worth the effort to learn code and theory. Give him a true picture of ham radio; don't just hand him an old copy of *How to Become a Radio Amateur*, which shows him how to build a regenerative receiver for the ham bands (and other white elephant projects).

Many Novices come to me asking what equipment they should buy. My checking account is still hurting from some of my financial misadventures as a Novice, so I guess that puts me in the "veteran" class. The lessons I learned might be of value to others, too. If interest warrants, I will list a few tips in a future issue on spending money for ham equipment.

. . .Andy Bourassa WA1LJJ ■

73 BOOKS FOR HAMS

VHF ANTENNAS

This handbook is a complete collection of up-to-date information about VHF and UHF antennas, with design hints, construction and theory. If you've been wondering what array you need, this book will give you enough background to make the right decision. $3

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The Amateur Television Anthology is a collection of the technical and construction articles from the *ATV Experimenter*, edited by WØKYQ. If you're interested in ATV, this is the book for you. It covers the gamut from the simple to the complex in amateur television equipment. $3

73 USEFUL TRANSISTOR CIRCUITS

If you've been looking for a transistor circuit to do a special job, chances are there is a circuit in this book that will give you a head start. It covers circuits for audio, receivers, transmitters and test equipment. $1

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Vol. II. This book contains selected technical and construction articles taken from FM Magazine after March 1968. **$3**

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73 Magazine

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MOBILE CW RECEIVER

Just before vacation time many amateurs begin to get the urge to build portable equipment. Often last-minute construction jobs never get finished in time for vacation, especially if new circuits using FETs are tried. This is a story of a similar rush project where reliable tube circuits were used to finish the receiver the day before vacation. The receiver worked so well, the information is presented here for those of you who want to plan ahead for next year's vacation trip.

This 80–40 meter receiver uses four 6U8 tubes so that only one tube need be taken along on field trips for the spare. Each pair of tubes has the filaments wired in parallel so that the entire filament supply can be operated from the 12V car battery. The plate supply only draws about 15 mA, and the receiver can be run from

Ed Marriner W6BLZ
528 Colima Street
La Jolla CA 92037

three 45V dry batteries if a mobile supply is too much work to construct.

Designed especially for CW reception, a product detector was used. A 2.5 kHz bandpass i-f filter was made from two surplus low-frequency crystals. Plug-in coils were used to make wiring and band changing easy. Only one coil has to be changed when going to the other band. The mixer and rf coils are tuned to both 80 and 40 meters by using a large broadcast-type tuning condenser which covers both of the bands in the tuning range.

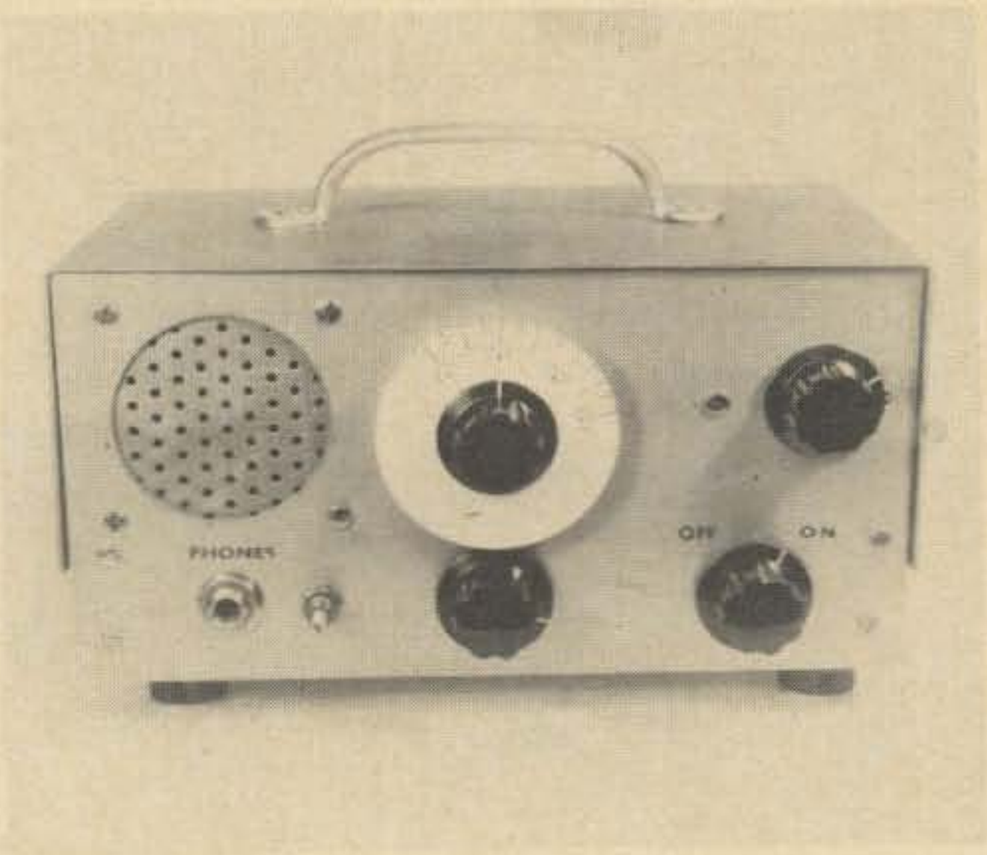
The low frequency i-f gives good selectivity, but images from strong commercial stations could pop in the ham band if they are near in location.

Theory

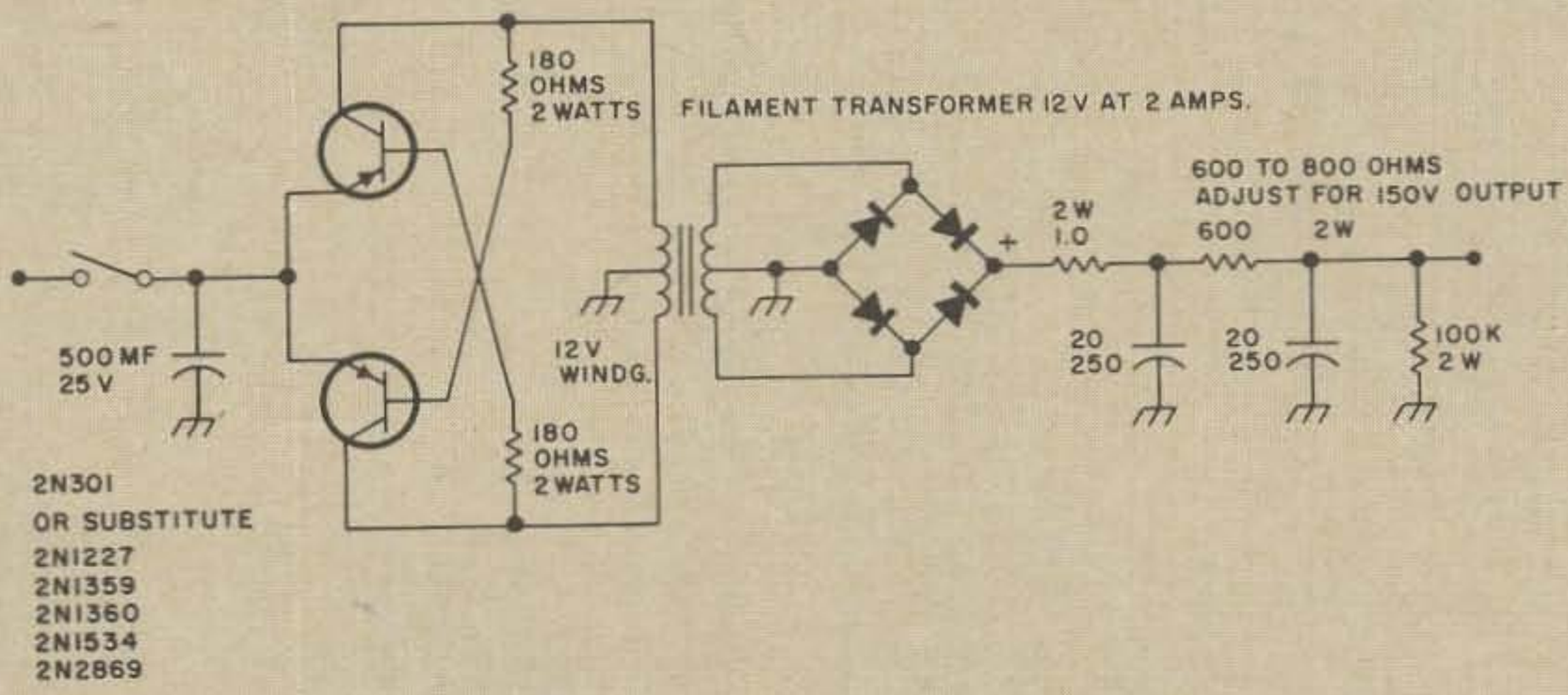
Starting off with the rf stage, the antenna signal is coupled to the grid through L1 and L2 and then fed to the mixer through L3 and L4. These coils are tuned by a ganged 365 pF tuning condenser so that one coil covers both the 80 and 40 meter bands. The ratio of coil to condenser is adjusted to have enough capacity to prevent unstable oscillations which might reflect back on the oscillator tuning.

The variable oscillator which tunes 3955–4455 kHz for the 80 meter band or 7455–7755 kHz for the 40 meter band is injected to the mixer through a cathode follower. This follower is necessary to prevent signals in the mixer from getting back into the variable oscillator and causing frequency shift. The follower is necessary. The oscillator oscillates with a strong signal to give enough injection to the mixer. Insufficient signal to the mixer also causes mixer oscillations.

