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JULY 1962

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Build TV Set (p. 61)

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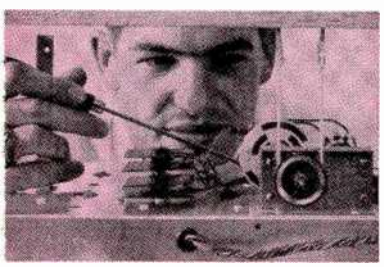

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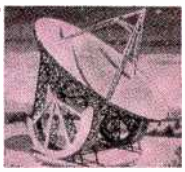

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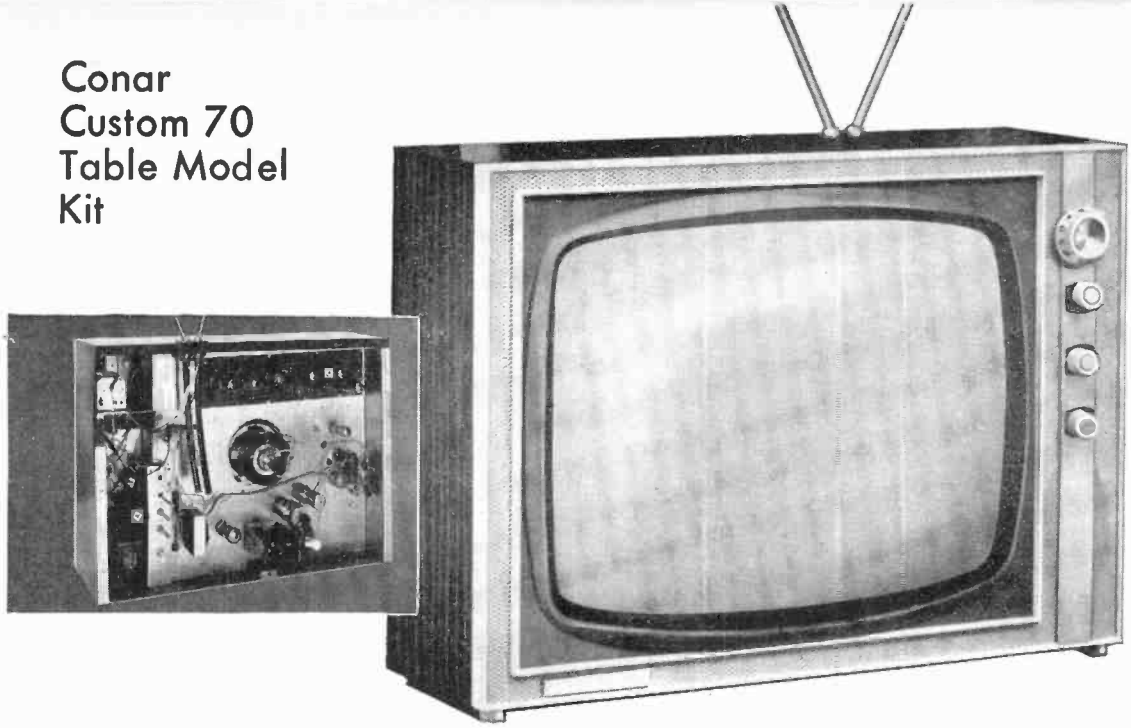

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POPULAR ELECTRONICS

VOLUME 17 JULY 1962 NUMBER 1

ZIFF-DAVIS PUBLISHING COMPANY

POPULAR ELECTRONICS is indexed in the Readers' Guide to Periodical Literature

This month's cover photo by Bruce Pendleton "Custom 70" TV Kit courtesy of Conar Instruments; Bar Generator courtesy of EICO Electronic Instrument Co., Inc.

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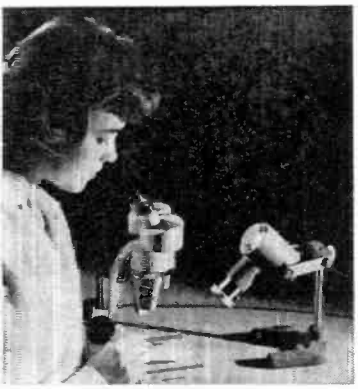
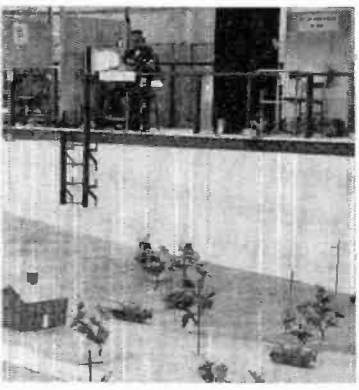




POP'tronics NEWS SCOPE

HOT NEWS—London's firefighters will be equipped with new-type portable radiotelephones that "speak only when spoken to." The specially designed VHF transceivers are being supplied to the London Fire Brigade by a Raytheon Company subsidiary. Unlike ordinary mobile radiotelephones, the new units incorporate analog computers. When a set is on "receive," it continuously sorts the various noises heard on ordinary two-way radios and silences the speaker until it hears a valid broadcast from another fire station or firefighter—eliminating the usual interference noises. The portable unit shown at left weighs only five pounds and command instructions can be easily heard above the noise at the scene of action.

POSTAGE STAMP STEREO—Electronic developments that are ushering in the space age will be adding exciting new wonders to the consumer market. One such item, a stereo amplifier the size of a postage stamp, was demonstrated by the Martin Company at the recent IRE Show in New York City. It is a member of a whole family of tiny electronic devices, tabbed "MARTEC" (for Martin Thin Film Electronic Circuit), intended for use in missile systems where space, weight, and reliability are prime considerations. So small indeed is a MARTEC computer circuit that it must be examined under a microscope (see photo).

TANKS A LITTLE—In a move to pare training costs, the U. S. Army has shrunk a battlefield, reduced maneuverable tanks to a fraction of their size, and brought miniature warfare to life in simulated combat. A mockup of 30 acres of terrain and radio-controlled miniature tanks—one of the micro monsters sports a turret TV camera—was built for the Army by General Dynamics/Electric Boat to 1/20th actual size. Costs of operating a real platoon of five tanks in actual training situations are conservatively estimated at over $75 a mile, while the simulator costs only pennies to run. A student tank platoon leader directs the five tanks while viewing the TV picture transmitted by the lead tank. Instructors rate performance by listening to commands and observing platoon maneuvers and "battle" developments.

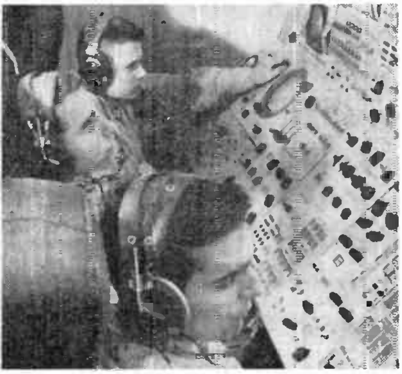
BEEP, BEEP, BOOP, BEEP! The world's first completely transistorized radio navigational beacon is now undergoing field trials at Mount McQuoid, the holding area for jet aircraft using Mascot Airport at Sydney, Australia. Developed by an ITT Australian affiliate, transistorized beacons are expected to serve an important function at many small and infrequently used airports that presently lack navigational aids due to high costs. Designed for isolated locations, these beacons can withstand all Australian climatic conditions—temperatures from 14° to 140° F and up to 100% relative humidity. Due to low power drain, a wind-driven generator can supply the power necessary to transmit omnidirectional Morse-code beacon signals.

(Continued on page 8)

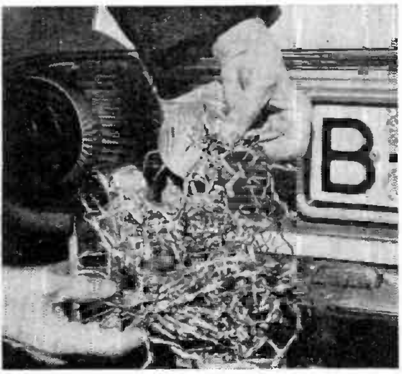
Continued

UPI

A LIGHT MEAL—Frying pans become instruments of modern science as the young homemaker tries to cook eggs with the heat from two 300-watt spotlamps. She is successful with the conventional lamp aimed at the frying pan at the left, but not so with the other pan. Here, a new "Cool Beam" G.E. lamp has no effect on the egg. This revolutionary spotlamp is expected to be widely used in food, candy, and other stores where heat due to high-intensity lighting can cause damage to fresh meat, candy, and certain fabrics.

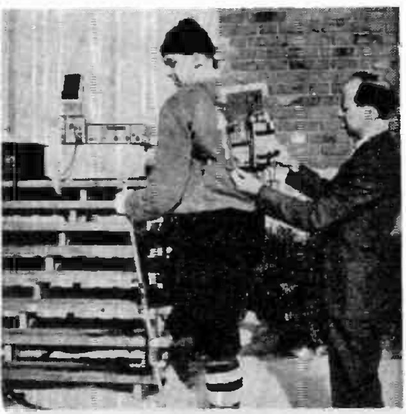


LAND-LOCKED ASTRONAUTS practice a moon flight in a simulated three-man lunar-probe spacecraft to help discover the effects that confinement and reduced physical activity will have on the spacecraft crew's ability to perform specified tasks. Three employees in the Martin Company's Space Systems Division recently "flew" the spacecraft simulator on a mission from earth, into lunar orbit, and back again. They were confined to the simulator for seven days, their only contact with "earth" being through a simulated radio communications system. As a result of the knowledge gained during this test, the spacecraft and associated equipment were modified to prepare for more extensive and more sophisticated research into simulated manned space flight.



UPI

RED TINSEL—At left is a sample of the metal foil which is being dropped in the Allied air corridors leading to Berlin in an attempt to jam radar communications of Western planes flying over East Germany. Commonly called "chaff," or sometimes "window," the pieces of metal foil are used as confusion reflectors. A few pounds of foil dropped at 50,000 feet will almost make a radar operator believe he is seeing the ghost of the "Hindenburg" returning to Berlin. Being very light, the chaff floats to the ground slowly, jamming radar signals for long intervals.



UPI

SCIENCE ON SKIS—Getting ready to carry scientific research to the ski trails, engineer William Johansen of the Stockholm Central Institute straps his new invention on the back of a skier. The lightweight portable apparatus is a cross between an electrocardiograph and an ultra-short-wave transmitter. It will detect and transmit the pulse beat of the skier in action to a special receiver which is tied into a computer and recorder. Small electrodes attached to the athlete's chest pick up heart beats much as the astronauts' electrodes do. This invention will be used in research connected with body activity measurements in various sports.

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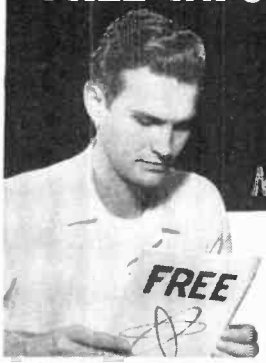

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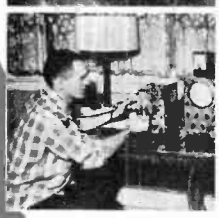

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FCC Report

By ROBERT E. TALL
Washington Correspondent

SUBSTANTIAL revisions in the organization of the Federal Communications Commission—with some pointed toward the agency's administration of the citizens radio service—have been under active study by the Commission for some time.

Under contract from the Bureau of the Budget, a management consulting firm reviewed the agency's operations over a period of several months, and has submitted a number of recommendations for changes in the organization of the FCC staff. While it is up to the Commission itself to carry through on the recommendations—and some of the suggestions are not regarded in a very favorable light at the agency—agreement on a number of the points raised is likely.

What does it mean for the CB service? The personnel assigned to administer the citizens service will be cut loose from some of their other responsibilities and allowed to devote more time and attention to the problems of the CB service, providing a more individual approach to CB problems.

Under the Hood. FCC engineers, and others associated with the mobile radio communications field, are paying increasing attention to efforts of mobile radio equipment manufacturers to reduce interference stemming from the electrical systems of the users' automobiles. The first breakthroughs have already occurred, and it is now possible for a CB'er or other mobile radio licensee to equip his car with such devices as low-radio-interference mechanical alternators, or fully electronic alternators or ignition systems.

License Fees. With virtually all interested parties having been heard from, there appears little doubt that the non-commercial two-way radio field has again escaped the formidable "filing fee" proposal of the FCC, which would have put the Commission in the position of charging money for the submission of an application, whether or

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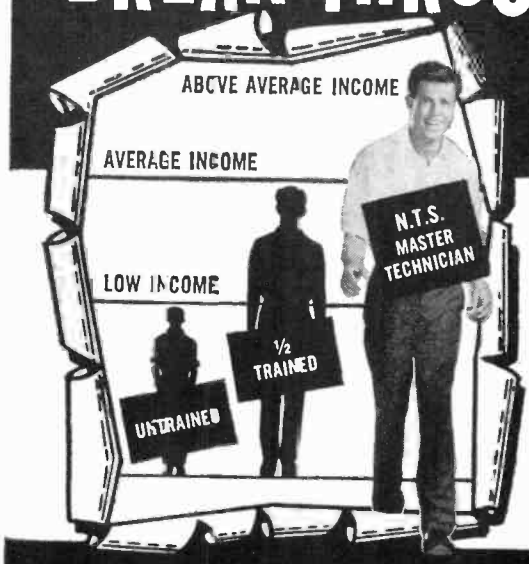

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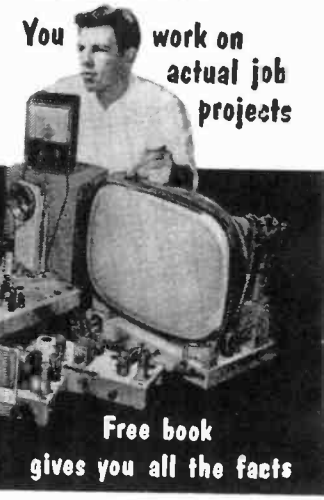

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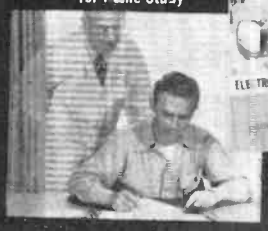

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FCC Report

(*Continued from page* 10)

not the application resulted in a license.

This is one proposal you can expect to die quietly, at least in its present form, despite a great variance of feeling on the subject between the FCC Commissioners themselves, and between Congressional leaders.

Most numerous among the flood of comments opposing the "fee" suggestion were those from radio amateurs and public safety radio communications licensees and organizations, but all licensee types were heard from.

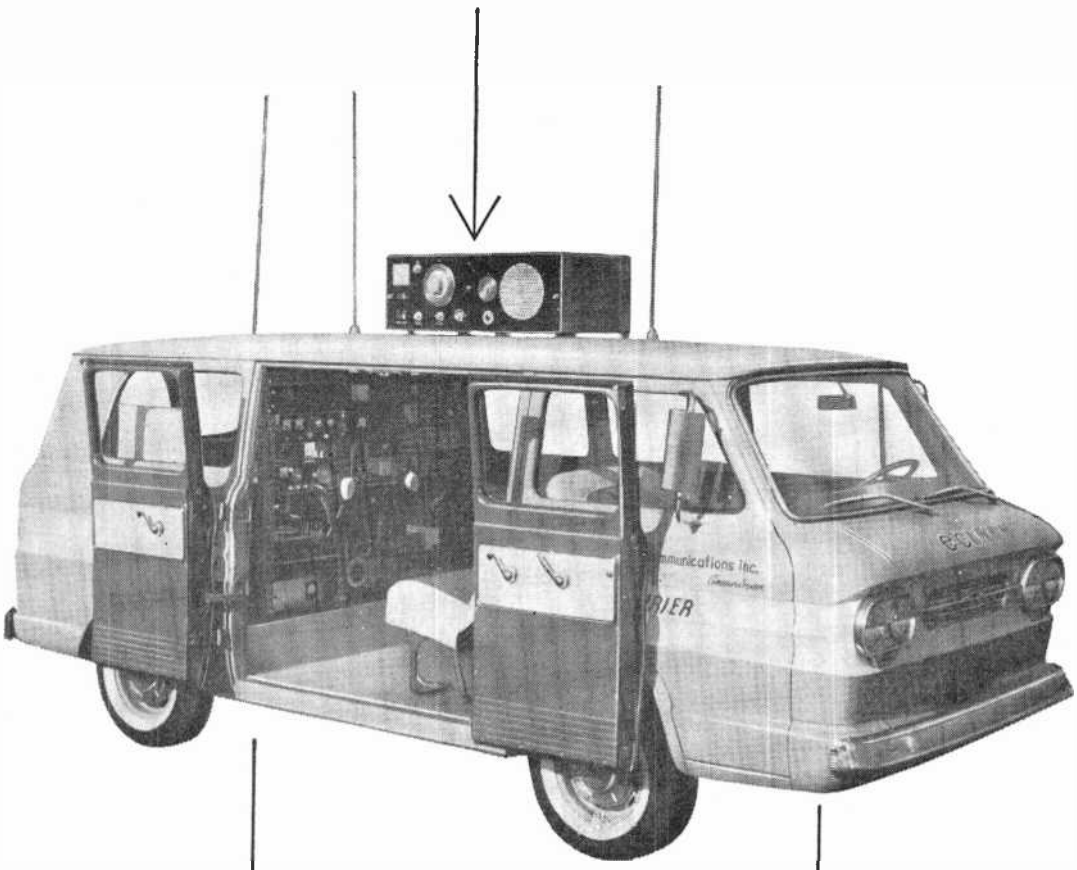
FCC "Forfeitures." At the time this column was written, it was an odds-on bet that Congress would pass, and President Kennedy would sign, new amendments to the Communications Act which would permit the FCC to slap $100 fines on radio licensees violating 12 specific provisions of the agency's rules. The Commission was going ahead with its planning to put the program into effect as soon as possible after it became law.

Officers of the Commission made it clear that they were not particularly "against" CB or other types of mobile radio licensees, and were not planning a full-blown crusade to crack down on insignificant or nonharmful infringements of the Commission's rules. But they expect to get a little more respect from CB marine, and other mobile radio operators due to the agency's new authority.

Also in the Congressional mill at the time this column was written was a Communications Act amendment permitting the Commission to stop requiring that applications, and other documents submitted to it, be subjected to "oath or affirmation" before filing. The measure was more than halfway to its goal as law. In asking Congress to make the change, the Commission said the present requirement that applications be notarized is an "unnecessary burden" on both the public and itself.

New CB Form. Citizens Band equipment salesmen and other interested "bulk" users of FCC citizens radio application forms (Form 505) have been advised by the Commission that a new, simplified version of the form will be available within a month or so—by early fall at the latest—and will become effective as soon as it is practicable.

Mandatory cutoff date for the use of the present Form 505 has not yet been established. Starting this fall, however, CB applicants will be cautioned to question their salesmen as to whether the older



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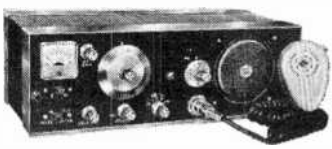

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FCC Report

(*Continued from page* 12)

forms are still effective, to prevent an unnecessary delay in the Commission's processing of their applications.

Under the new setup, equipment manufacturing firms will be permitted to print their own stock of the application forms, but the Commission warns that "care should be taken that the finished product is an exact duplicate, not only in text but also in dimensions and in paper stock and color." The agency recommends "photocopy reproduction."

Rules Flap at FCC. Critics of the FCC's CB rules got an unexpected assist several months ago when one of the Commission's hearing examiners—a king of a "judge" in formal agency hearings—put the blast on the citizens service regulations, and, in effect, called several of the rule sections too vague to be enforceable.

There was little expectation that the examiner's views would go unchallenged by the FCC Safety & Special Radio Services Bureau, however, and it was doubtful that the examiner's decision—in a CB enforcement case—would have any appreciable immediate effect on the agency's administration of the service. Several of the CB rule sections scored by the examiner were already undergoing revisions at the staff level of the Commission.