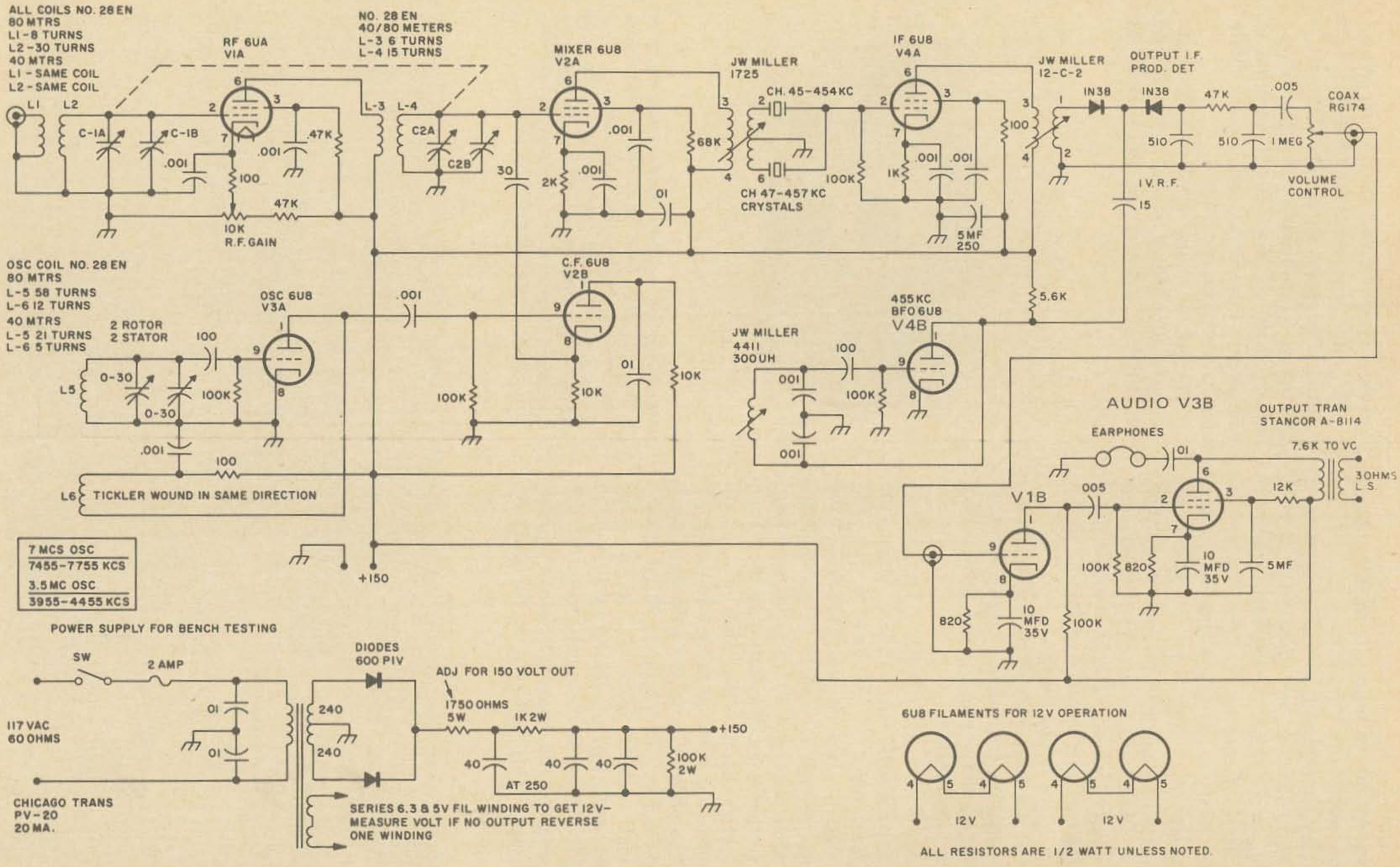
The output of the mixer is fed through a crystal filter which has low loss, and only one i-f stage was necessary since there was



Front view of receivers showing the epicyclic ball-bearing drive head for the dial fitted with a home made dial plate. The mechanism is 10 to 1 and can be obtained from British Radio, 142 Wisconsin Ave. NW Wash. D.C. Upper right are the ganged rf and antenna coil tuning condensers. Center lower knob is the rf gain control.



Mobile power supply for CW receiver.



Schematic diagram of mobile CW receiver. Note: power supply should be kept away from receiver to keep field away from modulating the audio output transformer.

enough gain, and selectivity was obtained in the low-frequency channel crystals. This signal output from the i-f was fed into a product detector and then to the audio stages.

Circuit Discussion

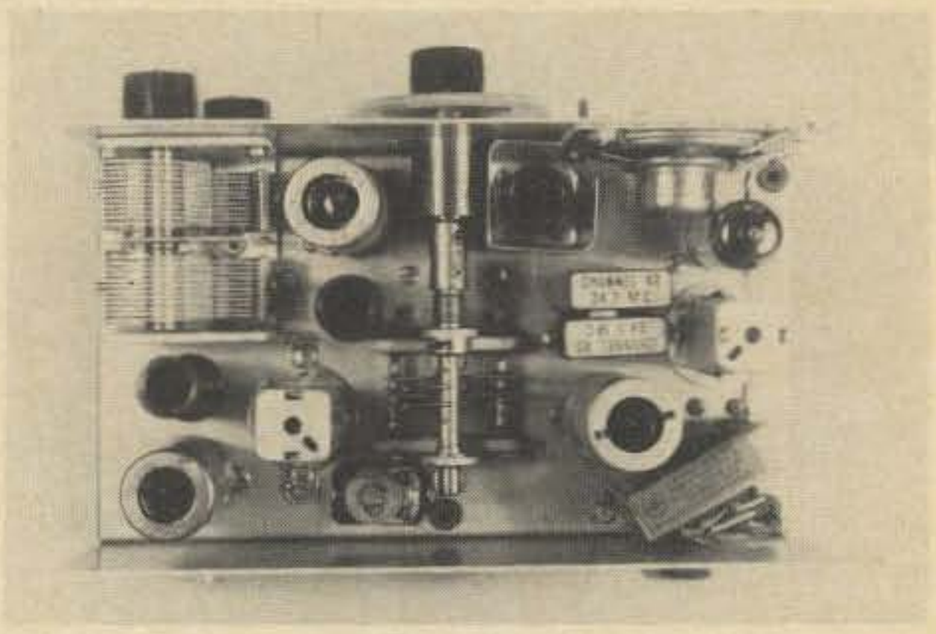
Power to the receiver should not exceed 150V to comply with requirements to the triode section of the 6U8s if long life is expected. As it turns out, there is plenty of gain using 150V, and the receiver works very satisfactorily with only 150V or less. Volume is more than enough for earphone reception, but the 6U8 will drive a speaker, although the tubes were not designed as audio output speaker drivers. The output transformer is a little higher impedance than necessary, but it cuts down on the tube current and is better when used as the auido choke for earphone reception. The tiny transistor speaker could be replaced with a larger speaker – there is enough drive.

The diodes used in the product detector should be of the germanium type to obtain leakage; do not try to use silicon types if the 1N67s or 1N58s are not available. Low-leakage diodes cause the signal to block.

Crystal filters were made from two surplus crystals to give a selectivity of 3 kHz. If too narrow a bandpass is used the i-f stage will oscillate. A J. W. Miller No. 1725 i-f transformer specially designed for coupling into the crystals was used. It tunes the 455 kHz channel 45 and channel 47 ranges. Experimenting is in order if you have the time to try various bandwidth crystals and adjustments of the i-f transformers, but the crystals indicated will give all the selectivity necessary. The i-f signal needs about 1V from the bfo to mix properly and be passed on to the 47 kΩ, and 500 pF capacitors used as the rf filter.

Construction and Tuning

The receiver is built on a California Chassis type A-119 which is 4¼ x 8 x 1½ in. The dial drive is a British Radio vernier type No. 892 with a 5-to-1 ratio. More ratio could be used because the receiver does tune sharply. Parts placement can be changed around, but it is suggested the tube arrangements be used as shown. It was found necessary to remove the variable oscillator from the same envelope because the mixer tube pulled the oscillator. Experience is a great teacher, and some of the troubles can be prevented by following instructions.



Top view of receiver with the crystal filter and output i-f transformer to the left of the tuning condenser. Note the oscillator coil is shielded.

Once the receiver is wired it can be aligned by listening to the 40 meter signals, although initial adjustments can be made with a signal generator and a modulated tone when peaking the i-f's. During the tuning, be careful you don't screw the slugs off the threads. Since only 150V was used it was not necessary to use the customary 1000Ω and .005 μF bypass condensers around the various supply leads to prevent interaction between circuits. Placing a single 40 μF condenser on the chassis gave