CB'ers who do not think the citizens rules are clear in all cases would have been warmed by the examiner's conclusion that the CB rules leave "a good deal to be desired as an instrument of regulation." The examiner noted that he, as an experienced government attorney, doesn't have a "clear idea" of what several sections of the rules are expected to convey, and doesn't know how the average layman can be expected to understand them.

Particularly cited in his decision as being "deficiencies" was the use of such terms as "personal," "private," or "substantive" communications, which, he said, do not hold water from a legal point of view as they were construed by the FCC staff in the enforcement case.

CB Petition. In one of the latest formal moves seeking revisions in the citizens rules, the 14W Association of Seattle, Wash., has petitioned the FCC to exempt five consecutive frequencies at either the upper or lower extreme of the present Class D frequencies from several current CB restrictions. The purpose would be to put the "uncontrollable elements" in the CB service in a "specific segment of the band" and permit users conforming to the

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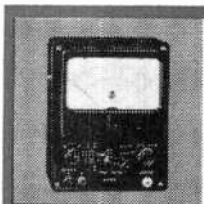

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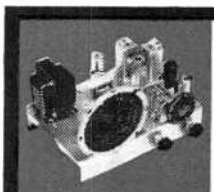

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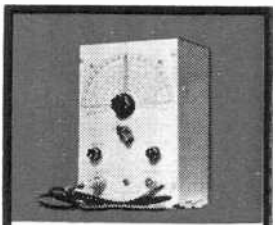

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FCC Report

(*Continued from page* 14)

intent of the citizens rules to operate with "minimum conflict."

The Seattle 14W Association declared that improper usage of the Class D service has reached such proportions that it "threatens to eclipse the worthwhile purposes for which the service was originated." The group said it feels that most people, "given the opportunity to both engage in their hobby without recourse to examination and also conform to regulations," would take advantage of the requested rule changes and shift their activity "to frequencies where both of these ends were afforded."

CB Speech. More than 2000 Class D citizens radio service licensees, gathering at the Morrison Hotel in Chicago several months ago, were advised by FCC Land Transportation Division Chief Ivan H. Loucks not to look for relaxations by the Commission on present power output or antenna height limitations in the Class D service, but to expect the issuance of some proposed rule changes soon.

Mr. Loucks, whose division administers the citizens service at the staff level of the Commission, said that the agency has "many of the present problems involving the citizens service under consideration," and that the present rules "are far from static" and have "definitely not been frozen in their present form." -30-

COMING NEXT MONTH

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(*see page* 29)

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What Does F.C.C. Mean To You?

What is the F.C.C.?

F.C.C. stands for Federal Communications Commission. This is an agency of the Federal Government, created by Congress to regulate all wire and radio communication and radio and television broadcasting in the United States.

What is an F.C.C. Operator License?

The F.C.C. requires that only qualified persons be allowed to install, maintain, and operate electronic communications equipment, including radio and television broadcast transmitters. To determine who is qualified to take on such responsibility, the F.C.C. gives technical examinations. Operator licenses are awarded to those who pass these examinations. There are different types and classes of operator licenses, based on the type and difficulty of the examination passed.

What are the Different Types of Operator Licenses?

The F.C.C. grants three different types (or groups) of operator licenses—commercial radiotelePHONE, commercial radioteleGRAPH, and amateur.

COMMERCIAL RADIOTELE*PHONE* operator licenses are those required of technicians and engineers responsible for the proper operation of electronic equipment involved in the transmission of voice, music, or pictures. For example, a person who installs or maintains two-way mobile radio systems or radio and television broadcast equipment must hold a radiotelePHONE license. (A knowledge of Morse code is NOT required to obtain such a license.)

COMMERCIAL RADIOTELE*GRAPH* operator licenses are those required of the operators and maintenance men working with communications equipment which involves the use of Morse code. For example, a radio operator on board a merchant ship must hold a radioteleGRAPH license. (The ability to send and receive Morse is required to obtain such a license.)

AMATEUR operator licenses are those required of radio "hams"—people who are radio hobbyists and experimenters. (A knowledge of Morse code is necessary to be a "ham".)

What are the Different Classes of RadiotelePHONE licenses?

Each type (or group) of license is divided into different *classes*. There are *three* classes of radiotelephone licenses, as follows:

(1) Third Class Radiotelephone License. No previous license or on-the-job experience is required to qualify for the examination for this license. The examination consists of F.C.C. Elements I and II covering radio laws, F.C.C. regulations, and basic operating practices.

(2) Second Class Radiotelephone License. No on-the-job experience is required for this examination. However, the applicant must have already passed examination Elements I and II. The *second class* radiotelephone examination consists of F.C.C. Element III. It is mostly technical and covers basic radiotelephone theory (including electrical calculations), vacuum tubes, transistors, amplifiers, oscillators, power supplies, amplitude modulation, frequency modulation, measuring instruments, transmitters, receivers, antennas and transmission lines, etc.

(3) First Class Radiotelephone License. No on-the-job experience is required to qualify for this examination. However, the applicant must have already passed examination Elements I, II, and III. (If the applicant wishes, he may take all four elements at the same sitting, but this is not the general practice.) The *first class* radiotelephone examination consists of F.C.C. Element IV. It is mostly technical covering advanced radiotelephone theory and basic television theory. This examination covers generally the same subject matter as the second class examination, but the questions are more difficult and involve more mathematics.

Which License Qualifies for Which Jobs?

The THIRD CLASS radiotelephone license is of value primarily in that it qualifies you to take the second class examination. The scope of authority covered by a third class license is extremely limited.

The SECOND CLASS radiotelephone license qualifies you to install, maintain, and operate most all radiotelephone equipment except commercial broadcast station equipment.

The FIRST CLASS radiotelephone license qualifies you to install, maintain, and operate every type of radiotelephone equipment (except amateur, of course) including all radio and television stations in the United States, and in its Territories and Possessions. This is the highest class of radiotelephone license available.

How Long Does it Take to Prepare for F.C.C. Exams?

The time required to prepare for FCC examinations naturally varies with the individual, depending on his background and aptitude. Grantham training prepares the student to pass FCC exams in a minimum of time.

In the Grantham *correspondence course*, the average beginner should prepare for his *second class* radiotelephone license after from 300 to 350 hours of study. This same student should then prepare for his *first class* license in approximately 75 additional hours of study.

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The Grantham course is designed specifically to prepare you to pass FCC examinations. All the instruction is presented with the FCC examinations in mind. In every lesson test and pre-examination you are given constant practice in answering FCC-type questions.

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Is the Grantham Course Merely a "Coaching Service"?

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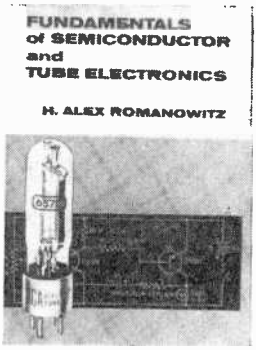

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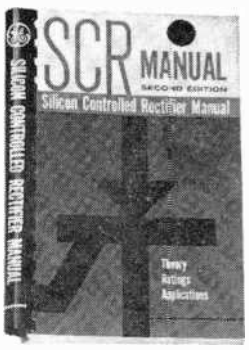

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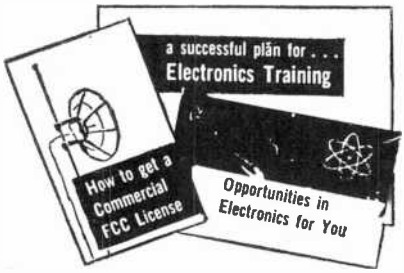

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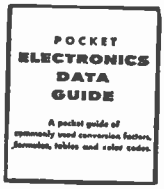

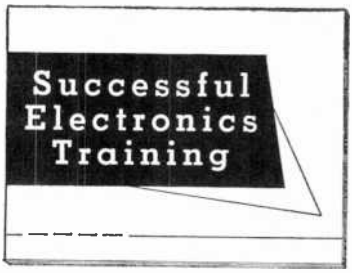

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(*Continued from page* 18)

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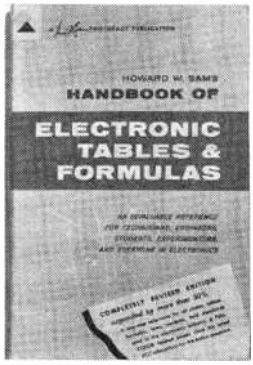

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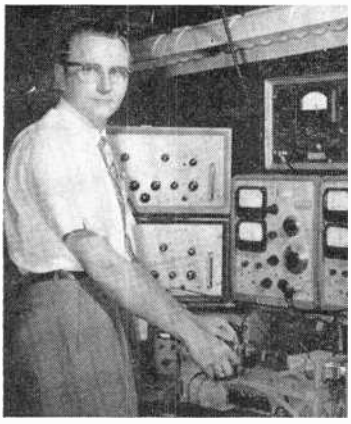
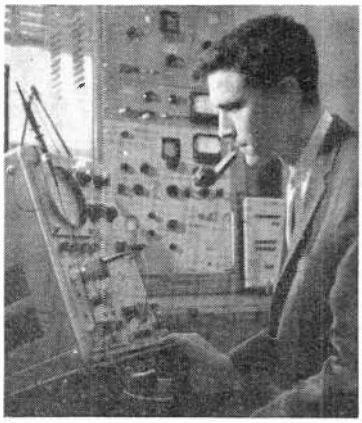
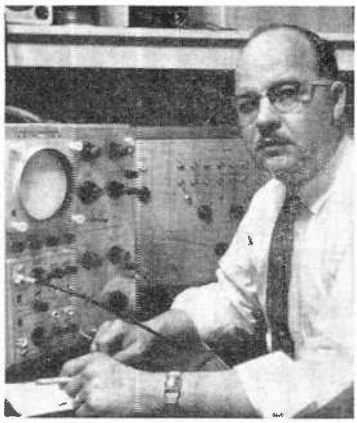


RICHARD S. CONWAY (CREI grad 1960) is Supervisor, Electronic Test Department Wilcox Electric Co., Kansas City, Mo.



ROBERT T. BLANKS (CREI grad 1960) is Engineer, Research & Study Div., Vitro Labs., Division of Vitro Corp. of America, Silver Spring, Md.



MEARL MARTIN, Jr. (CREI grad 1956) is a Senior Engineer and Field Support Manager, Tektronix, Inc., Portland, Oregon.

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- ☐ Nuclear Engineering Technology
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Name ..... Age .....
Address .....
City ..... Zone ..... State .....
Employed by .....
Type of present work .....
Education: Years High School ..... Other .....
Electronics Experience .....
Check: ☐ Home Study ☐ Residence School ☐ G.I. Bill 29

Bookshelf

(*Continued from page* 20)

have a continuing interest in repairing and restoring old receivers.

Published by Supreme Publications, 1760 Balsam Rd., Highland Park, Ill. 240 pages. Soft cover. $2.50.

New Literature

A 12-page illustrated brochure, describing the principles and function of language laboratories, has recently been published by Edwards Company, Inc., Norwalk, Conn. The free booklet (No. D-102) details the Edwards language teaching equipment and includes an outline of the three basic systems for language laboratory operations.

The revised and enlarged edition of the "Allied Electronics Data Handbook" contains an up-to-date listing of the most commonly used tables, formulas, and reference material. New material in this 80-page handbook includes basic transistor formulas and symbols, transistor circuit configurations, a battery interchangeability guide, charts showing direct interchangeability between American and British tubes, and attenuator network formulas. All the reference material of the earlier editions has been retained. If you would like to have a copy, send 35 cents to Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.

A new 8-page catalog for the "hobbyist" can be obtained free by writing to Wilson's of Cleveland, 6502 N.W. 16th St., P.O. Box 8995, Fort Lauderdale, Fla. It illustrates and describes various devices ranging from miniature electric motors to accessories and kits.

"How To Make Quality Tape Recordings At Home" is a 16-page booklet directed at improving home recording techniques. A chart of playing times for all available tape thicknesses, reel sizes, and recording speeds is included. Send 10 cents to Triton Electronics, Inc., 62-05 30th Ave., Woodside 77, N. Y., for your copy.

A stereo/high fidelity brochure covering a variety of products is now available free of charge from Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif. Featured in the brochure (#AL-1302-3) is the new 708A "Astro" stereo, AM-FM multiplex, tuner-amplifier—a complete stereo system packaged in a single chassis. —30—

LAFAYETTE AMERICA'S VALUE LEADER

HI-FI · AMATEUR · CB · RADIO

"WORLD FAMOUS" HE-29B 10-TRANSISTOR CITIZENS BAND "WALKIE TALKIE" T.M.

39.95 NO MONEY DOWN

SET OF 2 78.88

- Transmits & Receives up to 2 miles
- Crystal Controlled on Both Transmit & Receive
- Push-to-Talk Operation
- 46" Telescoping Antenna
- Earphone For Personal Listening
- Leather Case with Shoulder Strap

Ideal for Sportsmen — boating-fishing — camping

Now Lafayette has done it again. The world Famous HE-29 has been further improved. Packed with power, 10 hand-picked transistors plus 1 diode extend the range of the He-29B up to two miles under average conditions ie., no intervening obstructions.

No license or permit required. Compact, pocket size unit provides complete portable two way communications. Transmitter section is crystal controlled. Crisp, clear reception is furnished by the efficient superheterodyne receiver. Power is supplied by 8 miniature standard penlight batteries with a life expectancy of up to 50 hours.

Housed in a handsome black and chrome case. Supplied with leather carrying case w/Shoulder strap earphone, antenna, batteries and crystals for channel 10. Size: 6⅜x3¼x1⅝". Shpg. wt., 3 lbs.

HE-29BL ..... Net **39.95**
Set of 2 ..... Net **78.88**

NEW LAFAYETTE 2-SPEED STEREO PLAYBACK TAPE DECK

59.50 No Money Down

- Dual NARTB Equalized Transistor Preamps
- Frequency Response: 50-15,000 CPS@ 7½ ips
- Playsback. ¼ & ½ Track Stereo; ½ Track & Full Track Monaural

Enjoy the superlative reproduction and fidelity of pre-recorded tape at the price you'd expect to pay for a record changer. Precision engineered, with its own 6-transistor stereo preamplifiers designed to play back tapes with true NARTB hi-fi tape equalization, quality tape handling mechanism and heads. Accepts reels to 7". 10¾Dx14⅜Wx5"H.

RK-141WX .....Shpg. wt., 17 lbs..... Net **59.50**
RK-148W Furniture Grade Walnut Base wt., 4 lbs. Net **6.95**
RK-147W Portable Carrying Case wt., 5 lbs. ..... Net **9.95**

NEW! LAFAYETTE STEREO FM MULTIPLEX ADAPTER KIT

19.50

- Less Than 1% Distortion
- Self-Powered
- Noise Filter (switchable)
- Prealigned Coils
- Stereo Separation — 30 db @ 400 cps
- 3 Tubes — 2 Dual, 1 Triple-Purpose Tube + Silicon Rectifier
- Ideal For Any Tuner With Multiplex Output Jack

Enjoy thrilling FM stereophonic sound from any recent Lafayette Tuner or any other quality wide-band FM or FM-AM tuner with multiplex jacks. Hear the full range of audio frequencies in all the realism and magnificence of stereo sound by simply adding this low-cost Lafayette Multiplex adapter Kit. Engineered for anyone to build and operate, the KT-220 is easily connected to your tuners.

Size 8½Wx4⅜Dx4⅜H" for 110-125 volts, 60 cycles AC.

KT-220 Shpg. wt., 4 lbs. ..... Net **19.50**

NEW! LAFAYETTE HE-20C CLASS D Deluxe CITIZENS BAND TRANSCEIVER

109.50 No Money Down

NOW WITH These ADDED FEATURES

- 8 Crystal — Control Receive Position's
- 8 Crystal — Control Transmit Positions
- Improved Series Gate — Noise Limiter
- Built-in 12 Volt Power Supply
- Efficient Pi-Network

Quality engineering, design, and features give this Deluxe transceiver a place all-its-own in the Citizens Band Field. The HE-20B supplies you with a highly efficient 2-way radio-telephone communications system from your office, truck, auto, boat, store, home, etc.

HE-20CWX **109.50**

FAMOUS "MIGHTY 9" T.M. 9 TRANSISTOR PERSONAL PORTABLE

REG. 25.88 NOW ONLY **19.95**

- 3 Audio Stages
- Lightweight. Shirt Pocket Size
- 9 Transistors, 2 Diodes, 1 Thermistor
- Complete with Carrying Case Batteries and Earphone

Lafayette's "Mighty-9" portable, the most powerful transistor radio, is the answer for those who want the best, without spending the most. Compare this portable with others selling for much more — compare feature for feature and you'll see why the Lafayette "Mighty-9" is your best buy. Size: 4½Hx3Wx1¼"D. Shpg. wt., 2½ lbs.

FS-91L **19.95**

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NEW MAIL ORDER and SALES CENTER

111 JERICHO TURNPIKE

(2 Blocks West of South Oyster Bay Rd.)

SYOSSET, LONG ISLAND NEW YORK

LAFAYETTE RADIO DEPT. IG-2 P.O. BOX 10, SYOSSET, N. Y.

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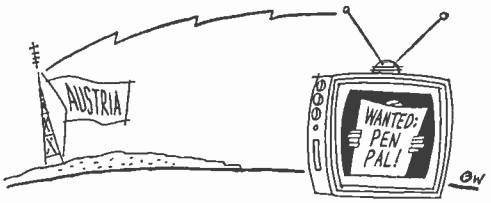
.on, we changed L2 to 7 or 8 turns of #22
e on a 1/4" ... Construction
its were cut somewhat by using the chassis

Address correspondence for this department to:
Letters Editor, POPULAR ELECTRONICS
One Park Avenue, New York 16, N. Y.

Pen Pal Wanted

■ I'm 21 years old, employed by the Austrian television system, and have been a subscriber to your magazine for several years. One of my



hobbies is short-wave communications, and I would like to get in touch with a "pen pal" having similar interests.

PETER PETROVICH
Landstrasse 90/17
Vienna III, Austria

Correction Corrected

■ In the article "Short Wave for Beginners" (January 1962 issue), Hank Bennett tells us that Leopoldville is in the Congo and Brazzaville is in Katanga. Leonard Phelps, in his correction (April 1962 "Letters") says that Leopoldville is in Katanga and Brazzaville is in the Congo. Both statements are wrong (or only partly right). Actually, Brazzaville is the capital of the Congo Republic (formerly French Middle Congo); Leopoldville is the capital of the neighboring Republic of Congo (formerly Belgian Congo); Katanga (capital, Elisabethville) is one of the six provinces comprising the Republic of Congo.

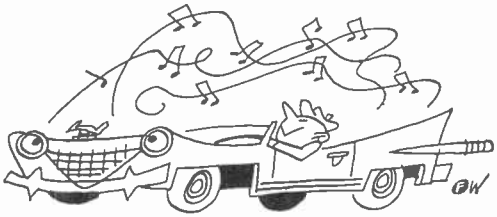
STEWART WEST
Union, N.J.

With at least four Congos to worry about here, it's no wonder that Messrs. Bennett and Phelps (and the "Letters" Editor) were confused. Thanks for finally clearing it all up, Stewart.

Mobile Multiplexer

■ Your article called "In-Car FM for MPL" (January 1962 issue) was quite interesting, and I determined to go ahead and install an FM radio in my car. Since the convertible already has two rear speakers (one on each side of the rear seat), I decided to add multiplex as well. I purchased a Knight Model KS-11 multiplex adapter kit and rewired the filaments for 12 volts. I also bought a

mobile plate supply, which handles both the receiver and the converter. The amplifier in the AM radio is used for the extra channel. I had previously installed provisions for disconnecting the AM



set's r.f. stages, because I use the radio as an auxiliary amplifier—feeding a speaker under the hood.

ALLAN L. STARR
Coral Gables, Fla.

Sounds like an intriguing installation, Allan, but it's too bad that you get only "mono" reception in the engine compartment.

Which Band for Police?

■ I'm planning to build equipment for tuning in police calls and other "public service" communications, and have been looking over the "Police Special Receiver" (July 1959 issue) and "The '10-8' De Luxe Converter" (January 1962 issue). What puzzles me is that the former tunes 30-50 mc., the latter 150.8-162 mc.; yet both are supposed to pick up police transmissions. Would I need both sets to get complete coverage?

JULIUS SISKE
Baltimore, Md.

Groups of frequencies in both the 30-50 mc. and 150.8-162 mc. bands are allocated for "public safety" use. This classification includes police, fire, and related services. If you're interested primarily in picking up a specific service in your neighborhood, check first to find out what frequencies are involved.

"Rat Runner"

■ I read Ken Gilmore's "Ultrasonics—Successes of Silent Sound" (December 1961 issue) with interest. One of the ultrasonic devices mentioned in the article was a unit designed to rid ware-

houses of rats. Could you tell me the name and address of the manufacturer so that I can write for more information?

JOHN CANNON
Milwaukee, Wisc.

One manufacturer of such a "rat runner" is Dynamic Sound, Inc., 15235 Lorain Ave., Cleveland 11, Ohio.

Compactron VHF Receiver

■ I converted the "Compactron VHF Receiver" (September 1961 issue) to cover the 35-54 mc. range with very good results. I used Ohmite Z-50 chokes for *L1, L3, L5,* and *L6* and a Hammarlund HF-15 variable capacitor for *C3*. In addition, I made up a new coil (having 12 turns instead of 2) for *L2* and dropped the supply voltage to about 150 volts by installing a 1200-ohm resistor in series with *R9*.

JIMMY SLAGLE
Henrietta, Texas

■ I built the "Compactron VHF Receiver" but, not being able to obtain the Merit power transformer specified, I used a Stancor PS-8415 instead. The Stancor differs from the Merit in that the former's high-voltage winding has slightly lower voltage and current ratings and the filament winding has no center tap. I grounded one side of the Stancor's filament winding in place of a center tap, but made no other wiring changes. The set is an excellent performer and is in constant use.

KERRY S. HAUPTLI, WPE2FLA
Westfield, N. J.

P. E. Collection For Sale

■ I've subscribed to—and read—POPULAR ELECTRONICS ever since the first issue. However, since my P.E. collection is beginning to take up more room than I can afford to give it, I've decided to let the whole shebang go to the first reader who

sends me $20.00. Every issue published to date is included, and there are duplications of the first few. No issues will be sold separately.

LAWRENCE CHURCHILL
314 N. 7th St.
Watseka, Ill.

Okay, Larry—stand by for the avalanche, and we hope you're not mad at us. -30-

HOW TO ORDER BACK ISSUES

Every month POPULAR ELECTRONICS receives many requests from readers who would like to know how to order back issues. Some readers want to obtain particular articles they have missed, while others want to complete their own back-issue files.

If you would like to order a specific issue of P.E., address your inquiry to:

Circulation Department
POPULAR ELECTRONICS
Ziff-Davis Publishing Co.
434 S. Wabash Ave.
Chicago 5, Ill.

Enclose 35 cents for each copy of issues less than six months old, 40 cents for each copy of older issues. Be sure to state the month and year of the issue(s) you want. In the event a requested issue is no longer in stock, your money will be returned.

NEW CB-3A Littlefone®

dual conversion,
8-channel citizens band

TRANSMITTER/RECEIVER

$159.95 (S-meter optional extra)

During a recent seven-month period, the Hallicrafters Company conducted a most unusual field test of its CB-3 citizens band transmitter. Through every conceivable condition of terrain, and weather, with almost completely continuous operation, the CB-3 was punished unmercifully and methodically . . . evaluated from every angle with the engineer's fine needle. Our purpose was not to prove something but to learn something. And in learning, to IMprove. Result: the new CB-3A "Littlefone"—solid and versatile expression of Hallicrafters' dedication to "THE NEW IDEAS IN COMMUNICATIONS."

EXTREME CONDITIONS WERE THE RULE

Early in July, 1961, test vehicles equipped with CB-3's were dispatched from Chicago northward into Wisconsin and Minnesota. A limited geographic area was picked, with no pre-planned route. Each short range destination was a "target of opportunity"—chosen to take advantage of the *worst possible conditions* as they occurred.

On D-day the temperature was 95°, and it ranged down to —20° before the test was completed. Identical and controlled transmission tests were conducted in both hilly and flat terrain, in cities and woodlands.

The CB-3 was operated on a continuous basis for periods ranging from four to twelve hours. More than 30,000 miles of mobile operation in the test vehicle were logged, plus unrecorded periods in trucks, boats—even an airplane.

TESTS WERE VARIED AND THOROUGH

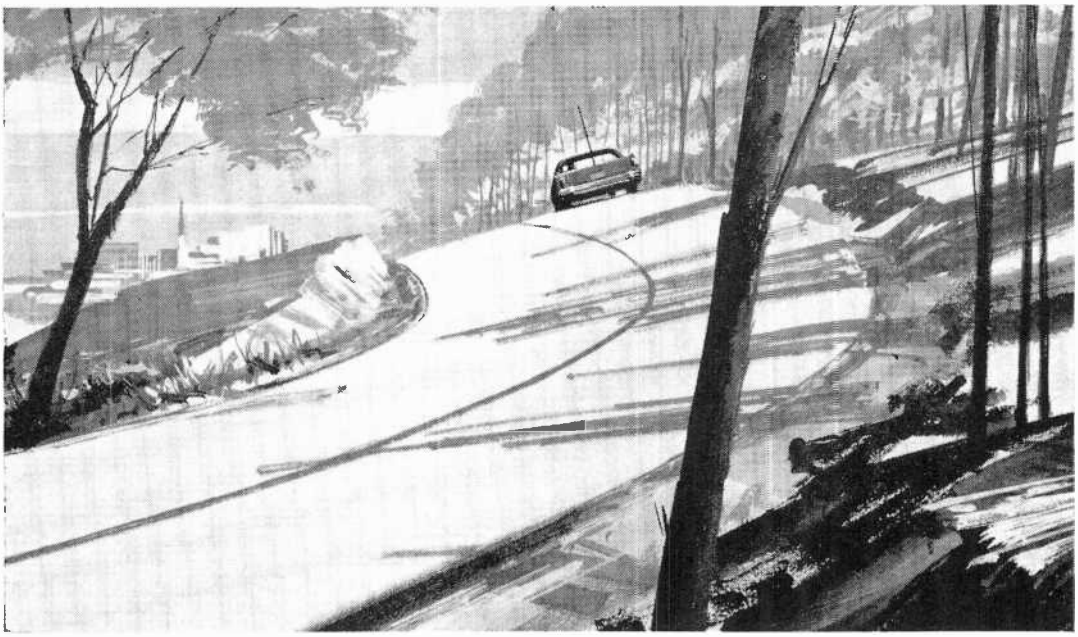
All tests were conducted on both an objective and competitive basis. At various times, standard equipment of the five most popular transceivers were employed in the same or directly comparable situations. Relative range, modulation, channel interference and heterodyne were measured.

Base units also were interchanged, and four different basic antenna systems rotated both in base and mobile installations. In all, more than 150 antenna installation modifications were made.

WHAT WE FOUND OUT

Range and speech quality were exceptional. The CB-3 under "normal" conditions (average of hilly and flat terrain, moderate weather conditions) produced 10-2 copy at 20 miles . . . up to 40 miles in the lake region of Wisconsin . . . as low as 8 miles in the lead and zinc mining regions southwest.

Average performance over the entire seven-month period was a *minimum of 7%* and a *maximum of 12% greater range* of intelligible speech than the five other units tested.



In the major metropolitan areas visited, some adjacent-channel interference was experienced on all units during peak traffic periods.

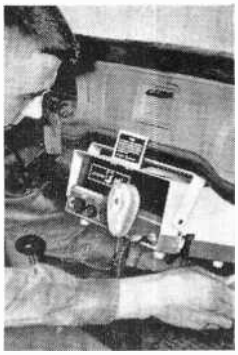
Reliability: in over 1,600 hours of operation, not a single major failure was experienced. Total parts replacement—two panel bulbs, one vibrator, two tubes. No visible deterioration of automotive electrical system. A microphone cord was broken due to carelessness.

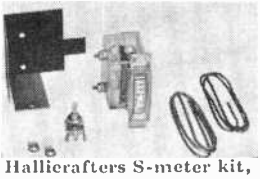
Antennas: Major deterrent to good communications was observed to be faulty antenna installation throughout the test areas. Of more than 90 existing base stations co-operating in the tests, most were using improper or unmatched antennas. Range was increased (all brands) from *a minimum of 50% to 70%* with corrective measures.

General observations: Mechanical design and exclusive drop-down chassis construction of the CB-3 permitted far easier access for crystal changing and removal of unit for base use.

External S-meter was required during tests; observers with technical background felt a need for S-meter provision in the CB-3.

Eight-channel flexibility and crystal controlled operation on both transmit and receive functions were distinctly superior to competitive systems, particularly in mobile and heavily populated areas.





Hallicrafters S-meter kit, optional at $8.95

Easy to install in place of removable panel.

Result—the new CB-3A with field-tested improvements!

- 8-channel, crystal-controlled convenience
- Maximum adjacent-channel rejection without loss of sensitivity through new type dual conversion.
- Removable panels for S-meter, future accessories.
- Built-in accessory jack (external speaker, etc.)
- FCC Type-Accepted.

Transmitter: 100% modulation on positive peaks; output amp. adjustable for maximum legal input; matches 50 ohm antenna systems; series-tuned 2nd harmonic trap for excellent TV suppression.

Receiver: Dual conversion—adjacent channel rejection 40 db. minimum; sensitivity less than 1 microvolt for 10 cb. signal to noise ratio; 6 kc. selectivity; electronic squelch operates on less than 6 db. change; audio output over 2 watts.

the new ideas
in communications
are born at . . .

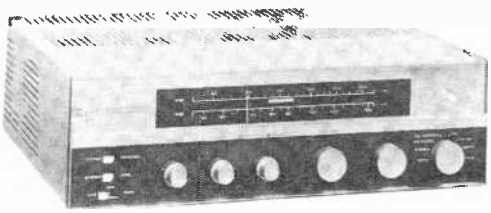
hallicrafters

5th and Kostner Aves., Chicago 24, Illinois

Hi-Fi Showcase

*A quick look at new products in the stereo/hi-fi field**

A couple of speakers and a record changer are all it takes for a complete stereo system, once you've assembled *Allied Radio*'s new KU-45 "Audio Center" kit. An AM/FM/FM-stereo tuner and a 32-watt stereo amplifier in a single "package," the KU-45 employs 20 tubes and offers a frequency response within 1 db from 30 to 16,000 cycles at its rated power. Even if you're not an experienced kit builder, there's no reason to shy away from the KU-45—it

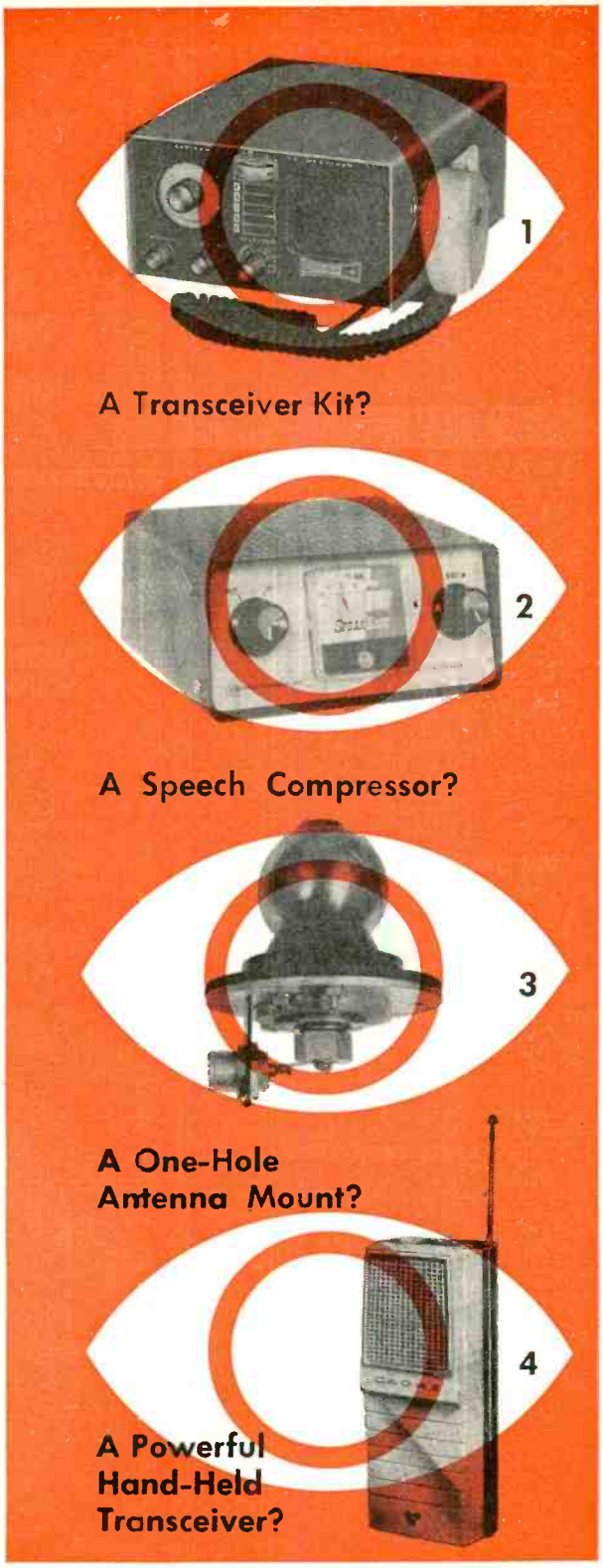


Allied KU-45 AM/FM tuner/amplifier

comes complete with a special pre-wired and pre-aligned FM "front assembly" along with all parts, tubes, wire, and solder (not to mention detailed, easy-to-follow instructions). Among its other features: a center-channel output for a third stereo speaker; input facilities for a stereo record player as well as tape recorder inputs and outputs, dual-concentric, clutch-type bass and treble controls. The kit is priced at $129.95; a special anodized case sells for $7.95, and a simplified version without the FM-stereo circuitry is available for $109.95. . . . First of a line of portable tape recorders from *Citroen Electronics*, the Model 660 is powered with a "cartridge" of six penlight batteries. A two-speed device, the 660 operates at both 1⅞ and 3¾ ips and is perfect for hi-fi applications requiring a general, all-round portable recorder. Available accessories include an a.c. adapter, a foot control, and an automobile cigarette lighter adapter; price of the 660 itself is $149.95.

Dynaco has a multiplex (FM-stereo) adapter kit specifically designed to complement the company's FM-1 tuner. Complete-

*Write to the manufacturers listed at the end of this column for more data on products mentioned



LOOKING FOR SOMETHING NEW IN CB GEAR?

Get Comparative Statistics on ALL CB EQUIPMENT in the 2nd Annual CB Equipment Buyers Guide & Directory

a part of the

AUGUST 1962 ISSUE of POPULAR ELECTRONICS

(on sale July 26)

PLUS: All of our usual features, construction projects, and departments

1 Daystrom Model DM-348
2 SpeakEasy
3 Webster
4 Cadre Model C-75

Showcase

(*Continued from page* 28)

ly automatic in operation, the FMX-3 adapter fits any of Dynaco's FM tuners and is wholly contained on the tuner chassis. In operation, a stereo broadcast automatically lights up the word "stereo" on the front panel, and a special filter network eliminates beats and whistles for perfect off-the-air tape recording. The adapter kit is priced at $29.95, while a complete FM-stereo tuner, factory-assembled and tested, sells for $169.95. . . . An inexpensive "miniature" tape recorder may be a handy little "adjunct" to your stereo setup, but the 3" reel capacity of most of these units doesn't allow much playing time. In answer to this problem, ***Ferrodynamics*** is producing a 3¼" reel containing 600 feet of ½-mil Mylar tape. The result: up to one hour of playing time on a two-track, 3¾-ips recording. As a bonus feature, the tape has a dry synthetic lubricant that eliminates squeal and reduces head wear. Suggested list price, $1.79.

From ***Gotham Audio*** comes a unique audio equalizer that combines almost every conceivable function of frequency discrimination. Built around a single inductively tuned circuit, the EQ-1000 universal equalizer provides high-frequency boost and droop, low-frequency boost and droop, high- and low-frequency sharp cutoff, and band-pass and band-reject functions with slopes as high as 24 db per octave. Intended primarily for professional applications in the recording and broadcasting fields, it lists at $1650.00. . . . The Model M1 multiplex (FM-stereo) adapter by ***Grommes*** comes fully wired and ready-to-go. Suitable for use with any high-quality FM tuner, it is inserted between the tuner's multiplex output and your amplifier's "auxiliary" inputs. The M1 is priced at $59.95, and a cover is available for $5.00 more. . . . The newest line of magnetic tape on the market is put out by an old-timer in other fields—***Eastman Kodak***. A high-quality, exceptionally uniform recording tape, it's available on 3", 5", and 7" "Thread-Easy" reels in both 1- and 1½-mil thicknesses. Each reel is packaged in a convenient one-piece box and protected by a dustproof polyethylene bag.

A compact, 2-speed tape recorder with provisions for 4-track monaural record and playback as well as 4-track stereo playback, ***Lafayette***'s RK-137 incorporates separate record/erase heads and a push-button safety switch to prevent accidental erasures. The RK-137 accommodates up to 7" reels, oper-

THE ONE AND ONLY knight-kit "SPAN MASTER!"

GREAT TO BUILD! GREAT TO OWN! packed with endless listening thrills

WORLD-WIDE 4-BAND SHORT WAVE RECEIVER KIT

ONLY $25.95

SEND NO MONEY

only $5 per month

You can hear *everything* on the fun-to-build "Span Master"—far and away the leader in its class for radio coverage, sensitive performance and value. Continuous tuning from 540 kc to 30 mc lets you hear ships, planes, direct broadcasts from Moscow, Berlin, Rome, London, Paris; tunes the 160, 80, 40, 20, 15 and 10-meter Ham bands—plus powerful local AM reception and dozens of other exciting broadcast services.

Bandspread dial and fine regeneration make tuning an easy pleasure. Has headphone terminals and speaker cut-out switch for private listening. Super-sensitive circuit. Easy to assemble from step-by-step instruction manual—includes list of foreign stations and international Morse code. Pyroxylin-covered cabinet with perforated white baffle and satin-chrome control panel. Complete with all parts, tubes, wire and solder. Size, 6¼ x 14 x 6¾". For 110-125 v., 60 cycle AC. Shpg. wt., 8 lbs.

83 YX 258BC. "Span Master" Kit, *only* . **$25.95**
83 Y 100. Outdoor Antenna Kit . . . . . **$ 1.03**
59 Y 110. Dual Headset . . . . . **$ 2.08**

Satisfaction guaranteed or your money back!