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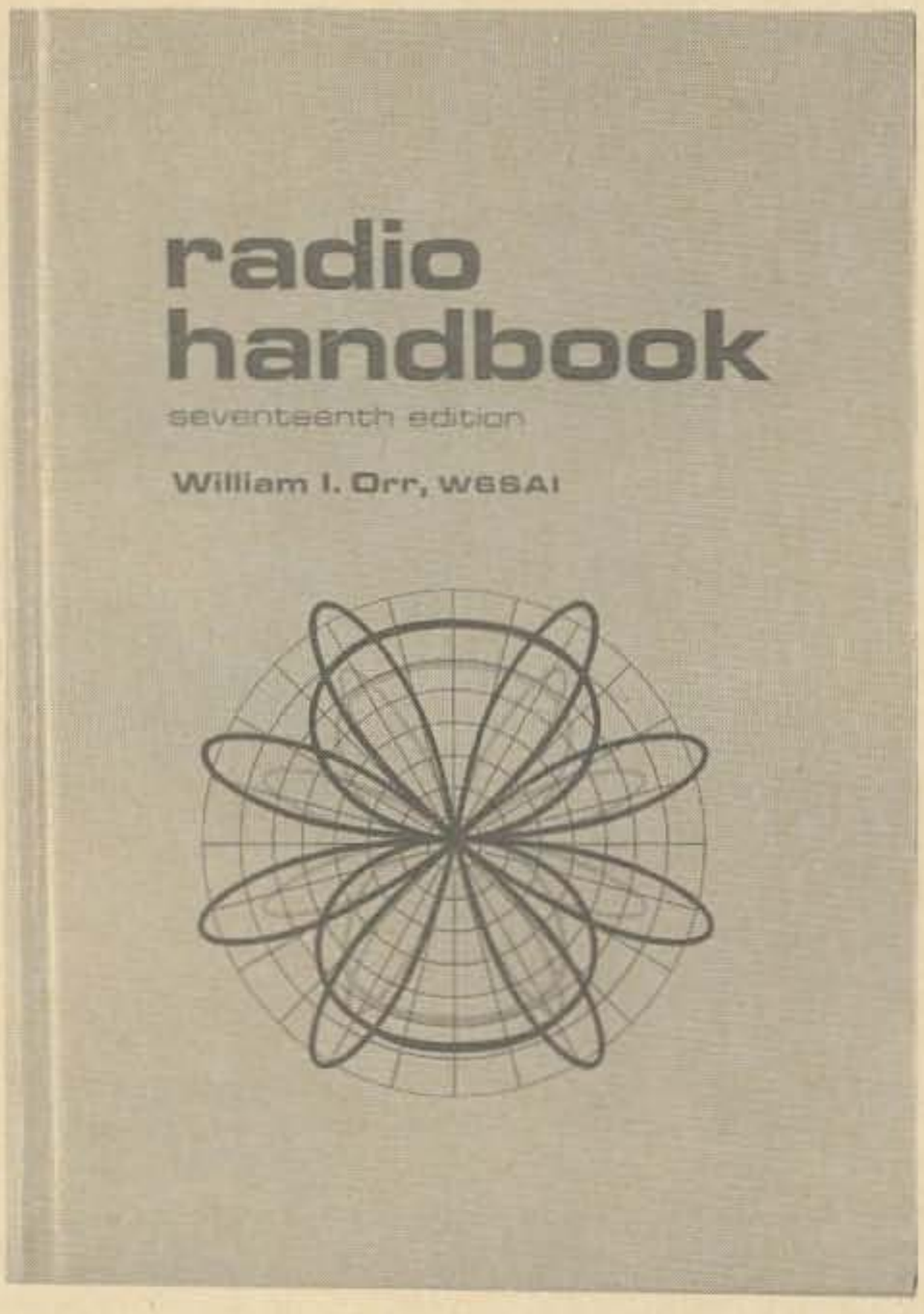

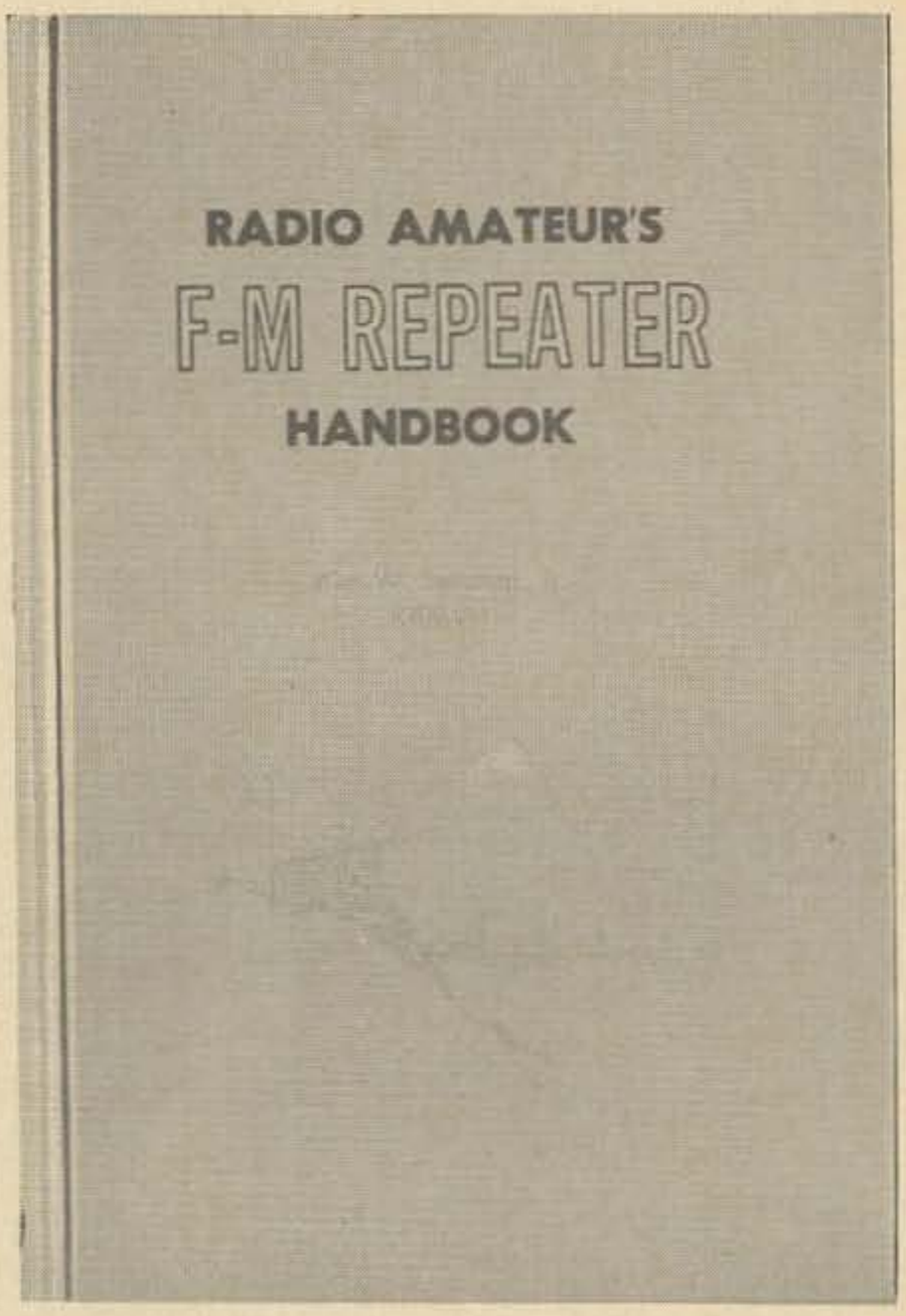

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enough filtering to stop coupling except for the audio supply where a 5 μF and 10Ω resistor helped the filtering.

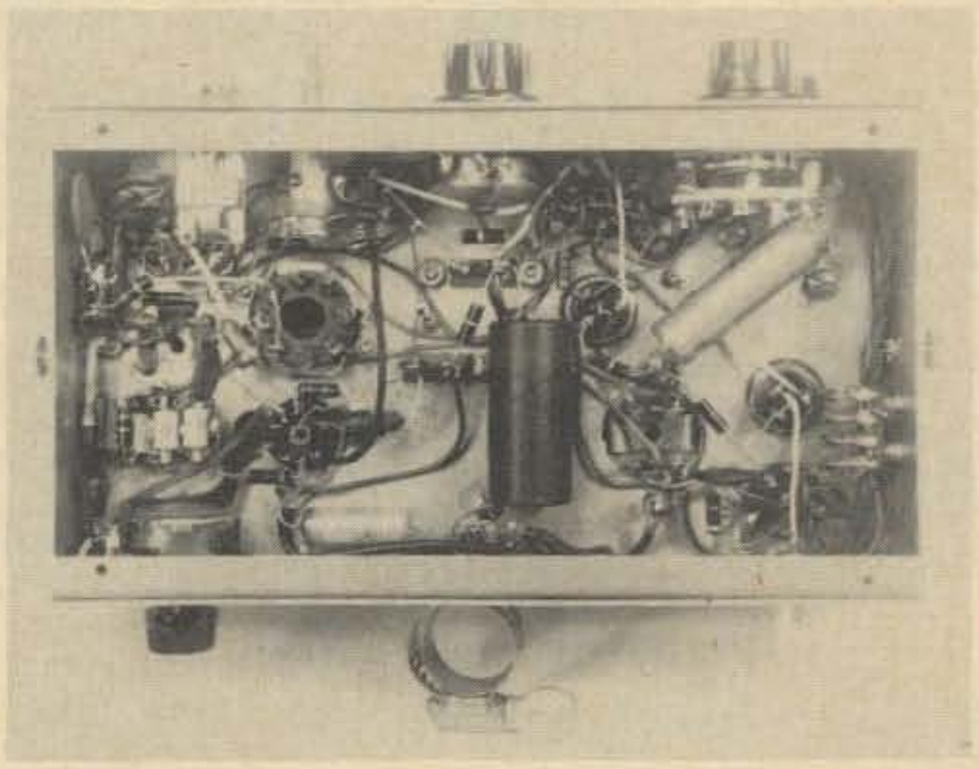
Once the i-f stages are aligned, peak up the rf and mixer condenser C1B and C2B. It is best to set the mixer tuning at a maximum peak, then adjust the trimmer for most signals, and then go back and peak the antenna trimmer. If there is not enough capacity, tuning of the condenser will cause oscillations. The trimmers were set almost full mesh with the number of turns given in the coil table. A separate antenna trimmer could be mounted on the panel if antennas are often changed because the trimmer has to be retuned when another antenna is used. Best performance can be obtained if a good antenna is used, such as an 80 meter or 40 meter resonant antenna, and although the receiver will work on ten feet of wire, the input is designed for low-impedance coupling.

While probably not necessary, it is a good idea to use the EBY tube shields over the tubes to prevent coupling between parts. An aluminum shield between the mixer and antenna coils is another good suggestion. The more shielding is insurance against possible oscillations between circuits.

The circuits in this receiver all tend to be high Q which gives the most signal output; however, it is best to be safe, and back off if necessary on some adjustments to give reasonable output with no oscillations. Since C1A and C2A tune the range 80 to 40 meters, there is no need to change plug-in coils when going from one band to the other. The condenser tracks satisfactorily. The oscillator coil does have to be changed.

The most difficult problem with aligning the receiver is to calibrate the variable tuning condenser. It is easier to pull out plates to obtain the proper bandspread and increase the 0.30 pF trimmer to compensate for the loss in capacity. The output of the oscillator can be picked up on the receiver in the shack if you have one; if not, try using the grid dip oscillator. Make sure the signal is on the high side of the amateur band because it is easy to slip the trimmer over to the low side. Once you set the 7.0 MHz position on zero, the 3.5 MHz position can be brought to zero by spreading the bottom turns of the 3.5 MHz oscillator coil until it is positioned on zero also.