ALLIED RADIO
KNIGHT ELECTRONICS DIVISION

Tune world capitals direct

Hear ships at sea

Hear planes in flight

Tune all your favorite local AM programs

- **Tunes Shortwave and Broadcast Bands continuously from 540 kc to 30 mc**
- **Bandspread Control for easy, enjoyable shortwave tuning**
- **Sensitive Regenerative Circuit for world-wide radio reception**
- **Built-in Speaker plus headphone terminals for privacy listening**
- **Transformer Powered for maximum circuit performance**
- **Handsome modern styling—includes wood cabinet**

SEND NO MONEY *order today!*

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☐ Antenna Kit 83 Y 100 ☐ Dual Headset 59 Y 110
☐ Ship No Money Down on Allied's Credit Fund Plan

Name _____
PLEASE PRINT

Address _____

City _____ Zone _____ State _____

Showcase

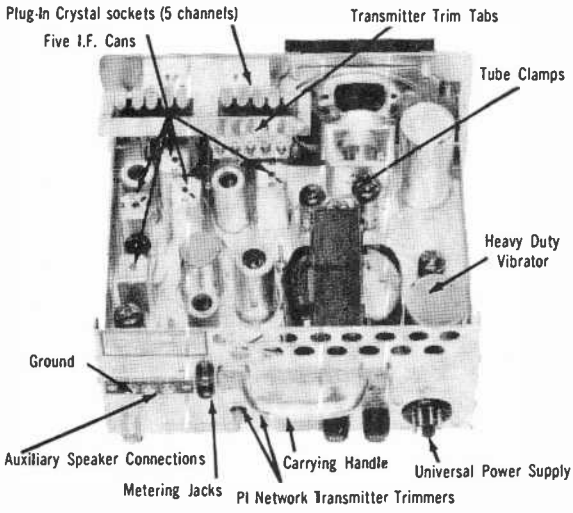
(*Continued from page* 30)

ates at 3¾ and 7½ ips, and is equipped with jacks for both microphone and radio/phono inputs. Among its other features: a pause button, a vu meter, a fast-forward and a fast-rewind function. Operating from any 117-volt, 60-cycle a.c. line, the recorder measures a compact 6½" x 13½" x 10⅝" and sells for $89.50. . . . Another new Lafayette product, the LT-78 stereo tuner, offers complete facilities for AM, FM, and FM-stereo reception. The superheterodyne AM circuit has three i.f. stages for high gain, and an 8000-cycle bandwidth for wide response; the FM circuitry features a 200-kc. bandwidth, a Foster-Seeley discriminator, and variable a.f.c. There is also a rear-panel-mounted stereo dimension control, a front-panel noise filter switch, flywheel tuning, and a pilot light to indicate when the multiplex is switched on. Price? Again, a low $89.50. . . . Designed for use with automatic turntables, *Pickering*'s new U38/AT cartridge has some extremely impressive characteristics. For one thing, it combines the mu-metal shielding of the stereo "Fluxvalve" with a high output (10 mv.) for good signal-to-noise ratio. What's more, it tracks at pressures from 2 to 5 grams, provides a response within 2 db from 20 to 20,000 cycles, and offers a channel separation of 35 db. Supplied with universal mounting hardware, the cartridge carries a price tag of $46.50.

Lafayette LT-78 stereo tuner

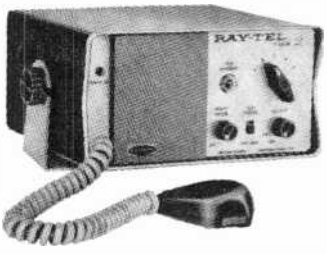
An adapter for 10½" reels that can give you up to 12 hours playing time per reel takes just three minutes to install. Made by *Roberts Electronics*, it fits the company's 990 four-track stereo recorder, 199D tape deck, and 191 and 192 professional recorders (although both the 191 and the 192 require a special motor for the adapter). Price, $49.50. . . . Two *Robins Industries* products are just the thing to help you take care of your tape heads. Packaged together in one "kit" are a two-ounce bottle of head cleaner with an applicator, and a two-ounce bottle (again with applicator) of lubricant for recording heads and tape guides. Price of the TK-6 kit, $2.00.

If you've been looking for an easy way



here's CB with REACH

RAY-TEL TWR 2



only $189.95*

This rugged, compact, dependable 2-way radio is performance-engineered to give you consistently clearer CB transmission and more stable reception.

Raytheon Ray-Tel TWR-2 features super-sensitive dual conversion superheterodyne receiver for maximum coverage, selectivity and sensitivity.

Raytheon crystals are ground to military specs. Each tube is clamped in to withstand the rugged field conditions associated with military type usage.

TWR-2 comes complete . . . ready to use right out of the box. No printed circuits, no relays. Full-range automatic volume control, automatic accurate tuning, noise-free stand-by reception, trim tabs for "on the nose" frequency performance.

For particulars on Ray-Tel TWR-2, including spec sheet and schematics, write Raytheon Company, P. O. Box 720, Westwood, Massachusetts.

Suggested list price

DISTRIBUTOR PRODUCTS DIVISION

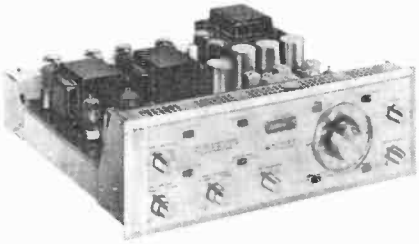
RAYTHEON

WESTWOOD, MASSACHUSETTS

Showcase

(*Continued from page* 32)

to convert binding posts or other screw- or solder-type terminals on stereo/hi-fi equipment to "quick-connect" phono jacks, ***Switchcraft***'s No. 373 molded audio adapter will do just that. A two-conductor long-handle phono jack connected to a 3" length of stripped and tinned shielded cable, the 373 mates with standard Switchcraft and RCA-type phono plugs. . . . Seaching the band for FM stereo broadcasts? You'll find them quick as a wink with ***Scott***'s new Sonic-Monitor and Model 340 FM tuner/



Scott 340 FM tuner/amplifier

amplifier. The first Scott product to feature this new device, the Model 340 has an output of 60 watts, and provides inputs for tape recorder, phono cartridge, or auxiliary sources. A special filter makes for noise-free off-the-air stereo tape recordings, and an ultra-sensitive silver-plated "front end" provides an IHFM sensitivity of better than 2.5 μv. To locate an FM-stereo broadcast, all you do is switch the "Sonic Monitor" to "Monitor" and tune across the dial until you hear a "monitor" tone from your speaker. Switch the Sonic Monitor to "Listen," and there's your FM-stereo program! The unit incorporates a professional-type tuning meter, and a handsome accessory case is available. Price of the 340, $379.95.

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
Citroen Electronics Corp., 832 N. La Brea, Los Angeles 38, Calif.
Dynaco Inc., 3912 Powelton Ave., Philadelphia 4, Pa.
Ferrodynamics Corp., Gregg St. & Route 17, Lodi, N.J.
Gotham Audio Corp., 2 W. 46th St., New York 36, N.Y.
Grommes Div., Precision Electronics Inc., 9101 King Ave., Franklin Park, Ill.
Eastman Kodak Co., Rochester 4, N.Y.
Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, L.I., N.Y.
Pickering & Co. Inc., Sunnyside Blvd., Plainview, N.Y.
Roberts Electronics, Inc., 5920 Bowcroft St., Los Angeles 16, Calif.
Robins Industries Corp., Flushing 56, N.Y.
Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.
H. H. Scott, Inc., Dept. P, 111 Powdermill Rd., Maynard, Mass.

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- ★ SIGNAL TRACER
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- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
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YOU DON'T HAVE TO SPEND HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 20 Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for Television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $26.95. The Signal Tracer alone is worth more than the price of the entire Kit.

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You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment.

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The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are 20 Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector Circuits. These are not unprofessional "breadboard" experimental circuits, but are factory-type circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build 20 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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- ● PRINTED CIRCUITRY

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You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

FROM OUR MAIL BAG

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Trouble-Shooting Tester that comes with the Kit is really sweet, and finds the trouble, if there is any to be found."

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

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- ☐ Rush me FREE descriptive literature concerning "Edu-Kit."

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1186 Broadway, Dept. 594-D, Hewlett, N. Y.

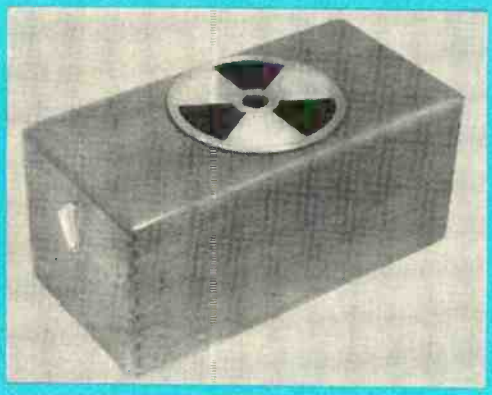
RADIATION FALLOUT MONITOR

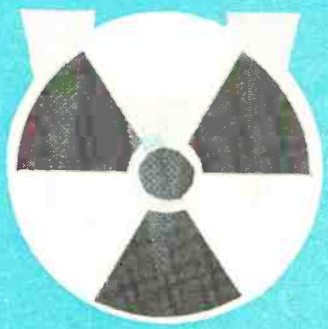
By R. L. WINKLEPLECK

"MOST OF US in this country," warns a recent Federal Civil Defense Administration booklet, "live within fallout range of some target which it might be important for the enemy to destroy." "Fallout," of course, causes the residual radiation from a nuclear explosion. Consisting of particles of radioactive debris which have been carried into the upper air by the force of the blast, it drops to earth over a wide and only generally predictable area.

The "Radiation Fallout Monitor" described here provides a means for keeping track of the radiation level in your neighborhood. Using one of

RADIATION FALLOUT MONITOR





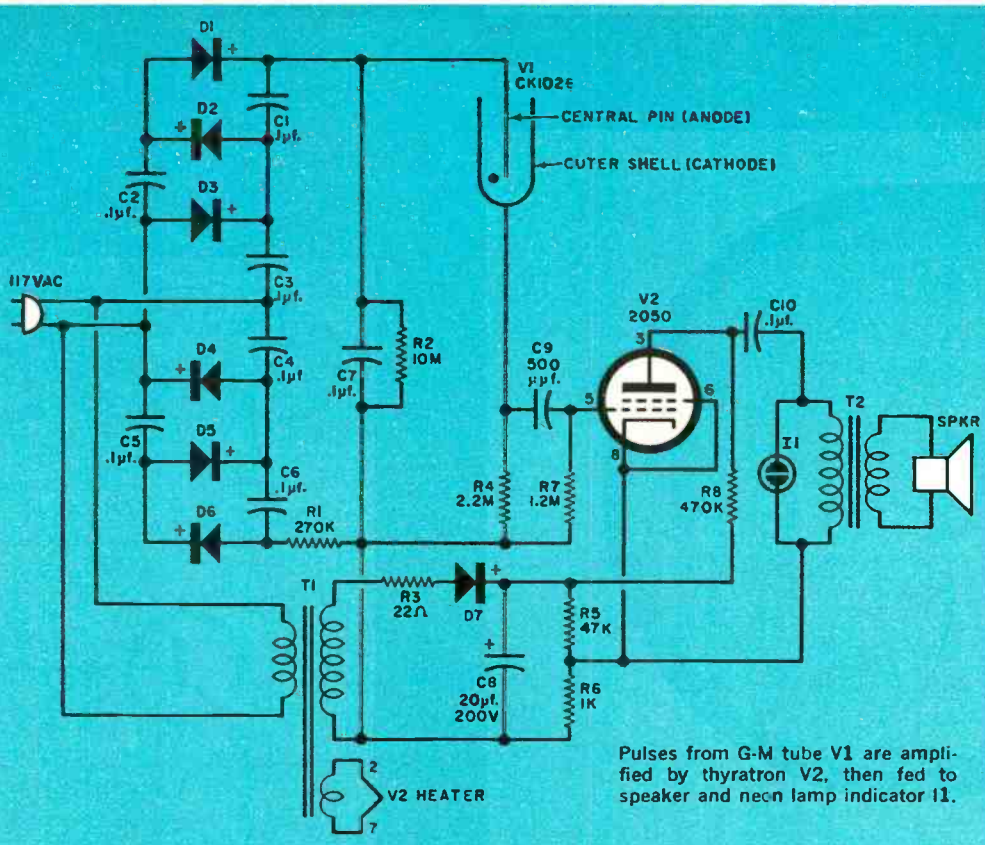
the least expensive Geiger-Mueller tubes available, the unit will give you a good idea of the natural radiation density—and any deviations will be immediately apparent. Using little current, it can be left operating continually to serve as a round-the-clock monitor.

This monitor, however, is to be considered only as an extra household precaution. The most reliable source of emergency information continues to be your local Civil Defense office. They'll know if the radiation from fallout has reached a dangerous level, and will advise you of the necessary protective measures to take.

About the Circuit. The approximately 800 volts required for the operation of the Geiger-Mueller tube (*V1*) is developed by a voltage-multiplier circuit consisting of diodes *D1-D6* and capacitors *C1-C6*. Resistor *R1* and capacitor *C7* act as a filter network, and load resistor *R2* tends to prevent excessive voltage fluctuation.

Don't attempt to check the supply voltage with a VOM, incidentally. You won't get a correct reading because even the high resistance of this instrument is enough to cause an overload. A VTVM with a high-voltage probe must be used.

The output of the supply is fed to *V1* through current-limiting resistor *R4*. Ordinarily, this voltage is not enough to cause *V1* to conduct. But when the glass



Pulses from G-M tube V1 are amplified by thyratron V2, then fed to speaker and neon lamp indicator I1.

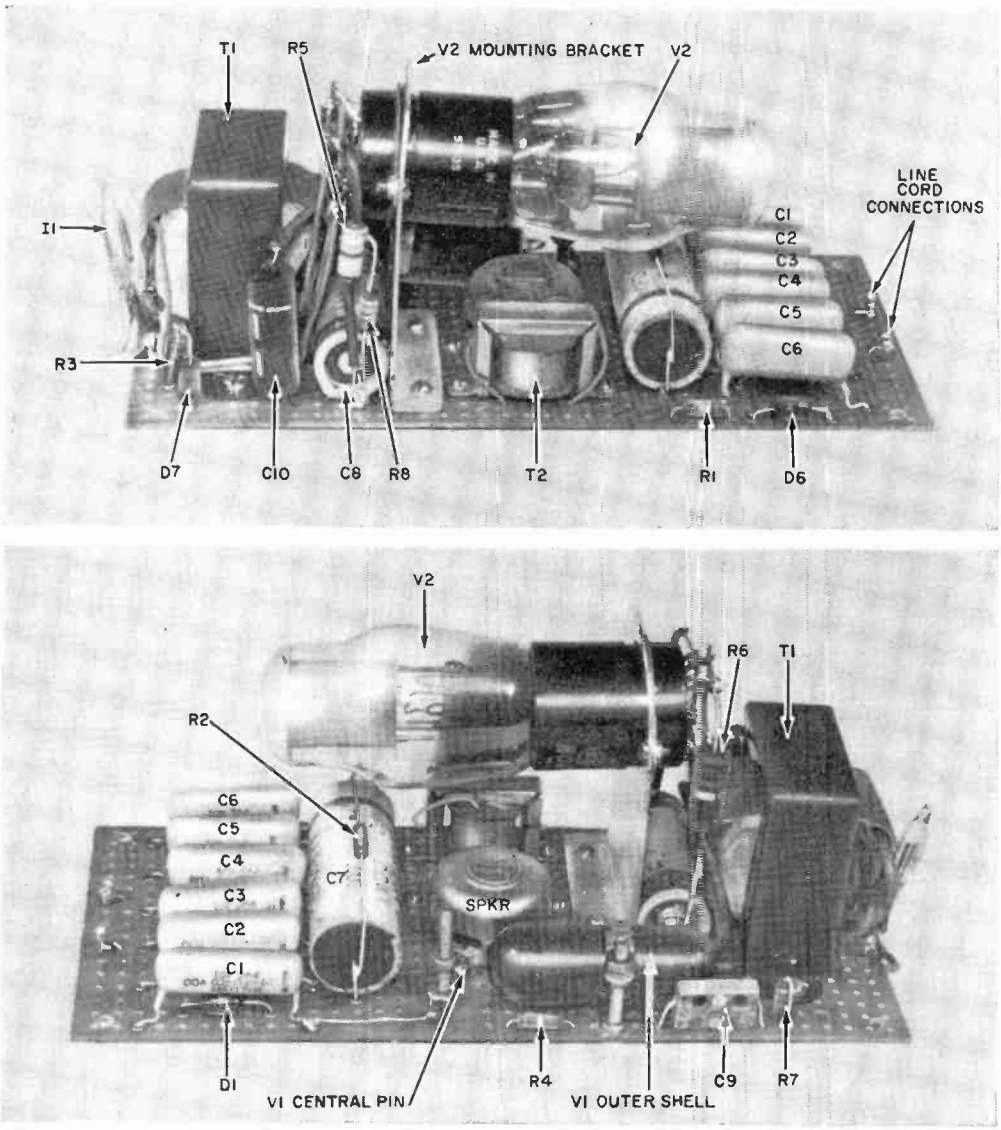
PARTS LIST

C1, C2, C3, C4, C5, C6, C10—0.1-μf., 400-volt paper capacitor
C7—0.1-μf., 1000-volt paper capacitor
C8—20-μf., 200-volt electrolytic capacitor
C9—500-μμf. mica capacitor
D1, D2, D3, D4, D5, D6, D7—1N2070 diode (Texas Instruments)
I1—NE2 neon lamp
R1—270,000 ohms
R2—10 megohms
R3—22 ohms
R4—2.2 megohms
R5—47,000 ohms, 1 watt
R6—1000 ohms, 2 watts
R7—1.2 megohms
all ½-watt, 5% resistors unless otherwise specified
R8—470,000 ohms, ½ watt, 5%
SPKR—1½" miniature speaker, 10-ohm voice coil (Lafayette SK-61 or equivalent)
T1—Power transformer; primary, 117 volts a.c.; secondaries, 125 volts @ 15 ma., 6.3 volts @ 0.6 cmp. (Stancor PS-8415 or equivalent)
T2—Miniature output transformer; primary, 2000 ohms; secondary, 8-10 ohms (Lafayette TR-93 or equivalent)
V1—CK1026 Geiger-Mueller tube (Raytheon)
V2—2050 thyratron tube
1—3¼" x 7¼" section of perforated board
Misc.—Wooden, plastic, or metal box, screen wire and scrap aluminum for speaker opening, scrap Lucite for I1's window, hardware, etc.

wall of the tube is penetrated by a particle of gamma radiation, the halogen gas inside ionizes for an instant, allowing conduction. This causes a positive pulse of a few volts to appear across *R4*.

Thyratron tube *V2* serves to amplify the pulse. Its plate is supplied with approximately 170 volts by a separate power supply consisting of transformer *T1*, diode *D7*, current-limiting resistor *R3*, and filter capacitor *C8*. The voltage is delivered to *V2* through load resistor *R8*, and *V2*'s cathode is biased about 4 volts positive with respect to its control grid by means of voltage-dividing resistors *R5* and *R6*.

With no voltage across *R4*, the cathode bias prevents the thyratron from conducting. But when a radiation particle causes a positive pulse to appear across that resistor, *V2*'s grid swings positive and conduction occurs. The instantane-



Views of both sides of the perforated board clearly show locations of the major components. Diodes D2, D3, D4, and D5, however, are mounted in the spaces between capacitors C1 and C6 and are not visible. The line connections are made via a pair of metal terminals inserted near C1 — C6.

ous voltage drop across *R8*, caused by the current drawn by the conducting thyratron, is fed through capacitor *C10*—ionizing neon lamp *I1*. This gives a visual indication of the presence of the particle and also induces a voltage in the secondary of output transformer *T2*, causing the speaker to click.

Thyratron *V2* would normally continue to conduct, even when the pulse disappears from the control grid. However, the instantaneous voltage drop across *R8* is large enough to reduce the plate voltage of the thyratron to the point where conduction cannot be maintained. Therefore, the tube cuts off, the load disappears from *R8*, and the plate voltage rises in readiness for the next pulse. This conduction/non-conduction cycle can be repeated a maximum of about 60 times per second.