During the tuning process the bfo was assumed to be peaked for a beat note by screwing in and out on the slug coil for proper tone. Try to use two silver mica capacitors across the bfo coil. Heat tends to make the small ceramic types drift.



Bottom view of receiver. Bfo slug coil is between earphone jack and rf gain control.

The details of the adjusting process can become boring to those more familiar with construction but this description should be satisfactory for those building the receiver. It will become apparent as you play with the adjustments what you can and cannot do, or where the limits of adjustment lie.

This receiver performs very well with plenty of volume for all normal portable or mobile work where CW is the primary interest. It will mount on the dash of most autos by cementing magnets to the bottom of the chassis unless you have a padded dashboard. No attempt was made to put it on 20 meters, but it would work except that the images would be more of a problem as you need more selectivity using the 455 kHz i-f's when going to the higher frequencies.

. . . W6BLZ ■

Alan Shawsmith VK4SS
35 Whynot Street
West End, Brisbane, Australia

QSLing

HAM RADIO'S OWN

CON GAME

In every human activity, sadly, there is to be found a racket of some sort and the QSL *situ* in our hobby is no exception. Compared to the magnitude of swindles outside of amateur radio, the card business falls under the classification of petty exploitation.

Those who don't or won't QSL fall into several categories. Firstly, there's the well intentioned bloke who is always *going* to get down to writing out his QSLs – but years have gone past and he's not faced it yet and you could safely take the odds at ten to one that he never will. There are many like this among us whose sins are those of omission, rather than commission. Lack of discipline is probably the commonest of human failings. While it is possible to tolerate these characters and philosophically accept the couple of dollars lost in IRCs, AMs, etc., in a futile attempt at verification, they nevertheless are living a daily lie, in that they blithely go on ending each QSO with "QSL sure"; adding nothing worthwhile to the standard of ethics or goodwill of our hobby.

Then there is that broad group who *don't intend* to QSL. These are the cheaters, the deceivers, and the small-time opportunists. They bring to ham radio the doubtful tone of the rat race outside. To these fellows, ethics and fair play are virtues for the squares. Among them is the type who sends his address with each QSO and promises to reply "as soon as I get yours." The verification never comes. The intention only is to take.

More than one possessor of a rare call is playing the averages. A DXpeditioner in Africa, who subsequently sent no cards, was heard telling a mate in a ragchew, "I've worked one hundred VKs; that should cover me in that direction."

In any company there's always a shylock or an exploiter who wants more than his pound of flesh. One who is determined to *sell* his call at the best possible price and show a little profit on his QSL printing costs at the same time. His request is anything up to five IRCs and SASE with your card – or make a contribution pse? For what? A check shows he has access to

a bureau, so a card is sent via this facility, followed by another, and maybe at a later date, yet another, but ND.

Then we have the manager/ham setup, a combination that's brought more than one piece of connivance into existence. True, the QSL manager has a real place in the modern scene. Most do their job ethically and well and provide a prompt service. Their assistance to hams in isolated areas cannot be overemphasized. But many managers are superfluous and the deceivers in this field are growing. I lay the blame directly on many U.S. hams. Anyone with a rarer than average call is swamped with offers to write the QSL service. The true reason being that the helper helps himself out of the bog of nonentity that threatens to flood those in countries that have a large ham population. It's a two-way status stretch. Both attain greater importance and identity and if the business is handled properly, there's sure to be a little capital profit.

My call sign is not one to be put up in large letters or attract a queue of callers, but offers of QSL services have come from the States (possibly quite ethical) and one commercially minded character wrote from the U.S. offering to relieve me of the workload at a pretty stiff fee per thousand cards sent. A middle man, out to show a profit both ways and gain the status of a manager to boot.

In defense of making panting aspirants pay to obtain a rare QSL, one DXer put it to me this way: "I really only come on the air to give the world a new country. Every time I press the key the queue quickly lengthens to infinity. I make several thousand QSOs a year. The QSL costs are beyond me. Nor can I afford the time."

In such a case the adjunct of a manager is quite in order. In fact it's a must, but the charitable bit about helping the boys to a new one is in reality most likely a rationalized half-truth in order to seek privilege. He's providing a new country, yes – but gaining considerable status in the process. The cost of the QSLs are still largely his responsibility, or a matter of arrangement with his manager; and the body of hams who make a QSO should not have to meet the cost of printing two QSLs and postage both ways. G2MI, who through his bureau has probably handled more QSLs than any other ham alive, recently made a comment to the effect that it behooves every ham to handle his own QSL affairs if he possibly can. I heartily concur.

In days past, when I sent IECs, SASEs and "contributions" etc. to those who requested them, my QSL return was between 75 and 80%. Nothing outstanding in this considering I was buying what I wanted. However, after a personal moment of truth wherein I rearranged my values a little and decided the dollars posted could be better used elsewhere, I sent my QSLs via the bureau (where this was possible) to a manager or direct S.M., but with *no* IRCs. Result: a 15% return. Draw your own conclusions. As in other levels of our society, the humble pay and the exalted claim privilege.

I was recently instructed by a manager to send SASE with my card for direct reply only. "Have no bureau and can't afford the time to cope with stamps and envelopes," he said. Special circumstances do occur, but in general the manager who has not the machinery or the time to provide an equitable service should not set himself up as a QSL caretaker. Getting stamps for SASEs is not possible for many hams.

Of course the line of distinction as to what's ethical and what's snide is often difficult to draw. The fast, modern, country-hopping ham DXpeditioner is continually calling for contributions to defray expenses and promote the venture further. Fair enough, and I've been happy to oblige, but the case customers naturally say, 'I'll put in a buck or two, if I get a QSL.' The end result of this in some cases is a little bribery or corruption.

The inequities outlined above are but a few of those indulged in. We all know of the much-boasted claim of those who simply consign SWL reports to the waste-paper basket. To write a reply and encourage a beginner is beyond the range of their compassion. Then there's that group who will only send a QSL to those from whom they want a verification. No thought is ever given to the many who may want a QSL

"If you have a dime, I'll see if the phones are working!"

from them. The day of the counterfeiter is not past either. They've appeared in the past and will do so again. Why spend hours and hours chasing a real rarie, when you can print your own? But these sharpies come quickly to grief. Printing and getting away with a phony QSL is harder it seems than passing a bad $10 note.

This brings one to the point of how to deal with the QSL deviate or purify the scene in general. Unfortunately, no encouraging prognosis is possible. So long as so few are so fanatically chased by so many, the prospect of elevating our QSLing standards is not bright. The blackmarketeer will continue to exist so long as he has the clientiele of Mr. Average Ham. Even the most honorable rare-country ham, on finding his QSL mail laced with dollars, is tempted to operate out of cupidity rather than for the art of DX itself. Is it the QSO or the almighty dollar that's sought? Likewise, the "seekers" don't really want the QSO – only the QSL. From here it seems only a simple step to dispense with the ten-second QSO and just send the card as a swap for the dollar.

The best improvement that can be hoped for, it seems, is an eventual "buyer resistance" to the card sharpie. DX-wise, the world is rapidly shrinking and an increase of hams in some of the emerging countries will take the novelty out of many exotic calls. I am optimistic too, that much of the activity created from pursuing new awards will become more selective. A glutted market results in discerning applicants, and no one will deny that the award field is pretty well saturated.

A gentleman's agreement is in truth an unwritten law and by this virtue alone it should be more binding than one imposed by constitution. It appears than many simply don't understand the real meaning of such an agreement. The ethics of QSLing are such that it is tawdry piece of business to *sell* one's call in a service that's called *amateur*. If the spirit of our hobby is to be truly observed and preserved, it is obligatory on each and every ham who says he QSLs to do so at par – or as near to this as possible.

. . . VK4SS ■

73

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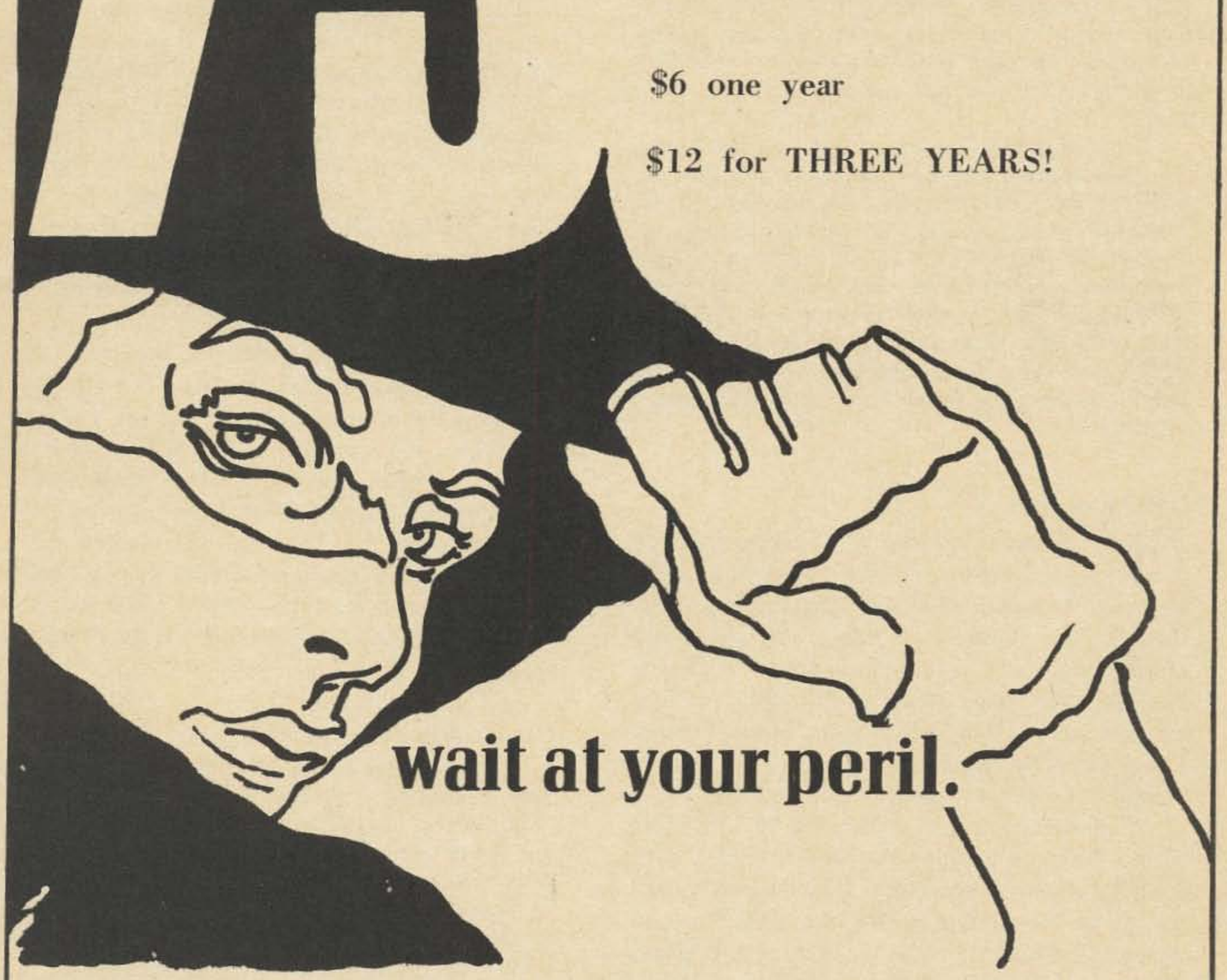

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73 MAGAZINE PETERBOROUGH, NEW HAMPSHIRE 03458

(continued from page 10)

transmitters, scanning receivers, handie-talkies, and such would proliferate.

The FCC would not only gain by getting back their 11 meter band for its original purpose, but would get several million dollars in fees for the new license and would get rid of the fantastic headache of even trying to monitor CB. 220 would, like other amateur bands, be self-monitoring. The FCC has a responsibility for the number of engineers and technicians in the country, since their regulations so profoundly affect this situation; this new license should greatly improve this situation.

The FCC would gain . . .the amateurs would gain . . .the country would gain . . .CB'ers would gain . . .and the manufacturers would gain. Everyone gains, and the best part that no one loses anything! Can you ask for a better deal than that?

It is estimated that some 25% of those active on CB now are unlicensed and that when the new prices go into effect that this could go up to 75%. The type of operations that we would have on 220 would eliminate the things that make illegal operation possible. Everyone would have a call . . .would be listed in the Callbook . . .would have QSL cards, etc. The whole thing would become legitimate. The ease of direction finding and the lack of skip contacts would soon stop all illegal operations.

DX'ing on FM

Ken was so enraptured with the beauties of southern New Hampshire that I thought it might be fun to blow his mind by taking him on a tour through the Presidential Range of the White Mountains, some 120 miles north of Peterborough. Ken packed five of his seven children into his car, but two kept popping out so Lin and I took them along in our car, along with Sage, now just five months old.

We headed up north, taking the back winding roads. We used mobile units on 146.94 FM to keep in touch. The system worked pretty well except for repeaters breaking our squelch a good deal of the time. Everyone enjoyed the Morse Museum in Warren, N.H., and the Lost River Caves. The high point of the trip probably was the tramway trip to the top of Cannon Mountain, with an FM Handie-Talkie in hand. From the top of Cannon we were able to break the repeaters all over New England. The best contact we had was with a mobile in Ontario, a total of 200 miles away, through W1KOO on Mt. Mansfield in Vermont. We had no trouble breaking W1KOO, a little over 50 miles away, and working stations one after another through it. We also made some contacts down in Massachusetts through W1ALE in Concord, N.H., about 70 miles away.

That evening, while visiting my folks just outside of Littleton, N.H. I tried the Handie-Talkie and found that I could break W1KOO from there too. Again, this was a good 50-mile hop. So I sat there in the livingroom of the farmhouse, talking with fellows over in Vermont, New York and up in Montreal. I also managed to work Ken, just three miles away in a motel, and guide him to the farm. The Handie-Talkie transmitted on 146.34 and received on 146.94, and since Ken had no crystals to receive on 34, he had to talk with me through W1KOO, a one-hundred mile path, even when he was parked in front of the farm.

The next day we headed off to Mount Washington. From there we made contacts through W1KOO and W1ALE again, plus W1ABI, and perhaps others. The local FM and TV transmitters raised the noise level and made it a lot more difficult to work out. Ken did a bad job on his hand on the way up the mountain, burning it when his radiator boiled over, so we didn't stay on top nearly as long as we might otherwise have. It takes third degree burns to keep Ken off the air for any length of time.

It is difficult to really describe the excitement of making contacts from the farm, but I've been visiting it for most of my summers for well over forty years and it is home to me. We've never had electricity there, nor water other than from a spring up on the hill which runs into the cellar and can then be pumped into the kitchen with a hand pump. It is about as remote as you can get these days. Yet, remote as it is, I could sit there and talk for hundreds of miles with my little Handie-Talkie.

One Dollar a Copy?

We increased the cover price of 73 earlier this year, expecting the worst. There was little choice . . .either we made the magazine smaller, publishing fewer articles, or else we had to raise the price. We took the gamble. We figured that since 73 published more articles than the rest of the magazines, the extra quarter was not really significant. We figured, but we didn't know.

The results are now coming in and I must truthfully tell you that the sales of 73 did change. . .they changed a lot more than I guessed they would. The sale of 73 went up. . .way up! 73 now has, our distributors tell us, the largest single copy sale of any amateur radio magazine in the world, and by a comfortable margin.

Subscriptions have been peaking up too, probably as a result of new readers paying a dollar for a copy and then noticing that there is a substantial saving when one buys a three year subscription for $12 instead of $36 on the counter. With more postage increases on the way, our subscription rates will have to go up appro-

priately. Sorry about that. Right now the lifetime subscription is by far our best bet, and you can buy it on the installment plan! $10 down. This too, alas, will be going up shortly. . .probably to $75.

Other Magazines

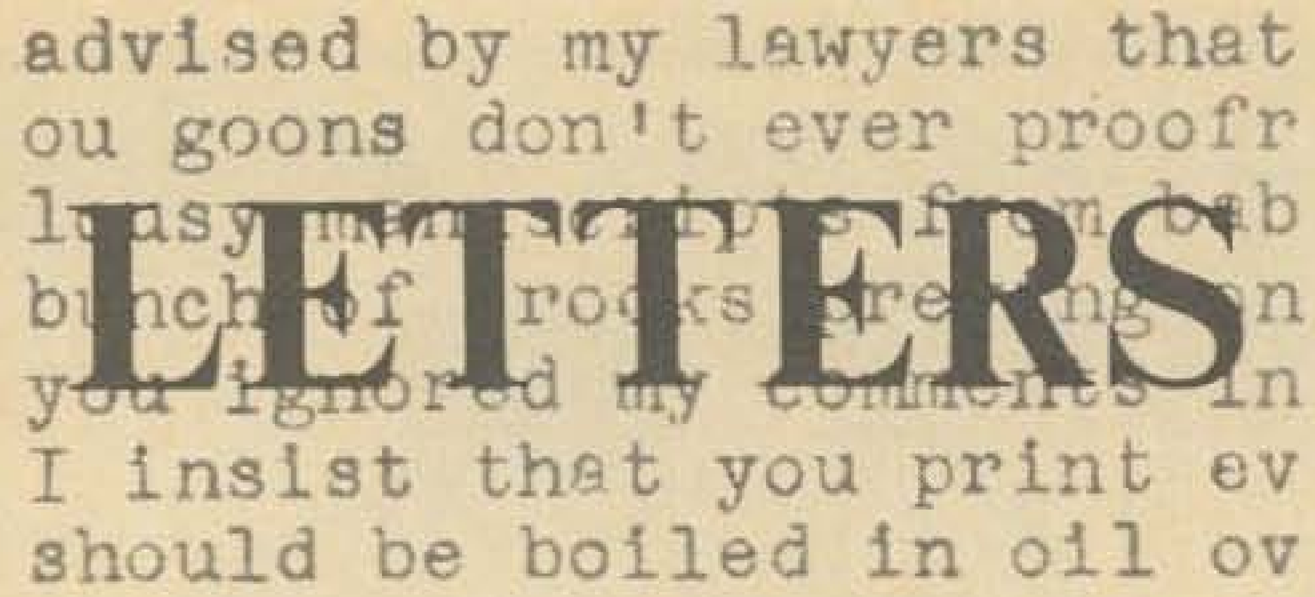
Four more magazines are in the works up here at 73 Hq. Radio Today is still in its early stages with just two issues published so far and acceptance at a high level from both readers and advertisers. Once it is strong enough to keep itself going we will begin work on introducing the next one. One is in the two-way field. . .one is a house organ for one of the big conglomerates. . .one is an entertainment magazine. . .one is about bringing up children. . .and a possible fifth is being researched for the gourmet field. There is a lot of money to be made in publishing today (in everything but the ham field), so this is a good time to take advantage of the plant we have built up, a plant that has the equipment and personnel to produce a number of magazines ready for printing, complete printing equipment for promotion and small books, etc. All this is only being partly used for 73 and Radio Today, so we can turn out a few more magazines.

Opportunities at 73

Our magazine is growing, as you may have noticed. This means that we have to add to our staff every now and then. Possibly you have thought about working in your major hobby. . . ham radio. . .if so, you might enjoy working for 73. We occasionally have openings that could best be filled by interested amateurs. The openings may be in bookkeeping, circulation, promotion, advertising, proofreading, typing, drafting, printing, or layout or even a combination of several of these fields. Most of all we need people who are interested in helping amateur radio to progress rather than just wage earners. Drop us a line and a resume if you like 73 and are interested in living in the most beautiful spot in the country.