Construction. The circuit is assembled on a 3¼" x 7¼" section of perforated board. All of the components are mounted

RADIATION FALLOUT MONITOR

on one side of the board and (in most cases) their leads are passed, through convenient perforations, to the other side. Here, the actual wiring is carried out; make all connections point to point and cover bare leads with spaghetti wherever necessary.

In some cases, the author ran component leads through brass eyelets installed on the board, rather than directly through the perforations. The eyelets make convenient junction points and, if all leads passing through are soldered in place, provide an extra-rigid mounting.

Thyratron *V2* is mounted horizontally, its socket being installed on a home-made aluminum "L" bracket. The exact dimensions of the bracket are not important, but see that the socket is raised high enough above the circuit board so that *V2* will clear all of the components.

The Geiger-Mueller tube (*V1*) is held in place by a spring clip mounted on a machine screw and nut which, in turn, are anchored to the board. This clip also serves as a contact to the outer shell, or cathode, of the tube. It's connected into the circuit via a solder lug installed under the screw head.

Tube *V1*'s central pin, or anode, passes through a small hole drilled in another machine screw mounted near the tube. A second solder lug is similarly installed to connect the assembly into the circuit. Run a nut down the screw to make a secure electrical connection with the pin, but make it only finger-tight (this also applies to the nut holding the cathode clip). Excess pressure can easily ruin the tube.

The speaker specified in the Parts List is a bit larger than the one actually used by the author. It makes for a slightly tighter fit on the board, but has the advantage of being provided with its own mounting lugs, and it gives more volume as well. No great change in the relative component positions shown in the photographs is required.

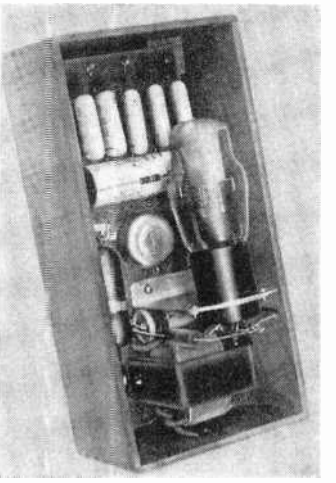
The author installed his completed circuit board in a wooden box which originally contained "Christmas" after-shave lotion. The speaker opening on top of the box was covered with black screen wire and decorated with the familiar radiation warning symbol (cut from a scrap of sheet aluminum). Flashes from the neon lamp are visible through a piece of Lucite glued into the end of the box near *I1*.

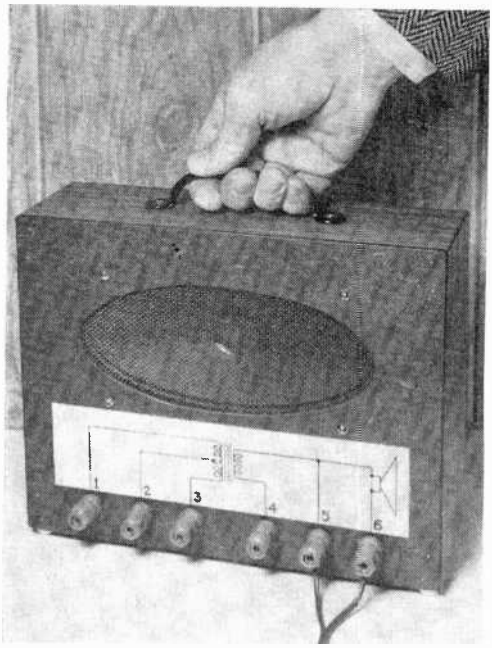
A set of rubber feet was installed on the box bottom—giving enough clearance for ventilating air to pass through several holes drilled there. An exit for the heated air is provided by the speaker opening.

The housing for the board isn't critical, of course, and you can adapt any metal, plastic, or wooden box which appeals to you. Just be sure to make adequate provisions for ventilation.

(*Continued on page* 100)

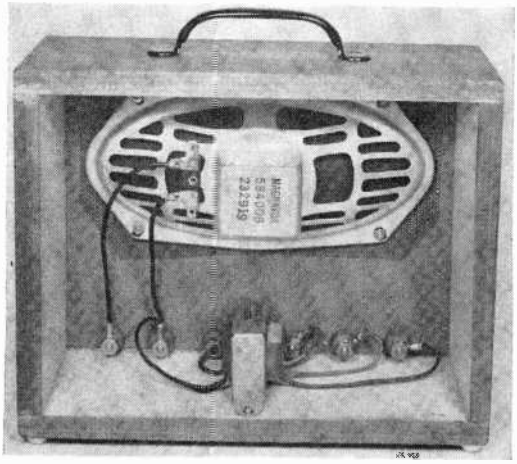
Author used shaving-lotion box (shown here with cover off) as a cabinet. Any similar container will serve if adequate ventilation is provided.





Designed for the serviceman, this Test Bench Squawk Box supplies for chassis under repair the missing audio circuit elements left behind in the customer's house.

The unit is as easy to assemble as it is to use. Rear view of author's model shows a Magnavox 4" x 8" PM speaker, output transformer, binding posts, connecting wiring.



TEST BENCH SQUAWK BOX

SERVICEMEN, professionals and amateurs alike, often work on television, hi-fi and radio chassis whose mating speakers are not on the test bench but miles away in the owners' cabinets. In most cases, the speakers are left behind because they are bulky, difficult to remove, and, once removed, prone to damage. Then how does one listen to the equipment being tested and repaired? It's easy, if you own a Test Bench Squawk Box. If you don't have one, an evening's time plus a few ducats for parts are all that is needed to assemble this audio aid.

The size and shape of the enclosure for the speaker are determined by the speaker size you plan to use. Standard auto replacement PM speakers are ideal; they range in size from 3" x 5" to 6" x 9", with a few odd-ball sizes thrown in. Assemble the enclosure using ½" hardwood for the sides, top and bottom, and ¼" fiberboard for the front. Cut out a port for the speaker, and then mount the speaker, six 5-way binding posts, and an audio output transformer so that the unit resembles the author's Squawk Box shown above. The transformer's output winding impedance should match the speaker's impedance, and the primary winding should be on the order of 5000 ohms center-tapped.

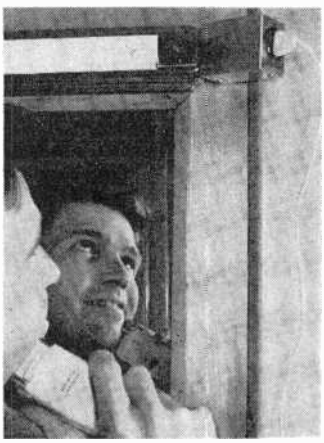
Interconnect the components following the schematic diagram shown on the unit in the photo at top, left; if you attach a similar schematic to the front panel of your Squawk Box, you will know at a glance how to connect the unit to a chassis. Then top off the construction by adding four rubber feet, a carrying handle, and—if you wish—a fiberboard back panel to close up the unit.

—Art Trauffer

SMOOTHER SHAVES
with Smoother Current

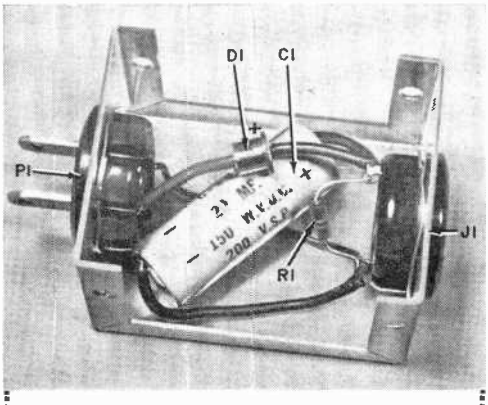
IF YOUR TRUSTY electric shaver "groans" in the morning and can't quite seem to "get going," maybe it needs a little d.c. "stimulation." Many of the older a.c./d.c. shavers which creep on a.c. often purr delightfully when operated on d.c. What's the answer? Build this little plug-in a.c.-to-d.c. converter—it'll take only an hour or so of your time and less than $3.00 of your cash.

Start construction by cutting a $1\frac{3}{16}$" hole in the center of each end of the utility box (it's easiest to use a chassis punch, but a circle cutter will also do the trick). Next, mount plug *P1* in one hole, and jack *J1* in the other, using the retainer rings supplied. This done, wire up the converter, following the schematic diagram and the photos at right. When wiring, be especially careful not to make any connections to the metal box itself—to prevent any possibility of an electric shock.



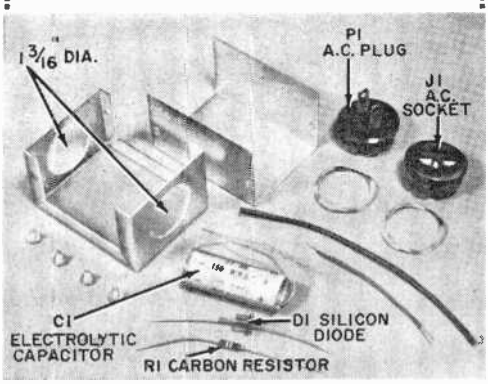
Your power converter is now ready to go. Simply plug your shaver into the converter, and the converter into a 117-volt a.c. outlet, and you'll shave with pleasure. It's best to unplug the converter when it's not in use, incidentally—someone might be tempted to insert a high-wattage or an a.c.-only appliance into it.

—*Joseph R. Noonan*



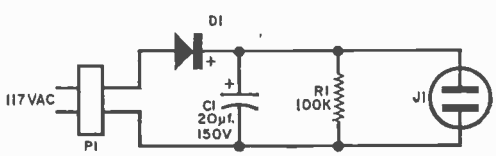
PARTS LIST

C1—20-μf., 150-w.v.d.c. electrolytic capacitor
D1—750-ma., 200-PIV silicon diode (Lafayette Radio Type SP-197 or equivalent)
J1—2-pole female a.c. socket, retainer-ring mounting (Amphenol Type 61-F or equivalent)
P1—2-pole male a.c. plug, retainer-ring mounting (Amphenol Type 61-M or equivalent)
R1—100,000-ohm, ½-watt resistor
1—2¾" x 2⅛" x 1⅝" aluminum utility box (Bud CU-3000-A or equivalent)
Misc.—Insulated hookup wire, spaghetti, solder



All the parts you'll need are shown here; the photo at the top of the page tells you how to mount them.

Wire the converter exactly as shown in diagram below. "Plus" of D1 must connect to "plus" of C1.



ONE FOR THE

Auxiliary receiver tunes 122—144 mc., operates from any 12-volt car battery

SOME EXCITING LISTENING is to be had in the VHF regions—signals from airplanes en route, emergency operations at airports, Civil Air Patrol missions, even local hamfests lurk in these frequencies, literally waiting to be pulled in. Unfortunately, though, most of the VHF "events" seem to take place just when you don't have a VHF receiver handy!

Of course, the obvious way to be prepared for a "find" on the VHF airwaves is to carry a VHF receiver in your car at all times. There's nothing very original about this idea, and it may even sound somewhat impractical. But it is just what we would like to suggest: "One For The Road" . . . and only the road; a VHF receiver so small that it can get lost in the glove compartment and so inexpensive that you can toss it into the car and forget it until you need it!

Although the unit shown here is the extreme in simplicity, it covers the 122-144 mc. range and is more than capable of satisfying the curiosity of the occasional VHF "eavesdropper." In addition, it can do a creditable job as an auxiliary receiver in times of emergency.

Since it uses one of the tubes designed for "hybrid" car radios, the need for vibrators or high-voltage power supplies is eliminated—the only power required to operate this receiver is 12 volts d.c. Thus, not only are costs and circuit complications reduced, but installation is as quick as 1-2-3. In fact, all you have to do to install this receiver is plug it into your cigarette lighter!

About the Circuit. As you may have already noted, the 12EC8 tube in the set consists of a triode and a pentode in the same envelope. Fortunately, the tube's triode section will oscillate at frequencies up to 200 mc. or more with plate voltages as low as 6 volts! And the same characteristics that make it a good VHF oscillator also make it a good superregenerative detector.

A single tube in a superregenerative circuit can often equal a full-sized com-

ROAD

By **HOWARD F. BURGESS,** W5WGF

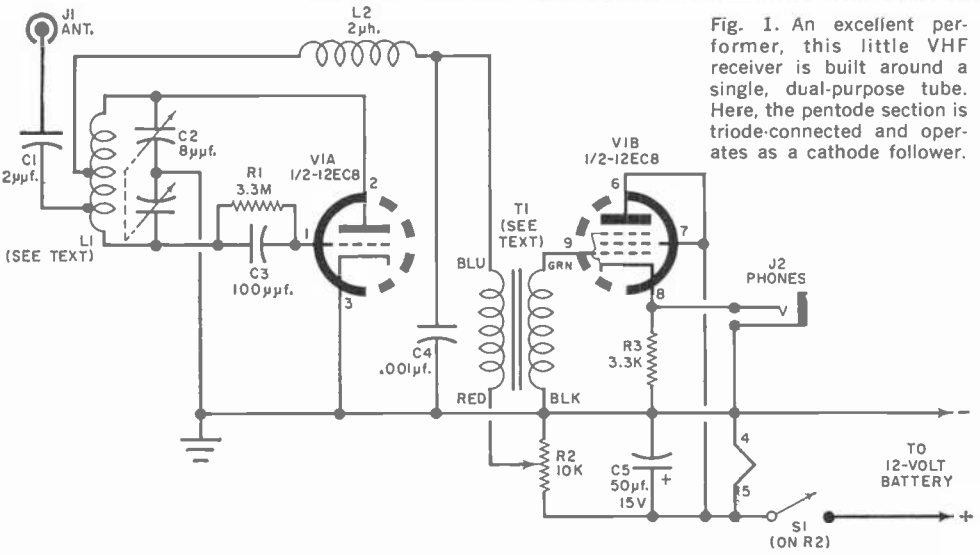


Fig. 1. An excellent performer, this little VHF receiver is built around a single, dual-purpose tube. Here, the pentode section is triode-connected and operates as a cathode follower.

PARTS LIST

C1—2-μμf. mica or ceramic capacitor
C2—8-μμf. midget variable capacitor, "butterfly" type (E. F. Johnson 160-208 or equivalent)
C3—100-μμf. mica capacitor
C4—0.001-μf. ceramic capacitor
C5—50-μf., 15-w.v.d.c. electrolytic capacitor
J1—Banana jack
J2—Miniature phone jack, non-shorting type (insulated type required for circuit in Fig. 2)
L1—Antenna coil (5 turns of #16 wire, ⅜" in diameter, spaced ½" long, tapped at center and 1 turn from end)
L2—2-μh. r.f. choke or 24 turns of #30 enameled wire close-wound on and connected in parallel with a 2-megohm, ½-watt resistor
R1—3.3-megohm, ½-watt resistor
R2—10,000-ohm miniature potentiometer, linear taper, with s.p.s.t. switch S1
R3—3300-ohm, ½-watt resistor
S1—S.p.s.t. switch (on R2)
T1—Miniature interstage transformer, at least 1:3 turns ratio—see text
V1a/V1b—12EC8 tube
1—4" x 2" x 2¾" aluminum utility box (Bud CU-2115-A or equivalent)
Misc.—Mica-filled 9-pin socket for V1, telescoping antenna, scrap aluminum for shelf, wire, solder, earphones, etc.

munications receiver in sensitivity. However, one of the unfortunate features of the "superregen" is its tendency to radiate interference on the channel being received. In this receiver, the power input to the detector is in the vicinity of 300 microwatts or less, so radiation should be of little concern.

With the triode section of the tube used as a detector, the pentode section is still available as a stage of audio amplification. However, in the circuit shown in Fig. 1, the pentode is triode-

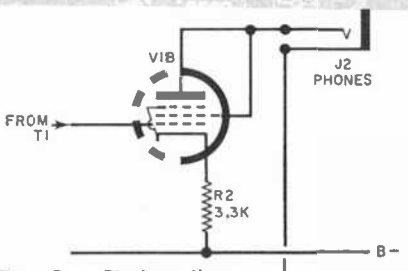
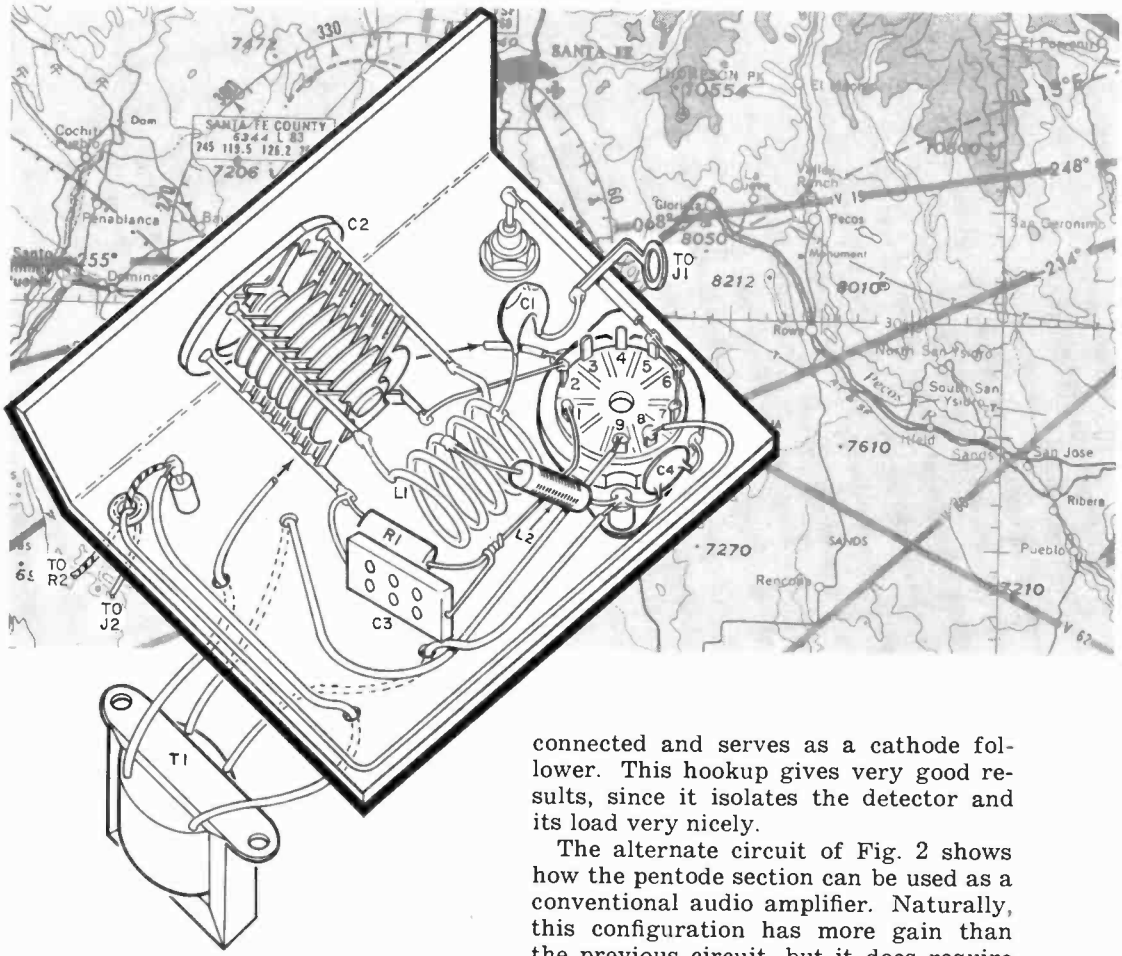
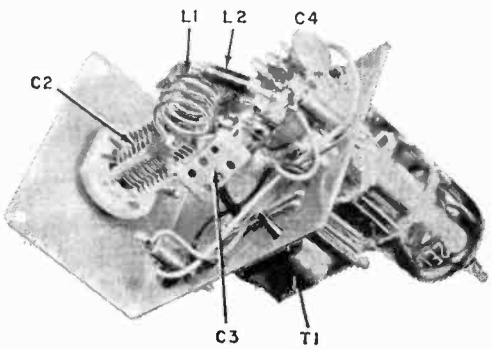


Fig. 2. Placing the phones in the plate lead increases overall gain.