. . . Wayne ■

DX'ing from JY



Please would it be possible for you to insert my name and address in 73 as I would like to get one or two pen pals in other parts of the world who are as intensely interested in all aspects of ham radio, TV, and electronics as I am. I am nearly 16 years of age, in my third year at college (fifth form), and have all the normal interests that a healthy male of my age should have, especially the above mentioned. I have been sold on radio, etc., since I was 11 years old and collect every knowledgeable radio book I can get hold of. I would be most grateful if you can help me out.

Warren Dyer
25 Bronwyn Street, St. Albans
Christchurch 5, New Zealand

CW

I have followed the incentive licensing bit somewhat casually but have to ask, "What is all the furor about, anyway?" Is it truly possible that the chance of being reexamined in some relatively elementary theory and being required to send and receive CW at the blinding speed of 13, or even 20, wpm has the whole fraternity shook up? If this *is* a fact, it suggests to me that many amateurs have: (1) lost pride in accomplishment, (2) have no business in the hobby anyway, or (3) worse yet. . .both! Ergo, in my honest opinion, ham radio would be the better off without them. The feeble excuses of "no time," "too old," "can't study," etc., leave me cold. I have raised a family, am working full time on a second-career job (23 years in the navy), am taking an extensive correspondence course and considering additionally some college night school. Incentive? You better believe it! I *want* my license, my rig, and all that goes with it, and I can tell you here and now, they're going to have to take it away from me! Maybe others don't care, but as for myself, the idea of earning something has a great amount of appeal, including an Extra class ticket I picked up in 1954. As far as I can remember, this cherished bit of wallpaper, at the time, offered *absolutely nothing*, promised nothing (I already had Class A), except a large measure of satisfaction in being able to do it.

Except for those who have a physical handicap, anybody who wants a license (any level) and has guts enough to work for it, can get it. Those lacking in this attribute and content to be sécond best, will, as always, sit on the sidelines moaning and groaning that they are being discriminated against and wait for somebody to give 'em something for free. Well, fellows, have fun. It's cold and lonely out there, but you'll have plenty of company with the rest of the second team.

You may well ask if I belong to the ARRL. You bet I do! I have been so affiliated for over 30 years and I know where responsible, demonstrated leadership for amateur radio may be found.

Gene R. Cate W4GEF
3647 Huckleberry Street
Memphis TN

Is this the familiar if-I-did-it-so-can-you syndrome?

. . . Ken

CW Not Anachronistic

Thanks to Wayne Green for the kind words for CW in the April issue of 73. I do not know Wayne's authority for the statement: "I know that the military uses it very little any more." *Very little* is not defined, but I assumed it was approaching the insignificant.

I do not agree because my information acquired over more than 30 years of being closely connected to the Navy's communication-electronics is probably closer to the real facts than Wayne's. (The Navy was still military the last time I looked.) I am in a position to know that there are still a large number of messages being moved by CW each month over Navy circuits (or else the reports to headquarters in Washington are being gundecked). Several hundred radiomen are being qualified each month in CW in service schools. In addition, Speed Key Certificates are being issued each month. Talk to Navy radiomen who have been on distant deployments and you will learn that it is not uncommon to have to resort to CW as a last ditch mode when TTY and voice circuits go out. True, other modes carry a large part of the traffic these days, both in military and commercial circles, but CW remains the old, reliable standby when others fail.

It is still my professional judgment that people should not rush out and buy lilies for CW's funeral. They may need them for their own first.

Lester Harlow WB6ZNW/W4CVO
5015 Cape May Avenue
San Diego CA

The Navy fought off airplanes and aircraft carriers for more years than anyone thought they could. . .perhaps they will be able to hold onto CW as long as battleships.

. . . Wayne

Ham Exchange

In the past months I had some nice, some very nice experiences with Ham Hospitality. In the middle of May, we had a couple of days off school, and I was invited to New York by 4X4FN, who showed me around town (around city, sorry). We had a real nice party with hams at his house, and also at YO2BOs, where I had the chance to meet a couple of American and foreign amateurs.

My second very interesting experience took place the first week of April. I was invited to Purdue University by CP6DG and CP5FQ, and had a great time too, of course!

I am an exchange student in the states until August 1970, and do not have any relatives here, and in my case, Ham Hospitality is doubly nice, and I am thankful to 73 for having had the idea and having put it in practice! I hope many other hams will be able this way to experiment and enjoy international friendship.

If anyone is in HB9 land, my address is Susi Christen, En Brochat, 1093 La Conversion, with

the phone number (021) 280504, I would be very glad to serve as a guide and do everything possible to make everybody feel at ease.

Susi Christen HB9OE/W4
International House J.S.U.
Jacksonville AL

So There!

73's needle is stuck! Still harping against incentive licensing! It is here; let us face it! I speak now to the 73 staff.

For your own benefit, I suggest that you reread and reanalize Subpart A, General, 97.1, Basis and Purpose.

Amateur radio is not a *right*; it is a *privilege* to be earned; granted us under the control of the FCC by our government.

This continual harping reminds me of the story of the old hound sitting on a burr, howling in pain and just too damn lazy to get up.

I too, was very disturbed when incentive licensing was first proposed; then I reread 97.1 and decided to try and do something about it.

I am a stupid old ex-farmer and I obtained my first amateur license in 1964. In September 1968 I made the Advanced class on the first try, but I failed the theory on the Extra. One year later I again took the examination and made Extra. If I can do it, anybody can. Why bitch? Sure it is work, it takes time and study; but what is a hobby, if it is not something to consume some time? There is also a lot of satisfaction in achievement; try it. I held a radiotelegraph First back in 1932 under the Dept. of Commerce; but that elapsed in 1935 and was never renewed. I admit it helped me with the CW part and was also a factor in entitling me to a two-letter call; but I feel that any General today can at least make the Advanced – which has nearly all the privileges of the Extra.

I was glad to see the Callbook list license classifications. I know of one Technician who immediately disappeared from the 75 meter phone band, and heard of one Conditional who sold all his gear rather than submit to reexamination.

Now you are starting to bitch about paying $9 for a five-year license. Bet you spend more than that on 807s or golf or bowling or fishing and hunting. The Canadian boys now are paying $10 a year for their license. I would like to see them boost the license fee on the 10-4 boys up to $50; maybe that would take the hobbying out of it and return it to the business enterprises for which it was originally intended.

H. C. Swanson WØLZ
193 20th Avenue SW
Cedar Rapids IA

Maybe everyone who doesn't think the same way you do should be lined up against the wall and shot.

. . . Ken

Upgrading

I found Wayne's April editorial very easy to agree with. The ink on my Technician class license is barely dry. If I may, I will make a comment on the difficulty of the written portion of the exam. Admittedly I will fairly soon be one of those EE college graduates that Wayne mentioned. The material might make up a fair hour quiz for junior level EE students. As a text of technical competence, it is trivial.

Several years ago Uncle Sammy sent me to thirty-eight weeks of electronics school at Treasure Island. Not many of the graduates would have to live with the license manual very long to pass the General. The same can be said about the graduates of junior college and community college vocational electronics courses.

The problem of cheating is very real. Probably the best answer is one suggested by radical Wayne Green: To have three witnesses present to administer the test (and all mail order tests).

I also feel that the Novice test should be renewable with a fee for renewal, but not for the original license. Also, that the Novice and Technician should be held concurrently.

I also have some thoughts on the invective, I mean incentive licensing, issue and the stupid butchering of the bands which I won't go into here, but there is one thing which might help. Since the FCC, with considerable prodding from Congress, is going to raise the license fees from $4 to $9 to help defray the cost of the operation of the government (what are our taxes for?), why not charge the $9 for renewal of the same class license, but retain the $4 for new licenses or upgrading to a higher license. This would put incentive into incentive licensing.

James E. Galbraith WA7NYM
403 College
Moscow ID

Techs on 10?

A few weeks ago I sat down and wrote 73 about my feelings on Techs getting part or all of 10 meters so they would be able to get the code practice needed to pass the General. Well, after reading Wayne's editorial in the April issue I again feel I must say something.

Referring to his "Solution to the Code Problem," I would like to give you an idea of what the club I belong to is doing. First, let me say that I am the president of this club and have only been a member for the last year.

I was given code practice by an oldtimer here in town who wanted to get new people interested in amateur radio. After a year and a half as a Novice, I was about to give up on the 13 wpm. At that time I heard the club was going to give code and theory classes so the Techs in the club could upgrade their licenses. I informed three other people of this and they too were welcomed (two were Novices and the other had no licenses at all).

Out of this club of about 20 there was not one Tech who was even interested enough to take the time to attend those classes.

Now, 9 months later our club again decided to give code and theory classes; as before, not one Technician even showed up. Still we were able to give 11 Novice tests and all were passed.

My point is this, all I hear is how the code is stopping some good hams from using the lower bands. If they were the least bit interested in putting a little effort out they could have those rights.

As for giving the Techs 10 meters I would go along if (and only if) it was for CW only. They say this is the only band they can practice on.

I would say if 10 meters was opened to Techs, there would not be any more CW on it than there is on 6 meters today.

Joe Dinger WA9YZD

Repeater Shortcut

Why make repeaters that come down to audio? Why not heterodyne the input to a high i-f, and then back to an output frequency. There are thousands of TV translators which utilize this mode of operation and some legal FCC-approved FM translators as well! (Broadcast FM.) (There are also some illegal broadcast translators working the FM bands that I know of.) Heterodyne microwave systems are very common.

So why not make up a ham repeater that operates the same way. It is easy to tap the amplifier stages to allow squelch cutoff or some such control of the output. The power consumption is less, and the ability to keep the signals sounding better is to be desired.

I'd like to know if anybody in the country is using a pure rf translator. Also, in comments re rules, I think we should keep them flexible enough so we are not ruled out of using translators as opposed to repeaters. Translators are easier, and generally less trouble.