An aluminum shelf (above), about 2¼" deep x 1⅞" wide, holds most of the components, with tuning capacitor C2 mounted on the shelf's 1" lip. Holes in lip of shelf (below) must match those in front panel of case.



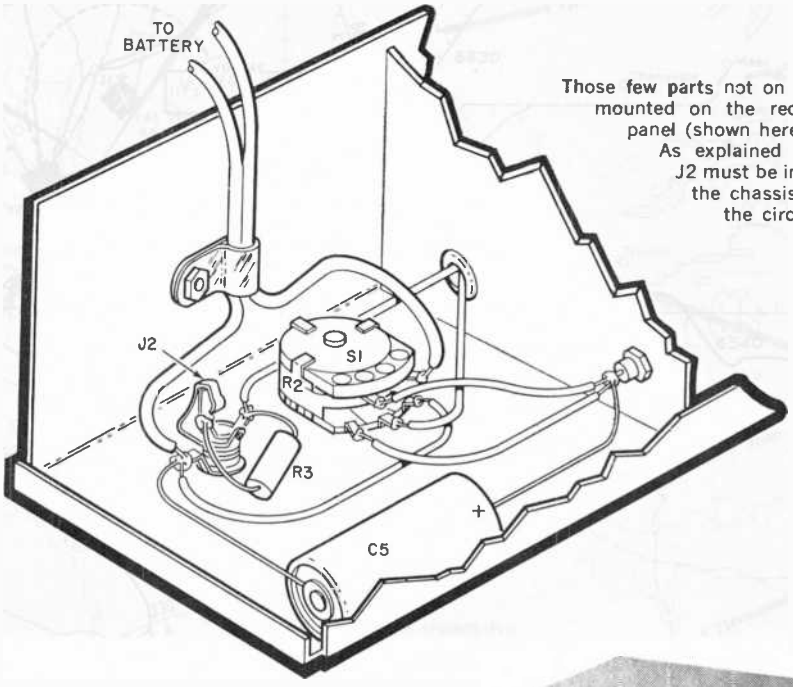
connected and serves as a cathode follower. This hookup gives very good results, since it isolates the detector and its load very nicely.

The alternate circuit of Fig. 2 shows how the pentode section can be used as a conventional audio amplifier. Naturally, this configuration has more gain than the previous circuit, but it does require that the output jack be insulated. However, the added voltage gain will be appreciated in many cases, especially if you intend to do most of your listening with headphones.

Construction. If full speaker volume is your goal, then your best bet is to build the circuit of Fig. 1 and feed its output into the audio section of your car radio. Alternatively, with the 4" x 2" x 2¾" case suggested, there's still room enough for the serious experimenter to include a power transistor to drive a speaker.

Several versions of the receiver have been built, and they have all worked—even with substitute parts and some pretty "haywire" hookups! With the construction and circuit as simple as they are, the photos and drawings should just about tell the complete story.

In the author's case, the small interstage transformer (*T1*) came from his



Those few parts not on the shelf are mounted on the receiver's front panel (shown here face down). As explained in text, jack J2 must be insulated from the chassis if you build the circuit in Fig. 2.

spare-parts box, but any miniature plate-to-grid coupling transformer with a turns ratio of 1:3 or more will work (the Argonne Type AR-155 is a good choice). A standard size interstage transformer can be used with quite a saving in cost if the receiver is spread out on a larger chassis.

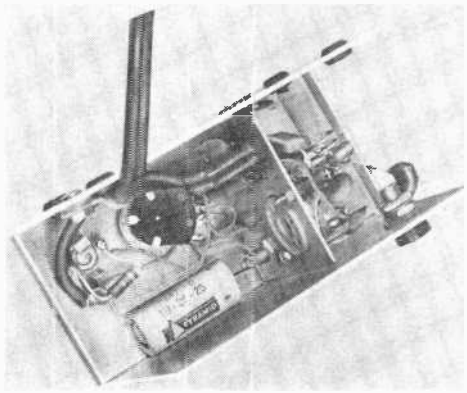
All of the parts except regeneration control *R2* and capacitor *C5* should be mounted on a small aluminum shelf. As long as you keep the leads from capacitor *C2* to socket pins 1 and 2 as short as possible, placement of the other components isn't especially critical. For best results, however, coil *L1* should be kept at least ¼" away from such large parts as transformer *T1* or the chassis itself.

Adjustment and Operation. After the receiver is wired, it can be tested by "clipping" it across a 12-volt car battery for a trial run—just make sure that the ground lead on the receiver is connected to the negative lead on the battery. Plug a pair of phones into the phone jack and advance the regeneration control until you hear the familiar smooth rushing sound of the superregenerative detector.

If the signals are strong enough, a 12" section of a telescoping antenna inside

(*Continued on page* 96)

Completed receiver (above) needs only an earphone, an antenna, and a battery to operate. Note that the entire receiver is housed in front portion of the case (below).

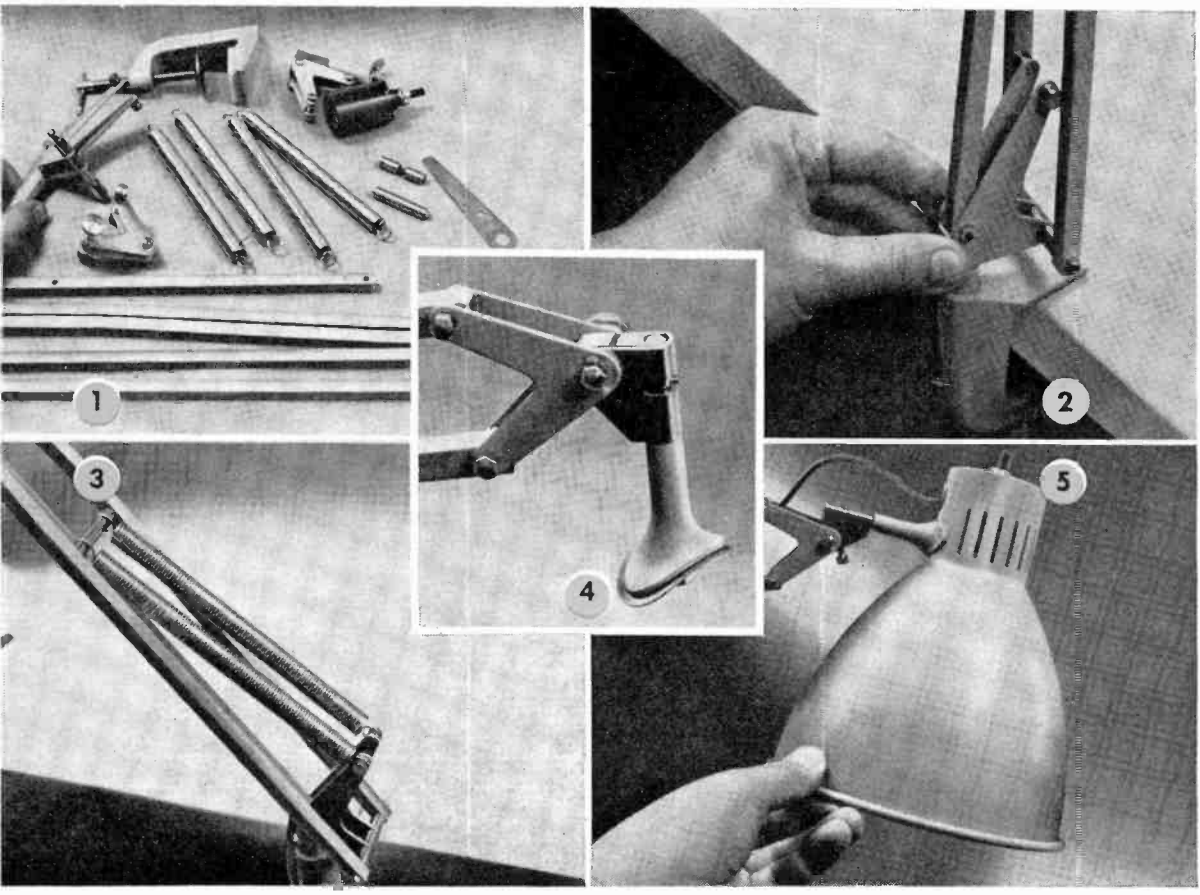


Tech-Lyte Kit

Proper lighting is frequently overlooked in the home electronics lab or workshop. Why strain your eyes peeking into dark corners when you can buy a kit for only $9.95 and assemble a free-movement utility lamp? Sold by Zack Electronics, 1422 Market St., San Francisco 2, Calif., the "Tech-Lyte" kit was put together in the POP'tronics lab in just about 30 minutes.

In Photo 1 are the unassembled parts as they arrive from the manufacturer. Photos 2 and 3 show how the base clamp and arms are mounted, as well as the counterbalancing springs which permit free lamp movement. A rod for the lamp shade (Photo 4) is attached to the neck assembly elbows which hold the other ends of the tubular arms together. The line cord to the lamp is carefully strung down the arms and around the elbows to prevent it being pinched or shorted out.

The lamp shade and socket (Photo 5) complete the assembly. Immediately available, the Tech-Lyte comes in grey, black, brown, or mist green.



TRANSISTORIZED TREMOLO

. . . adds "color" to musical instruments

By A. E. DONKIN, W2EMF

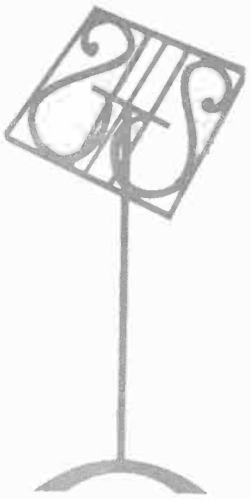
GOT A MUSICIAN in the family? You can delight him (or her) *and* your friends by constructing this little electronic tremolo. Reasonably easy to build, it makes a perfect addition to an electric guitar. Add a suitable mike, and you can use it with almost any musical instrument.

Like other tremolos, this device produces a "throbbing" effect on the sound of an electric musical instrument which is played "through" it. Unlike some versions, however, this circuit is transistorized and battery-operated, with several resultant advantages.

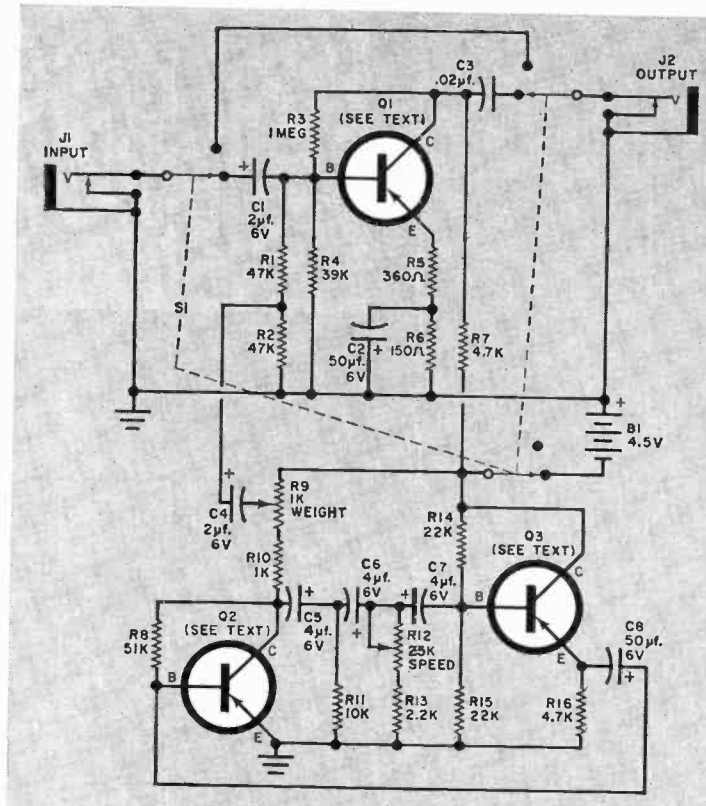
For one thing, the number of components is reduced; and so, too, is the cost. In addition, the unit is small enough and light enough to be attached directly to the musical instrument; this means that it can be readily controlled by the musician himself. Finally, the battery power supply substantially reduces the possibility of hum in the amplifying system.

About the Circuit. The transistorized tremolo is connected between the output of an electric musical instrument and an audio amplifier. It functions by varying the amplitude of the electrical signal from the musical instrument at a rate of about 5 to 15 times per second.

In the circuit shown here, transistor *Q1* is connected as an amplifier and is biased to draw very little collector current. To match the impedance of a magnetic instrument pickup, its input impedance has been increased by leaving



TREMOLO



Most components in the tremolo circuit are mounted on a piece of Vectorbord, with only the battery holder, jacks, potentiometers, and switch installed on the metal chassis itself (see photo at right). Although potentiometer R12 controls the "speed" or frequency, substituting other values for R11 will alter the basic frequency, as explained in text.

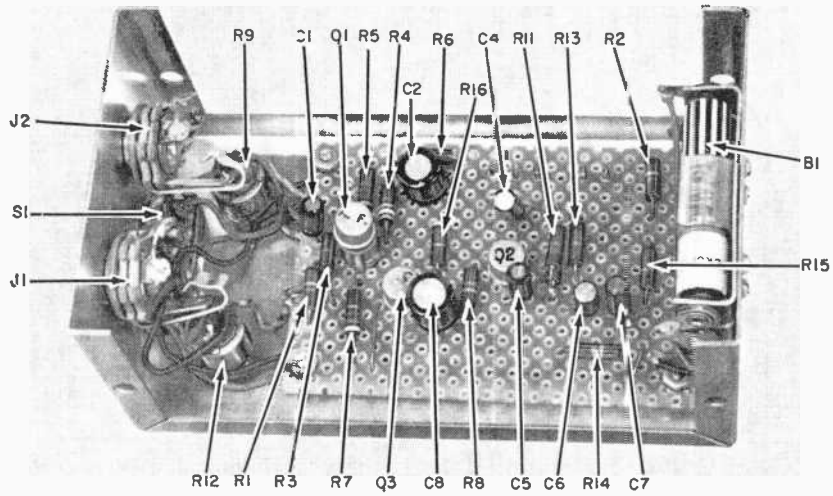
a portion of the emitter resistor unbypassed (*R5*).

Since transistor *Q1* is operated in the low-current region, its gain varies rapidly with changes in collector current. A low-frequency (5- to 15-cycle) signal is superimposed on the d.c. bias for this stage via resistors *R1* and *R2*, causing the collector current (and hence the gain) to vary.

Transistors *Q2* and *Q3* operate as a phase shift oscillator to generate the 5- to 15-cycle signal. Transistor *Q2* is a common-emitter amplifier supplying the phase shift network, and *Q3* is an emitter follower to adjust impedances and provide positive feedback. The frequency of the phase shift oscillator is adjusted by varying one "leg" of the phase shift network (potentiometer *R12*); the depth or "weight" is controlled by adjusting potentiometer *R9*.

Construction. Layout of the transistorized tremolo isn't critical, but it's still a good idea to follow the author's parts placement as nearly as possible. A $2\frac{7}{16}$" x $3\frac{1}{2}$" piece of Vectorbord facilitates mounting the smaller components, and Vector terminals can be used as tie-points where needed.

Potentiometers *R9* and *R12*, jacks *J1* and *J2*, switch *S1*, and the battery holder should be mounted in the utility box first, leaving as much room as possible for the Vectorbord assembly (be sure to allow enough clearance to insert and re-



PARTS LIST

B1—4.5-volt battery (three Burgess Type 7 "slim" penlight cells in series or equivalent)
C1, C4—2-μf., 6-w.v.d.c. miniature electrolytic capacitor
C2, C8—50-μf., 6-w.v.d.c. miniature electrolytic capacitor
C3—0.02-μf. miniature paper capacitor
C5, C6, C7—4-μf., 6-w.v.d.c. miniature electrolytic capacitor
J1, J2—Phone jack, shorting type
Q1, Q2, Q3—Audio transistors, pnp type (Lafayette SP-239 or equivalent)
R1, R2—47,000 ohms
R3—1 megohm
R4—39,000 ohms
R5—360 ohms, 5%
R6—150 ohms
R7, R16—4700 ohms
R8—51,000 ohms, 5%
All resistors ½ watt, 10%, unless otherwise noted
R9—1000-ohm miniature potentiometer, linear taper
R10—1000 ohms
R11—10,000 ohms
R12—25,000-ohm miniature potentiometer, linear taper
R13—2200 ohms
R14, R15—22,000 ohms
S1—3-pole, double-throw slide switch (Lafayette SW-94, with one section unused, or equivalent)
1—5¼" x 3" x 2⅛" aluminum utility box (Bud CU-2106-A or equivalent)
3—Battery holders (Keystone Type 137 or equivalent)
1—2 11/16" x 3½" piece of Type 85G24EP Vectorbord
Misc.—Type T28 Vector push-in terminals, miniature knobs for R9 and R12, wire, solder, hardware, etc.

move the batteries). The Vectorbord should then be cut and drilled, after which the other components can be mounted.

Although the transistors in the author's model are of the "2 for 98 cents" variety, they function quite satisfactorily. For optimum results, the transistors should be interchanged in the circuit, and *Q1* selected for lowest noise (*Q2* and *Q3* aren't particularly critical). If the transistors are installed in either sockets or Vector terminals, they can be "selected" after the Vectorbord assembly has been wired into the Minibox.

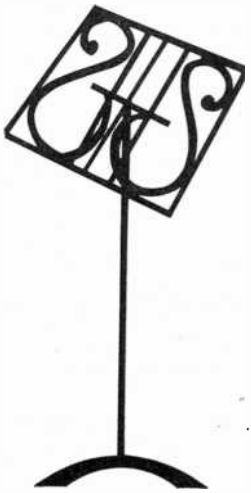
When wiring, be sure to "heat sink" the transistor leads with a pair of long-nose pliers. You may want to use the same treatment for the electrolytic capacitors, just to be on the safe side; in addition, the polarities of the electrolytics must be observed.

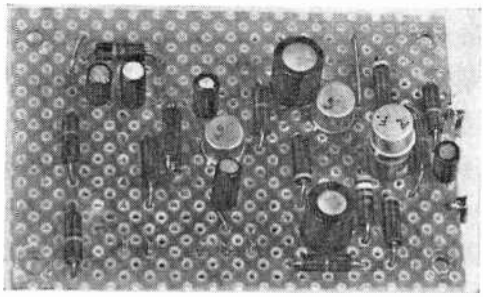
After the wiring is completed, the Vectorbord should be fastened to the top of the box with ¼" spacers, and the leads from it to the balance of the circuit soldered in place.

Check-Out and Operation. The unit is ready for testing. Install the batteries, again observing polarity, and turn the unit on. To check for oscillation of *Q2* and *Q3*, simply measure the collector voltage of *Q2* or the emitter voltage of *Q3*. A rapid fluctuation indicates that the oscillator is operating properly.

Now insert the tremolo between the

TREMOLO





Here's how the Vectorbord subassembly should look when it's ready to be installed in the chassis box.

Hooking up the transistorized tremolo is simplicity itself—just plug the electric guitar or other musical instrument into jack J1 on the tremolo and connect an audio amplifier and speaker to jack J2.

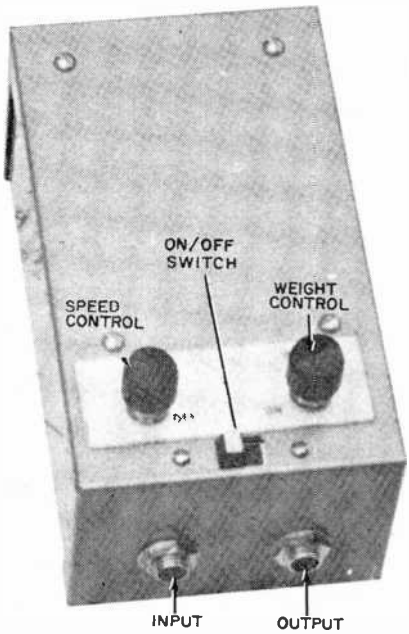
output from the musical instrument and the input to your amplifier, as shown. The "weight" control, *R9*, should be adjusted until a "throbbing" is noticeable in the amplifier output; don't advance the "weight" control too far or you may cause a "thumping" sound in the speaker. The "speed" control, *R12*, governs the rate of tremolo and should be adjusted to suit your taste.

If desired, the range of adjustment of the "speed" control can be modified by adding a resistor in parallel with *R11*, since reducing the effective value of *R11* will increase the speed. In the author's model, *R11* was paralleled with a 1000-ohm resistor for an effective value of about 900 ohms.

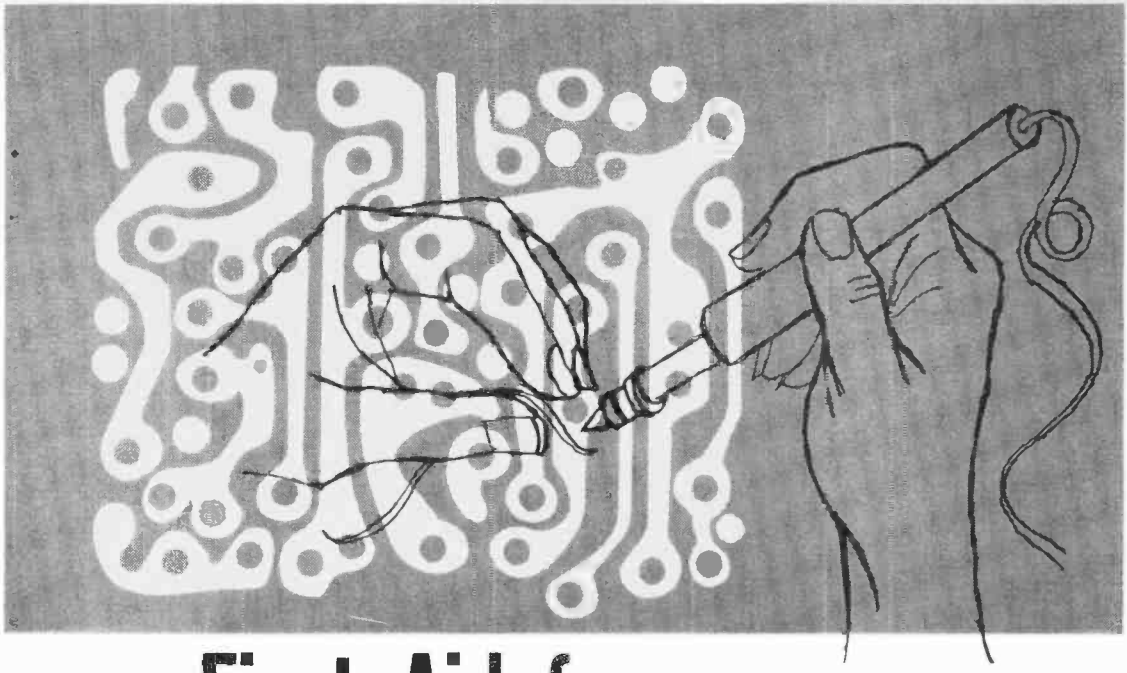
Possible Troubles and Cures. The simplicity of the circuit is some insurance against trouble. If the components and wiring seem to be okay, lack of oscillation may be due to low *beta* in *Q2* or *Q3*, although the requirements for this portion of the circuit aren't very exacting.

"Thumping" can be reduced by experimenting with smaller values for capacitor *C3*. The final value for this component depends to some extent on the amplifier you happen to use, but don't reduce the capacitance too much or you'll cut out most of the low frequencies.

Since the amplifier stage (*Q1*) is operated at low collector current, the amplitude of the input signal is limited, and large signals will cause distortion. Even so, most guitar pickups won't overload *Q1*. But if distortion does occur, you should be able to correct it by reducing the output level of the instrument and increasing the gain of the amplifier accordingly. -30-



The transistorized tremolo, all wired up and rarin' to go. See text for instructions on adjusting speed and weight controls.



First Aid for PRINTED CIRCUITS

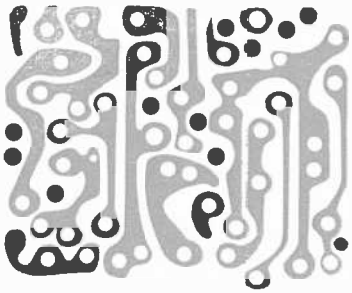
Because they differ radically from conventional circuitry, printed boards require some specialized servicing techniques

By J. W. I. CODY
Systems Operation,
Heavy Military Electronics Dept.,
General Electric Co.,
Syracuse, N.Y.

DURING THE PAST DECADE OR SO, printed circuits have been perfected to an amazing degree. Today, practically all electronic equipment manufacturers use them in their products. In fact, the list of equipment containing printed boards is almost endless—television sets and radio receivers, timing units, hi-fi/stereo equipment, photocell devices, meters, computers, transmitters, strain gauges, motors, switches, automobile gauges, moisture detectors, and even musical instruments.

Like anything else, of course, the components used on printed-circuit boards can't last forever. But careful replacement of defective components by a skilled and experienced technician can restore a printed-circuit board to a "like-new" condition. Use of the procedures we're going to outline should serve to decrease the time con-

PRINTED CIRCUITS



sumed in servicing printed circuits and reduce the number of boards that have to be scrapped.

A Word About Tools. To repair printed-circuit boards successfully, it is absolutely essential to use the proper tools. To disregard this rule could mean considerable damage to, or even destruction of, the board under repair.

In checking and tracing circuits on printed boards, needle-tipped test prods should be used to penetrate the lacquer coating of the board.

A low-wattage soldering iron is a "must," since such an iron will furnish sufficient heat to melt solder reasonably fast and yet not produce excessive heat which might damage the board. An iron with a 25-watt element should be used for replacing components, and a desoldering kit for removing them.

The multiple component bar tip is used where components with clusters of connections in a line are to be removed; the circular tips are used for removing tube sockets, transformers, and other components which have a circular cluster of connections; the slotted tip is especially useful for removing solder and at the

Tools You'll Need to Repair Printed Circuits

Fluorescent light fixture with built-in magnifier
Six-volt, 25-watt soldering iron, with transformer
Low-heat desoldering iron kit, including several special tips (multiple component bar, slotted soldering aid, and various-sized circular tips)
Rosin core solder (60/40)
Diagonal cutters
Long-nose pliers
Curved long-nose pliers
Tweezers
Thin blade knife (to separate flat component contacts)
Needle-tipped test prods
Rosin lacquer
Lacquer solvent
Six-inch calipers (to identify points from one side of board to the other)
Soft brass wire brush

An important tool: fluorescent lamp with built-in magnifier. This is Dazor's Model M-209.

same time straightening bent lugs. The slotted tip also serves the purpose of "soldering" in portions of a board where space is especially limited; in this case, the slot should be carefully filled with solder and the solder transferred to the joint.

You'll find other useful tools listed in the box at left below.

Replacement Techniques. Where a resistor or other component with end leads is mounted parallel to the board (or even vertically, with one lead looped over and bent down to the board), replacement is a simple task.

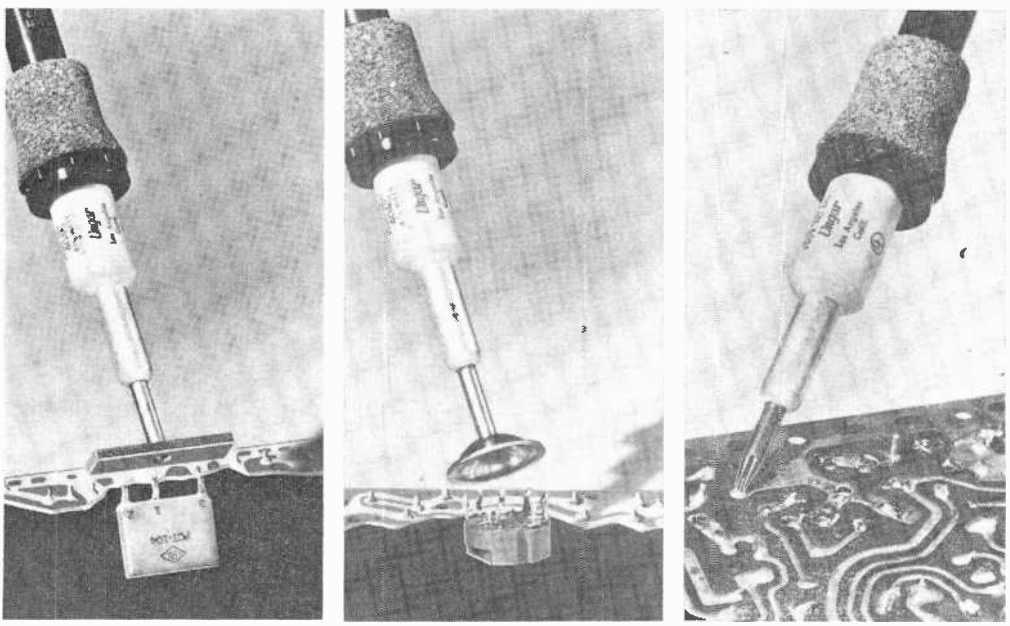
For example, to replace a resistor, you just cut the old component in two with a pair of diagonal cutters, crush the ends so that portions of the old leads contained within the resistor body can be used for installing the new component, make loops in the leads still affixed to the board, join the loops with the leads of the new component, and solder the connection carefully. (Be sure to use as little heat as possible, since excessive heat can cause the printed wire to raise from the board).

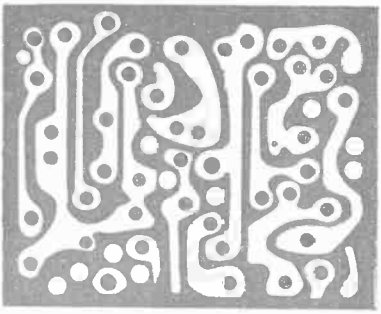
If a component is mounted vertically, clip the leads as close to the body as possible. Or, if the component is seated on the board, as in some circuits, clip the top lead and unsolder the bottom lead. Remove the bottom lead from the hole, then place one lead from the new component in the hole and solder it in place. Finally, join and solder the top lead to the clipped lead which was removed from the defective component.

A simple jig can be assembled by using two wooden blocks (their size will depend on the dimensions of the board to be repaired). With two ordinary, spring-type clothespins mounted on each block, the defective board can then be clamped in the clothespins between the blocks and repaired. Pieces of felt cloth should be cemented to the upper and lower jaws of each of the clothespins to protect the board from damage.

In the event that any of the printed conductors have been broken, either by rough handling or a short circuit, they should be repaired. If the break is 1/16" or less in length, the copper should be cleaned carefully with solvent and solder flowed into the break to effectively "bridge" the gap. A small brass

Safe desoldering of printed-circuit boards is one of the first steps in repairing them. The specialized components shown below are part of Ungar's Model 270 desoldering kit, and include a tip for components with "in-line" contacts (left), circular contacts (center), and wire leads (right).



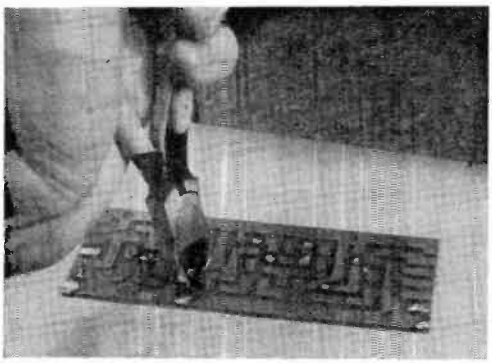


brush can often be used to advantage in cleaning the copper, incidentally.

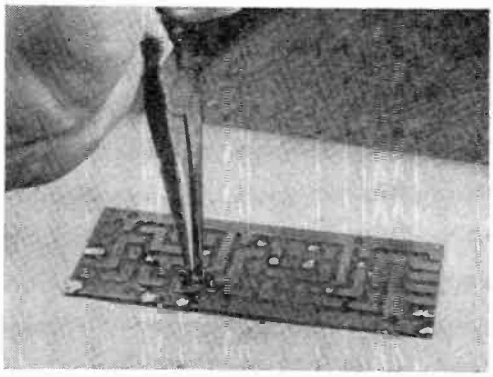
Where the break is of greater magnitude, a wire "bridge" will be required. The ends of the copper conductor should be carefully cleaned with solvent and a brass brush. Then a piece of tinned #22 wire, long enough to bridge the break and provide a ¼" lap at either end, should be laid in place. Solder the ends of the wire to the copper conductor, and the job is done.

From time to time, you'll no doubt run across cracked or even broken boards. Whether or not to repair these boards will depend on several conditions: (1) the severity of the break, (2) the availability of a replacement board, and (3) whether or not the equipment can be left

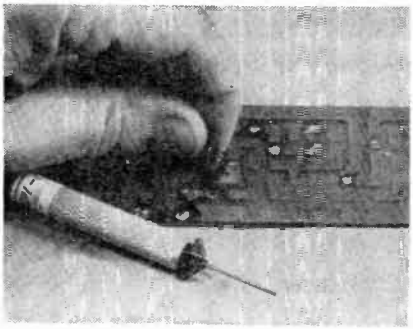
(*Continued on page* 99)

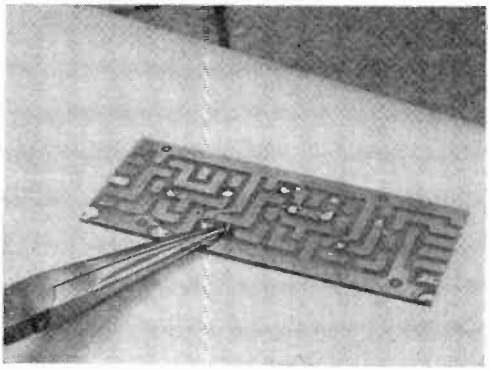


CUTTING. Replacing a resistor is easy if you do it right. First, cut it in half with side-cutting pliers.

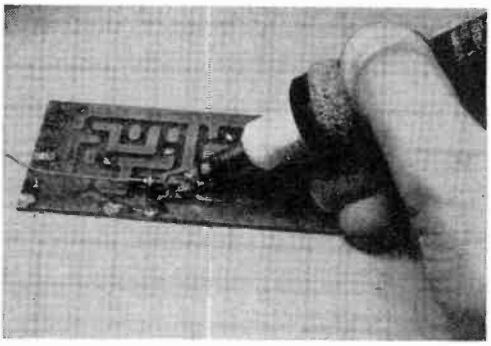


CRUSHING. Smash the rest of the resistor with a pair of pliers, and you're left with two bare leads.



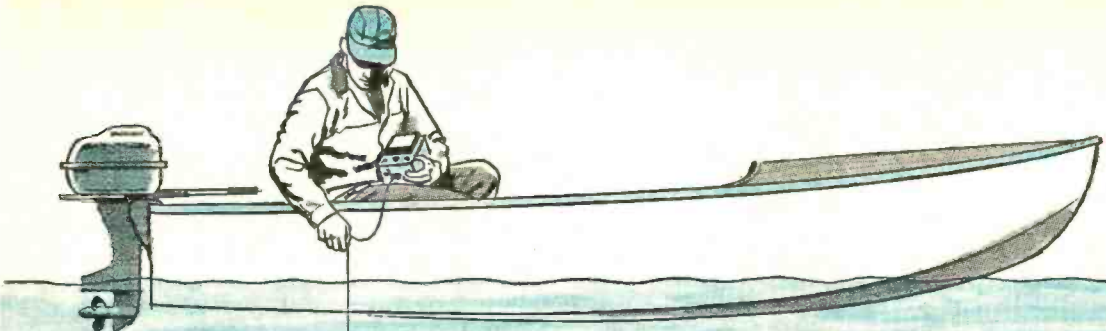


LOOPING. With a little practice, you can use long-nose pliers to form a tiny loop at end of each lead.



SOLDERING. Pass the leads from the new component through the loops, then solder them in place.

For more professional-looking loops, you'll want to use one of the "pig-tail" tools now on the market. The one shown here is made by Twirl-Con.



THE FISH FINDER

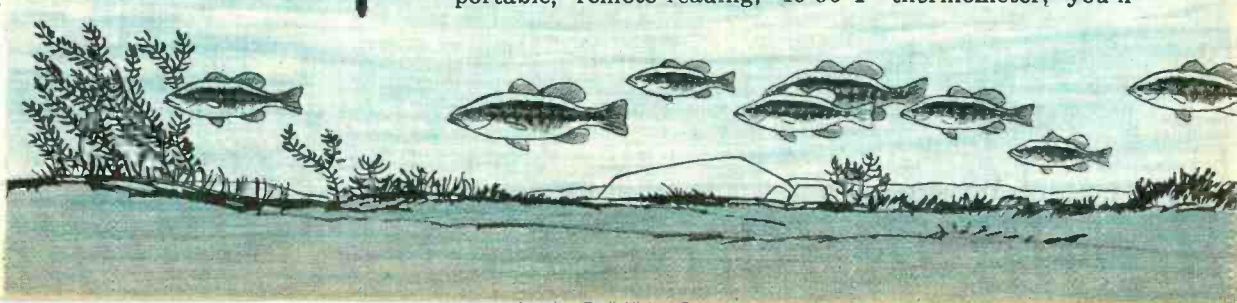
Pity the poor fish when anglers probe the depths with underwater thermometers

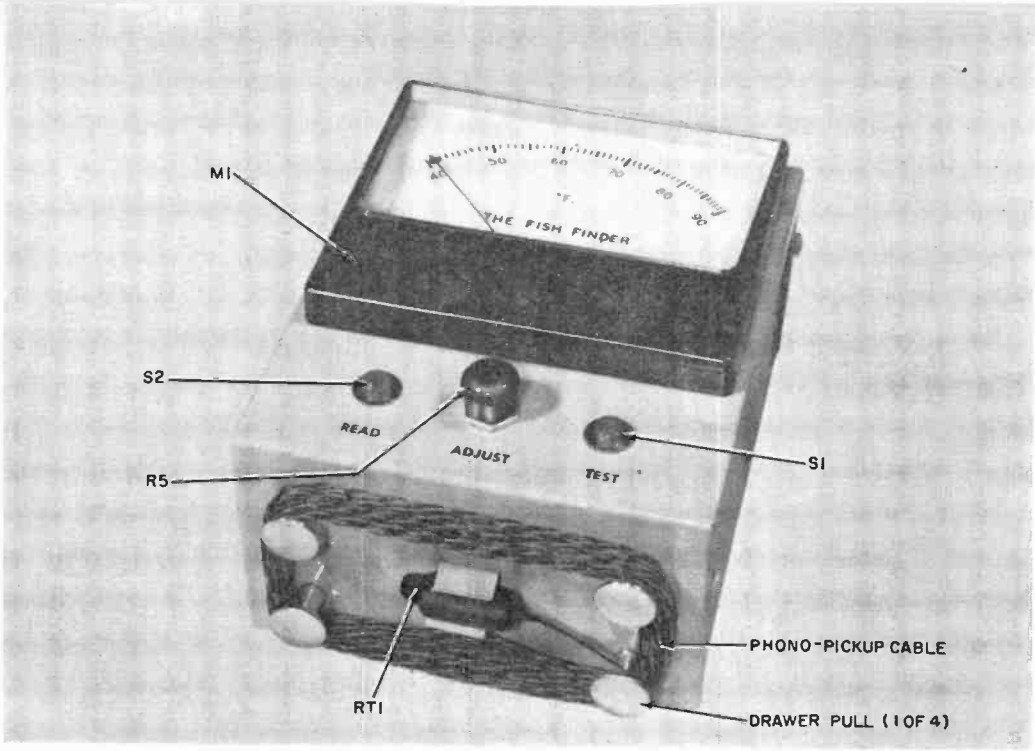
By R. L. WINKLEPLECK

NOT LONG ago, a "fishing nut" friend of mine dropped in with a problem. He needed an instrument, small enough to take on fishing trips, that would quickly and accurately read water temperature at various depths. When asked what he wanted with such a unit, he offered the following explanation.