Art Brothers W7NVY
Grouse Creek UT

Gil Boelke W2EUP has built and operated an all-solid-state translator that is completely portable. 73 is pushing him for an article on it. (For the benefit of other readers, Art Brothers was associate editor of FM. His recent request to the FCC for abandonment of Docket 18803 in favor of a new, more realistic docket has been receiving favorable official comment.)

. . . Ken

The Students Net

Various quarters of the amateur community take pride in the supposed courtesy of hams. Perhaps this often seems apparent in the way our bands sound under certain conditions, but I now feel an obligation to express my dismay at having to debunk this rumor.

During the month of May, many college campuses closed or went on strike, in protest to the invasion of Cambodia and the deaths at Kent State. It was natural that the strike leaders, needing some way of communication, and students at various campuses, needing information, should turn to amateur radio. Thus, the National Student Information Net was formed, expressly for the dissemination of information between colleges and into regular broadcast channels, at the campus radio stations. The net leaders checked with the FCC, and were in violation of no regulations, although many people did not agree with some of the information passed on the net (such as strike committee phone numbers, press releases, etc.).

Yet, throughout the operations of the net, on vaious frequencies (depending on band conditions), there were numerous jamming stations who attempted to impede operation of the net. Repeated statements of legality, allowal of breaking stations to express their dislike of net operations, and calling the FCC did not help. It was necessary to call the FCC every few minutes in order to have them attempt triangulation of the offending jammers. Tape recordings were made by net stations to help identify these illegal operators.

The melange of QRM was enough to fill a mental ward. Among the stations was "Big Ben," who whistled a tune familiar from church bells;

"Whistler's Father," whose tunes were fascinating due to the way SSB changes harmonic relationships in music; a phone patch putting a busy signal over the net, several stations tuning up for hours on end, and KØIKB who called CQ on the 80 meter channel for hours on end, despite the fact that the rest of the band was quite clear and our constant telling him that the channel was in use.

Indeed, if courtesy on the ham bands were to be enforced, one could make a fortune selling wouff honggs to use on the lids who persisted in causing QRM to this net. None of the net operators interfere with MARS nets, but the corrupted "patriots" on NSIN with their QRM have shamed amateur radio more than any ARRL publicity campaign could make up for.

Fred Goldstein WB2ZJQ
President/trustee WA2YXQ
Passaic NJ

At the present time I am listening to the National Student Information Net on 75 meters. This is a net carrying information between college campuses on the student strikes now being held around the country.

For the last half-hour this net has been subjected to the worst heterodyning I have ever heard in all my years as a ham. A number of hams have been deliberately trying to jam this net. Their methods have included broadcasting pure carriers, music, and CW, etc. In addition to being illegal, this sort of action can in no way be tolerated either by the amateur radio community or by our American society as a whole. The survival of our society depends in a large part on the continued free exchange of ideas and accurate information.

I am a college student (at MIT), and though I'm not in support of the strike, I'm in 100% support of the right of these fellows to operate their net with the same respect and cooperation of other hams that any other amateur net receives.

I hope I never again hear such a display of immaturity and irresponsibility on the part of any amateurs and I also hope the amateur community as a whole will join me in reaffirming the high standards and long history of service of our hobby.

Stephen D. Umans K8ZBE

As I write this letter, I am very much angered at the actions of one individual whom I had the occasion of hearing tonight (May 11, 1970). I was listening to the Student Information Net on 20 meters when KØPMS started a QSO directly on the same frequency as the net. He was asked very courteously to QSY several times by the net control station; however, this was ignored by this individual. Repeated efforts on the part of the net control station to contact this individual were ignored, until he finally came back once to launch his attack. I only wish that I had recorded the following sequence on a tape recorder. This individual enlightened us on his philosophy for conduct on frequency usage. He claimed that his license had written on it that he was *assigned* this frequency and that he had every right to be there. He went on to say that this philosophy of his worked for him for years.

I take no stand on the issues discussed on the net, but I will take issue to this flagrant action on

the part of KØPMS. If people like him are allowed to do such things I can see nothing but a dim future for amateur radio.

Gregory Niemyski WA1EMG

One good way of punishment would be for all amateurs to note the callsigns of the offending stations and boycott them in the future. A ham license is worthless if there is no one to talk to.

. . . Ken

Not All Bad

I have been interested in amateur radio for a long time. However, I used to live in the backwoods and I could never find anyone to help me learn the code or theory involved. As a matter of fact, I could never find anyone who could even tell me that I needed to learn code or theory. Because of this, I never became a ham.

But now, with the formation of an amateur radio club at the college I go to, I have the help I need to obtain my license. Actually, I have been studying for a few years, and while looking for a good magazine on amateur radio, I came across an issue of 73. What a discovery!

I honestly believe that there is not a better ham magazine on the market today. I find it difficult to believe that you can cram a magazine so full of information and not run out of material. One feature which I really like, and which I hope you will continue, is the absence of those cardboard reply mail inserts. The only thing more irritating would be unnumbered pages. Please keep those cards out.

I would like to make a couple of comments on letters printed in 73. First, in the April issue, in a letter from Edgar Wagner, the first sentence in the second paragraph begins, "To a Englishman. . ." The correct wording should be "To *an* Englishman. . ."

Secondly, how about all those snide comments about CB'ers? I will be the first to agree that possibly 80% of the CB'ers operating are either operating illegally or don't know what they are doing and have no legitimate reason for being on the air. But there are some (yes, Virginia, there are some) CB'ers who will only operate legally and who also perform invaluable services. Besides, CB is a very handy thing to have around. Don't knock *all* the CB'ers.

Raymond E. Miller KCQ6239
552 Claremont Avenue
West Chicago IL

Nobody at 73 knocks CB'ers. We just don't condone the illegal practices of some of the

"ham" types. Perhaps, when the FCC opens the 220 MHz segment to the Hobby grade of amateur license (no code, minimum theory), the days of CB misuse will be over for good.

. . . Ken

Who Needs Friends?

I just finished reading Ken's April editorial and wish to express a great big thanks for same. There must be some way of influencing or moving the FCC other than through the ARRL. I was so angry over the incentive licensing escapade that I dropped my membership in the League and do not intend to rejoin.

I got my Advanced ticket, but so what! If I want to work my friends I have to work in the high end of the band anyway, so it seems of actual little value.

I would go all out for incentive licensing if the higher classes could work voice in the top half of the CW portion of the band. This would make much more sense to me, especially since you can work CW over the entire band anyhow. Regardless, who needs a "friend" such as ARRL? Better I should have an enemy, for at least I would be suspicious of him from the very beginning.

Lavern Peterson KH6EKQ
45-323 Mahalani Place
Kaneohe HI

We believe it is time for the amateur radio operator to be represented by a national organization directed by and for the members. It would be nice if the League could fill the bill, wouldn't it?

. . . Ken

Here's $50 – I think I will go the whole route. Send me 73 for "your life or mine."

I think a series on building a serious VHF station would be great. Start with 2m complete antennas, converters, transmitters, etc. Then do 432. I really think this would be a goldmine of articles. Get the "Big Boys" to write some of them.

Marshall P. Williams WA5UNL
5429 46th
Lubbock TX

73 has the articles, but they aren't in the form of a series. Might not be a bad idea to think about it, though. Anybody else have ideas?

. . . Ken

Self-Destruction?

I first wish to say that I have subscribed to every Ham publication at one time or another, and I have found yours to be the most interesting. Secondly, I wish to comment on the Great Battle that your magazine has been carrying on for the past several years. I have off and on been reading the letters in your columns and found that most believe that one cannot stand in the middle of the road in the struggle with the ARRL and the fight for individual representation. I believe that the Great Battle has been stalemated by this radical and unfortunate position. Neither side can claim that they have all the answers, or all the supporters, and it seems to me that it is foolhardy to divide a minority into two entrenched factions that are sworn to battle to the death for God and amateur radio. I suppose that if the peoples of the world were split into two groups, then this method would be effective in

deciding which group were to survive. Unfortunately, we are not the world's population, but a minority; and, when the smoke of battle clears, one group or the other will not stand victorious, but both defeated. The remaining group will have been battle-tested, but small, weakened, and obnoxious in the eyes of our "don't make waves" government's opinion, will win their battle without firing a shot. Think! If you wished to destroy a group and their holdings, what better way than allowing the group to destroy itself. No, I am not screaming conspiracy; I am screaming *idiots*. You are the self-righteous lambs, not with the dignity of being led, but taking yourselves to the slaughter.

Judge your position by its results. What are they? Most of those opposed to the ARRL's position wished it to be destroyed and a new and better organization to grow from its ruins. Has this happened? Those who believed that the ARRL's proposals would strengthen the League and elevate the amateur's technical ability should also pause to reflect. Has this happened?

Change! Is that what you want? I sincerely hope so as that is certainly what we are getting. The direction of the change is the unfortunate thing: the decay of a once-proud entity always is unfortunate. I would have much preferred the status quo to suicide, but now I – and others like me – am being dragged along and forced to watch this abomination. Now nothing can stop this change; the impetus is too great. We (and I mean *we*) still can determine the direction of this change. The one great question is how can we accomplish reconstruction and redirection from the throes of self-destruction? After taking inventory the deplorable fact exists that the League is the only recognized agency in existence that still maintains any manner of respect or authority with the government. We need a liaison, and the League must be that liaison. That, regardless of your viewpoint, is a hard and inescapable fact.

What we must do, what should have been done in the beginning, is to change and support the League, not destroy it. If the effort that was put into demeaning the League had been channeled into reconstruction and reenforcement from the beginning, this situation could not have existed. Anarchy cannot exist, if isolated. We should have usurped their authority, isolating the anarchists and making them impotent. We cannot do that from outside the League: it must be accomplished from within. We must regain control of the League and its position of authority and use it for the common good.

The recipe to success is deceptively simple. Join, keep informed, participate, and vote! Above all else we must have patience! Although it may appear like our problems are of a fairly recent origin, starting perhaps around the time Wayne Green brought them to light, you couldn't be more mistaken. Vital organizations don't decay overnight. We lost the League years ago, and it may take years to reshape it again. The question that we all must answer in truth to ourselves is a basic one. Do you want to be a "ham," I mean do you really want to be a "ham" enough to forget about your investments in amateur gear and take time to think and be proud of being an amateur radio operator? Pride? Maybe it is the thing that stabs you in the back when a new acquaintance of yours invites you

over to see his ham setup and shows you his CB rig, the thing that's inside that old receiver or transmitter that you keep around for sentimental reasons, or the thing that makes you see your junk as "junque." Pride, or whatever name you can give to that sense of being that once united and made the League strong, we need now more than ever.

If implementation of your wishes is your problem, maybe the new structures, the roundtables that SSB brought upon us and the profusion of traffic nets, can be made to perform double duty. There is always someone on these nets and roundtables who has a definite opinion on how things ought to be run up there in Newington. If you agree with him, why not tell him to do something about it. Support him with your proxy and give him the backing he needs to put some of that QRN he's generating to some good use. Take some of that spare time at the end of the net to inform the net about what is happening inside the League, instead of filling the time with comments from the push, hold, and talk fans.

If you still need some incentive, first think about 11 meters, and then swivel around in that chair, look at your "ham" gear, and try to think of someone you can sell your rig to when you don't have any bands left to operate on.

N. Gary Boucher W3GNR
411 Waupelani Drive
State College PA

Forgotten

We are sorry to learn that Ken has led such a sheltered life and missed the dynamic and growing southeastern section of our country in both his travels and attention. May I bring 73 up to date with the repeater operation in our state?

The Carolina Repeater Society (WB5PLN) operates two repeaters near Columbia which covers a 60 to 70 mile radius to mobiles in the central portion of the state. The 6 meter repeater has a 52.76 input and 52.525 output. The 2 meter repeater has an input of 146.34 and an output of 146.94. Both repeaters are a split system. The two receivers are located on a tower near Edmund and are connected to the transmitter located near Gaston by separate 450 links.

WA4SSJ in Greenville operates a similar repeater with an input of 52.76 and output of 52.525. There is also a .34/94 two meter repeater on each side of us – Augusta, Ga. and Charlotte, N. C. All these systems are open repeaters. We welcome travelers and invite their use of our repeaters and invite our neighbors in the southeast to communicate with us.

Ken Adams K4MOC, President
Carolina Repeater Society
Columbia SC

All it takes is a spokesman. We at 73 don't publish repeater info until we get it. If you know anyone who wonders why his repeater never gets

listed in our directory, ask him how long it has been since he sent the particulars to 73. Squeaky wheels get greased better and more frequently.

. . . Ken

Bravo!

I have enjoyed reading 73 in the past, but the recent staff additions and the fine FM articles have done the trick! Here's my $12 for 3 years. Keep up the good work in FM! Although I do not always agree with the editorial policies of 73, I find it *does* provide the opinions not found in other ham magazines. 73 is not afraid to "speak up" and I admire that. Bravo!

John S. Cole WA8ZPF
488 Fourth Street
Manistee MI

You may be interested in reading the following comparison and rating of *73* and *QST* magazine, along with my comments and suggestions.

(Ratings are 1—5)

	73	**QST**
Tech. Articles	3.5	5+
Editorials	5+	2
Ham Ads	2	3.5
Interest	5+!!!	3–4
Overall Rating	5	3.5

As you can see, I prefer *QST* for articles for a purely technical nature, but as far as editorial glimpses of our hobby I prefer your magazine. Although many of your articles start on a technical theme they seldom "follow through" into a thorough discussion of the subject. However, your editorial columns are to be ranked with the best of other nonham magazines such as *Saturday Review* and the like – especially Dave Mann's *Leaky Lines*, which is one of the finest pieces of literary opinion work I have ever seen. I rate K2AGZ and his column an extreme 5+!!!!!

One more important rating:

Humor: QST-0.5 . . . 73-5+++++!

Paul Nelson WA5WOE
9773 Oak Point
Houston, TX

If you're moving, don't forget your ZIP code!

73 Readers' DOUBLE BONUS

Want info quick? Just check the box next to the name of the advertiser of your choice in the index below. We'll rush your name to the firm so you can get all the dope direct from the source. (Don't forget to include your name and address at the bottom.)

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SUN	MON	TUES	WED	THUR	FRI	SAT
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7A	7	7	7	7A	7A	14	14	14
ARGENTINA	21	21	21	14	14	7	14	14	21	21	21	21A
AUSTRALIA	14	14	14	14	7B	7	7	7A	7	7B	14	14
CANAL ZONE	21	21	21	14	14	7	14	14	14	21	21	21
ENGLAND	14	14	14	7A	7	7A	14	14A	14A	14A	14	14
HAWAII	14	14	14	14	7	7	7	14	14	14	14	14
INDIA	14	14	14	7A	7B	7B	14	14	14	14	14	14
JAPAN	14	14	14	14	7	7	7A	14	14	14	14	14
MEXICO	14	14	14	14	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	14	7B	7B	7A	14	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7B	7B	7	14	14	14	14	14	21	14	14	14
U. S. S. R.	14	14	14	14	7	7A	14	14	14	14	14	14
WEST COAST	14	14	14	14	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	14	7A	7	7	7A	14	14	14	14
ARGENTINA	21	21	21	14	14	7	14	14	21	21	21	21A
AUSTRALIA	21	21	14	14	14	14	7	7	7A	7	14	14
CANAL ZONE	21	21	14	14	14	7A	14	14	14	21	21	21
ENGLAND	14	14	14	7A	7	7	7	14	14	14	14	14
HAWAII	14	21	14	14	14	7A	7	14	14	14	14	14
INDIA	14	14	14	7A	7B	7B	7B	14	14	14	14	14
JAPAN	14	14	14	14	7	7	7	14	14	14	14	14
MEXICO	14	14	14	14	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	14	7A	7B	7B	14	14	14	14	14
PUERTO RICO	14	14	14	14	7	7	14	14	14	14	14	14
SOUTH AFRICA	7B	7B	7	14B	7B	7B	14	14	14	14	14	14
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WESTERN UNITED STATES TO

ALASKA	14	14	14	14	7A	7	7	7	7A	14	14	14
ARGENTINA	21	21	21	14	14	7	14	21	21	21	21	21A
AUSTRALIA	21A	21	21	21	14	14	14	14	7	7	14A	21
CANAL ZONE	21	21	14	14	14	14	14	14	14	21	21	21
ENGLAND	14	14	14	7A	7	7	7	7A	14	14	14	14
HAWAII	21	21	21	21	14	14	14	14	14	14	14	21
INDIA	14	14	14	14	7A	7B	7B	14	14	14	14	14
JAPAN	14	14	14	14	14	14	14	7	14	14	14	14
MEXICO	14	14	14	14	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	14	14	14	7	14	14	14	14	14
PUERTO RICO	21	21	14	14	14	7	7	14	14	14	14	14
SOUTH AFRICA	7B	7B	7	14B	7B	7B	7B	14	14	14	14	14
U. S. S. R.	14	14	14	14	7	7	7	14	14	14	14	14
EAST COAST	14	14	14	14	7	7	7	14	14	14	14	14

A = Next higher frequency may be useful also.

B = Difficult circuit this period.

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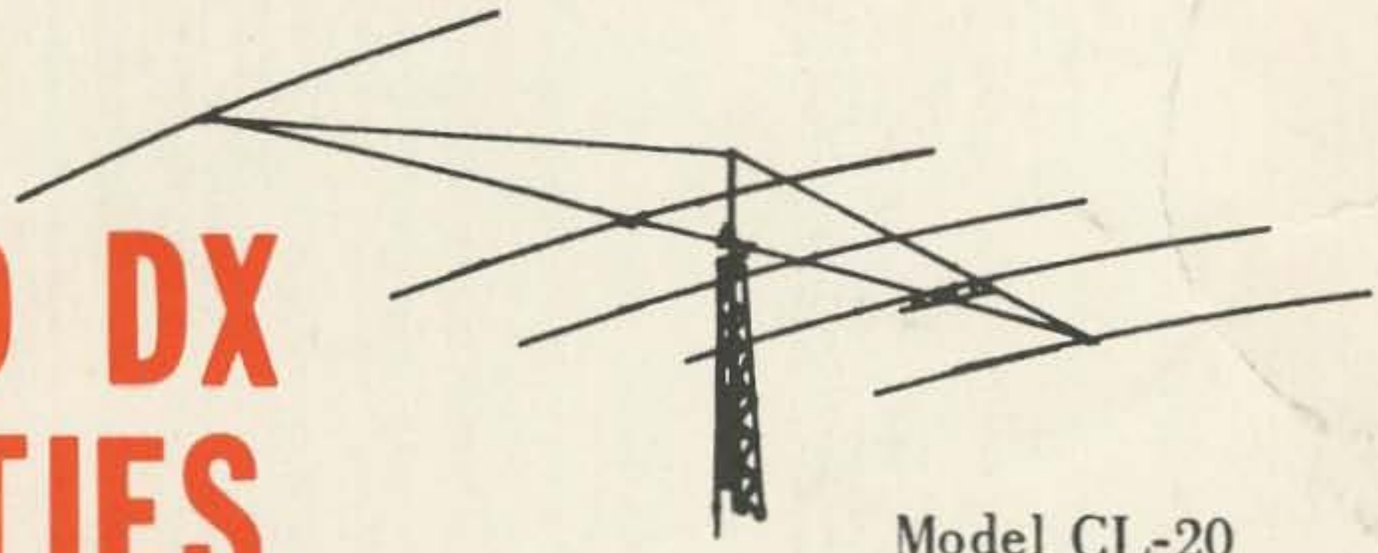

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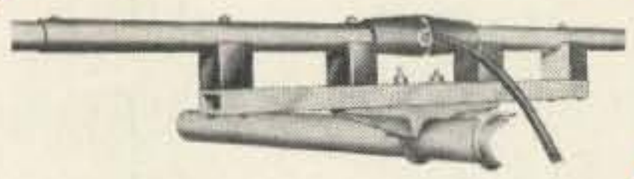

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