Different kinds of fish, it seems, have different preferences for the temperature of the water in which they swim. And water temperature (especially the temperature of still or slowly flowing water) is apt to vary with depth. By measuring the temperature at the depth of each "catch," he hoped to work up charts showing the temperature preferences of various species of fish. With the charts, he could select his future catches by placing his hook at a depth having the proper temperature for the type of fish desired.

The author doesn't guarantee the soundness of this theory, but the unit he designed to do the measuring is described here. If you'd like to try your hand at "scientific" fishing, or if you have any other use for a portable, remote-reading, 40-90°F thermometer, you'll





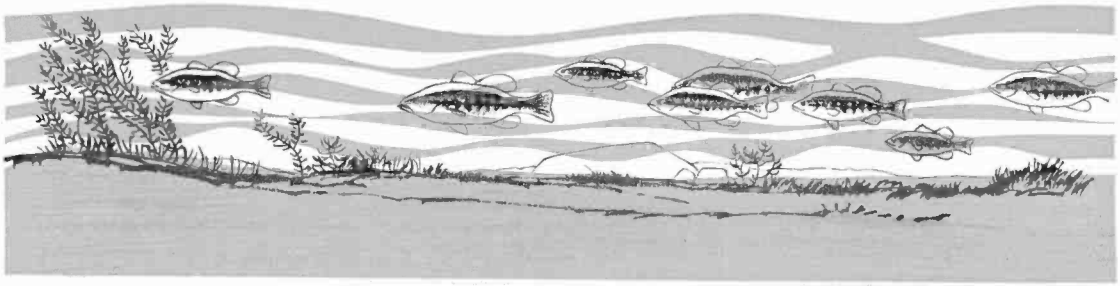
Completed "Fish Finder" is neat, attractive, and professional-looking. For protection against corrosion, apply a couple of coats of paint to box before mounting components.

find it worth your while to take a few hours of your time and put together the "Fish Finder."

About the Circuit. Operation of the Fish Finder depends on a device called the "Thermistor," a resistor which varies inversely in value with the temperature. When the temperature goes up, the resistance of the Thermistor goes down—and vice-versa.

But for our purpose, the important thing about the change of the Thermistor's resistance with temperature is that it's large . . . large enough so that the resistances of switch contacts, long leads connecting the Thermistor to the indicating device, etc., can be ignored in comparison. And we can read the greatly changing resistance with relatively insensitive meters and without elaborate amplifying circuits.

The Thermistor used in the Fish Finder forms part of a Wheatstone bridge circuit (see schematic diagram). Two "arms" of the bridge are resistors *R3* and *R4*; the other two are the Thermistor (*RT1*) and potentiometer *R2*. Assuming that the "Test" push-button (*S1*) is in the position shown (not depressed), the voltage from the battery appears (via "Read" push-button *S2* and potentiometer *R5*) across the bridge between the junction of *RT1* and *R3* and that of *R2* and *R4*.



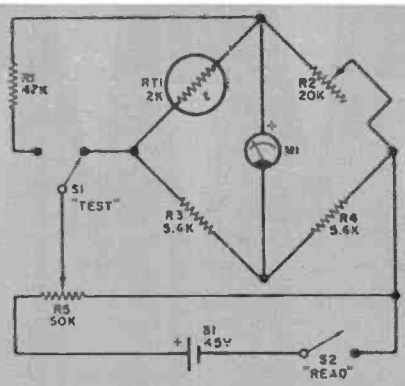
Notice, in this case, that *R3* and *R4* make up one voltage divider and *RT1* and *R2* make up another. Since *R3* and *R4* have the same value, the voltage appearing at their junction is one-half the voltage impressed across the bridge. And, when *R2* is adjusted to the same value as *RT1*, the voltage at their junction is also one-half the voltage across the bridge. Therefore meter *M1*, which is connected across the two junctions, sees no voltage difference between its terminals and reads "Zero."

But if the temperature of *RT1* should change, its resistance would change proportionally. This, of course, would alter the voltage at the junction of *RT1* and *R2*. And, since the voltage at the *R3-R4* junction remains the same, meter *M1* now sees a potential difference and shows a reading. The magnitude of the reading is proportional to the temperature change at *RT1*, so *M1* may be calibrated as a thermometer.

Potentiometer *R2* determines which resistance value of *RT1* will "balance" the bridge, giving a zero reading on *M1*. Hence, *R2* controls the lower temperature limit of *M1*'s calibration.

Potentiometer *R5* adjusts the voltage input to the bridge. It has no effect on the meter reading while the bridge is in a balanced condition because there will be no voltage difference between the junction of *RT1* and *R2* and that of *R3* and *R4* whatever the voltage input. However, potentiometer *R5* does determine how high the meter will read for a given degree of temperature change (or bridge imbalance). Therefore, it controls the upper temperature limit of *M1*'s calibration.

"Test" switch *S1* and resistor *R1* are used to maintain a check on the battery voltage. When *S1* is depressed, the arm of *R5* is switched from the junction of *R3* and *RT1* to the free end of *R1*. This provides a reference reading on *M1* which does not vary with temperature but is dependent only on the voltage of *B1*. (Though *RT1* remains in the circuit when *S1* is depressed, its effect on the

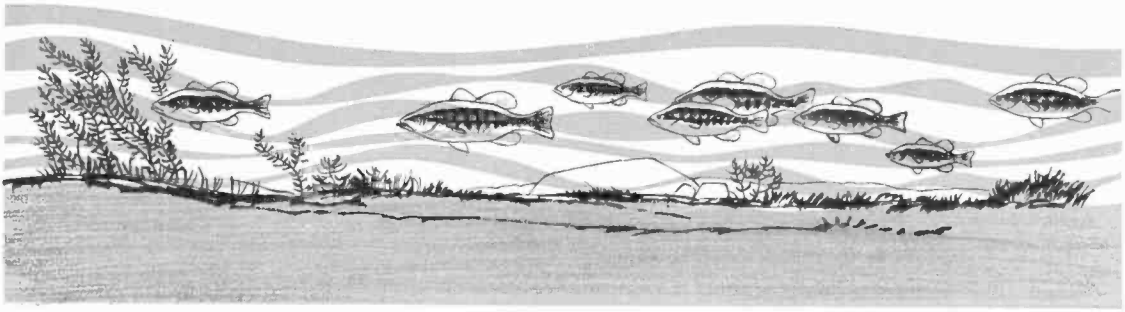


Thermistor (RT1 on schematic) is used as one leg of a Wheatstone bridge indicator.

PARTS LIST

B1—45-volt battery (Burgess XX30 or equivalent)
M1—0-1 ma. meter (Simpson Model 1329 or equivalent—see text)
R1—47,000-ohm, ½-watt resistor
R2—20,000-ohm potentiometer, linear taper
R3, R4—5600-ohm, ½-watt, 5% resistor
R5—50,000-ohm potentiometer, linear taper
RT1—2000-ohm Thermistor (Veco 32D14)*
S1—S.p.d.t. push-button switch
S2—S.p.s.t. push-button switch
1—7" x 5" x 3" aluminum utility box (Bud CU-3008-A or equivalent)
1—4½" x 3¾" section of perforated board
25'—Phono pickup arm cable, vinyl insulated (Belden Type 8430 or equivalent)
Misc.—Foam plastic or rubber, plastic tube, solder, tool dip, connector for B1, drawer pulls, grommet, plywood, etc.

*Three dealers handling Veco products are: Electronics Center, 160 5th Ave., New York, N. Y.; Electronics Supply, 11201 W. Pico Blvd., W. Los Angeles, Calif.; and Radio Shack Corp., 730 Commonwealth Ave., Boston, Mass.



meter reading becomes negligible.) As the battery voltage decreases, the meter is brought back to the reference point by adjusting *R5*.

Construction. All of the components except Thermistor *RT1* are housed in an aluminum utility box. A 6″ x 5″ x 3″ box was used by the author, but the more common 7″ x 5″ x 3″ size specified in the Parts List will do as well.

Locate switches *S1* and *S2*, potentiometer *R5*, and meter *M1* on the box's front panel. Resistors *R1*, *R3*, and *R4*, and potentiometer *R2*, are mounted on a 4½″ x 3¾″ piece of perforated board.

Meter *M1*'s terminal posts are passed through two holes made in the board, and a solder lug, washer, and nut are installed on each post. The nuts and washers rigidly hold the board assembly in place, while the solder lugs provide a means of connecting the meter to the rest of the circuit.

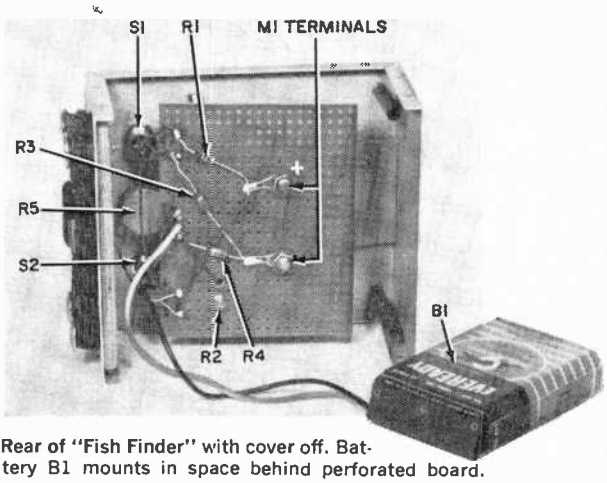
Battery *B1* is wedged in between the board and the top of the box. A scrap of foam plastic or rubber glued underneath the battery provides further support, and sideways movement is restricted by a pair of hollow dowels slipped over the upper meter mounting screws.

Four small drawer pulls mounted on the bottom of the box serve as a rack on which the 25′ Thermistor cable can be coiled when it is not in use. Since the drawer pulls which the author had on hand were fitted with wood screws, a 4½″ x 2¼″ piece of plywood was placed in the box bottom for them to "bite into."

Waterproofing. Both the Thermistor and the Thermistor-cable junction must be suitably waterproofed. In the model described here, *RT1* was connected to the cable and slid into a plastic tube. The tube was then wrapped with wire solder (which acts both as a sinker and a heat-transfer surface).

Next, the whole assembly was dipped several times in encapsulating compound —allowing each layer to dry before redipping—until a solid, waterproof surface was built up. The net result was a short cylinder about the diameter of a penlight cell. It is held in place on the bottom of the box by means of a battery clip.

An alternative waterproofing method might be simply to put several coats of encapsulating compound on the bare Thermistor, and its leads, after attachment to the cable. This might provide better heat-transfer characteristics, but the finished assembly would be awkwardly shaped and more susceptible to accidental damage. Another disadvantage is that a separate weight would then have to be attached to sink the Thermistor.



Rear of "Fish Finder" with cover off. Battery B1 mounts in space behind perforated board.

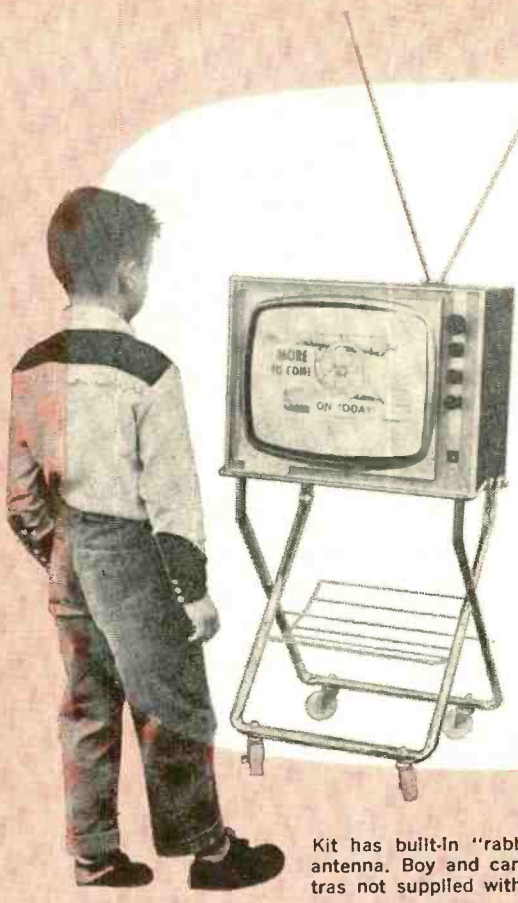
Regardless of how you carry out the waterproofing, a good preparation to use for encapsulating is "Insl-X Tool Dip." It's manufactured by the Insl-X Co., Inc., Ossining, N. Y., and is available by mail from Allied Radio, 100 N. Western Ave., Chicago 80, Ill. (Cat. No. 42 N 400 for the 6-oz. size).

The free end of the Thermistor cable is fed into the box through a grommet-lined hole in the bottom. To prevent moisture from leaking in, seal the grommet with household cement.

Calibration. The instrument was designed to cover a 40-90°F range (the most useful for the majority of fishing situations), but the upper and/or lower limit of this range may be shifted several degrees to suit individual tastes.

Begin the calibration by preparing a jar of water whose temperature has been set at exactly 40°F (or at the lower limit of the temperature range you desire) with an accurate thermometer. Remember that the larger the volume of water you use, the more stable the temperature

(*Continued on page* 97)



ALL ABOUT CONAR TV KIT

New kit manufacturer gets off to glowing start with TV receiver

Kit has built-in "rabbit ears" antenna. Boy and cart are extras not supplied with the kit.

COVER STORY

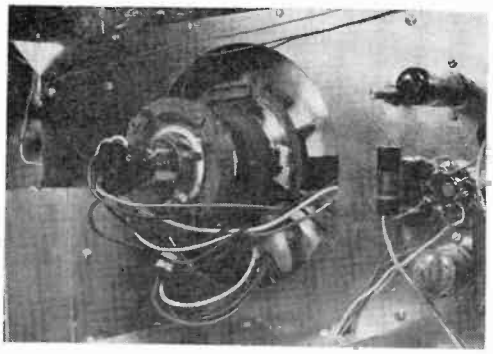
THERE'S something very exciting about assembling your own TV set. Maybe it's because everyone talks about building amplifiers, tuners, receivers, etc. Building a TV set is still held in awe, and many experimenters who wouldn't hesitate to dig into an amplifier just don't seem interested. Or are they? We believe that they are, but are reluctant to *chance* assembling something where the smallest error would be "obvious." Also, they may fail to consider that kit designs have come a long way in the past three or four years.

A prime example of how easy it is to assemble your own TV set is illustrated by the Conar "Custom 70" produced by Conar Instruments (division of National Radio Institute, Washington 16, D. C.). A 15-tube receiver (plus a 19AUP4 "pic" tube, as it is called), the Custom 70 is modern in circuit design and packaging. It is sold as a single kit for $135.00 (including Federal tax), or under a "pay as you build" plan with four packages at $36.00 each. We recommend the single package—once you've started, you're not likely to want to quit and wait for the delivery man.

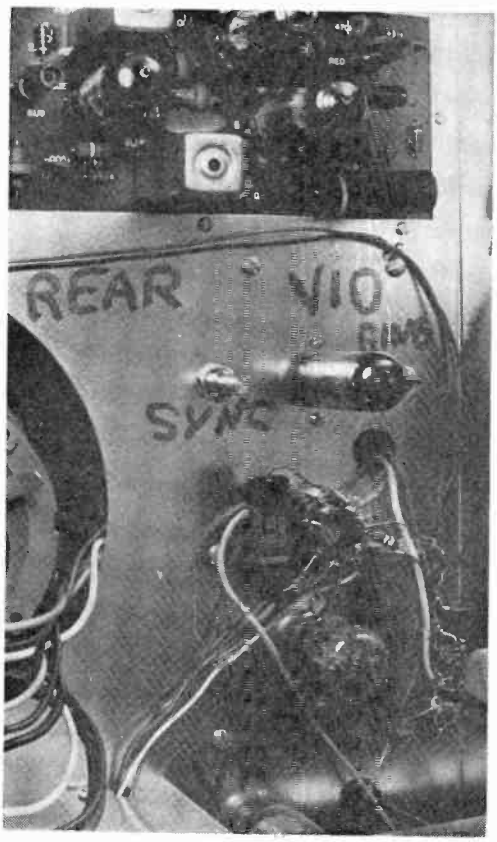
The Custom 70 makes use of a printed circuit for the i.f. channels, a transformer power supply (no shock hazard), and a carefully prealigned TV tuner. All other wiring is point-to-point, and there's plenty of working room. You can expect to spend between 10½ and 12 hours soldering in the various components.

Mechanical assembly will probably consume between 3½ and 4½ hours. This includes unpacking, mounting sockets and tie points, mounting subchassis, and installing the pic tube and chassis in the cabinet.

Conar's instruction manual is most comprehensive and spells out each wir-



Yoke assembly and centering rings in TV set are precision-manufactured. Connections to the picture tube go to plugs on the front of the chassis. "Pic" tube is aluminized and self-focusing.



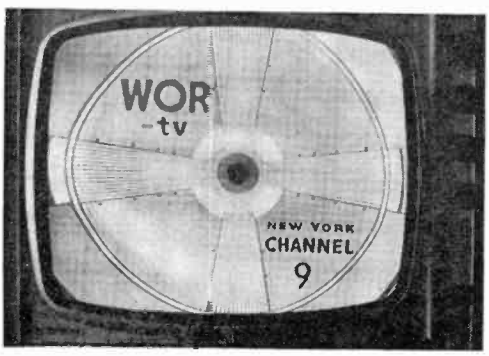
We recommend that the builder take a felt marking pencil and identify the front and rear of the chassis, as well as the various controls. This will simplify the wiring and eliminate errors.

ing step in detail. In fact, the only objection we had to the Custom 70 was that the instructions could have been more succinct. But then, when you have assembled this kit, you really feel you know your TV receiver backwards and forwards—something you can't say for a set you buy off the shelf.

One thing we feel should be emphasized is that the Custom 70 is "safe." The high-voltage supply is fully caged in a separate metal box and, once assembled, need never be touched. All other set voltages are of the order found in amplifiers and tuners. The transformer power supply is completely isolated from the a.c. line, reducing shock hazards; and once the pic tube is in the cabinet, it is grounded to the chassis with "Aquadag" strips.

At present-day prices, this kit will save you $35 - $50 over off-the-shelf prices. If that doesn't sound like much, once again may we say, "There's something very exciting about assembling your own TV set." —30—

As many readers are no doubt aware, Transvision Electronics, Inc., (New Rochelle, N. Y.) also sells TV kits, and has been doing so for several years. The TV receivers come in a wide variety of screen sizes and price ranges, and a catalog is available from Transvision for the asking.



After 14 hours of assembly time, the first picture on our screen came as a pleasant surprise. Slight distortion on left side of the screen was removed by resetting the ringing coil slug.

THE WHISTLE SWITCH

A cinch to build, this whistle-operated relay will turn electrical equipment on or off from distances up to 100 feet

By MARTIN J. LEFF

IN A LARGE mid-town Manhattan photo studio, the photographer had just finished posing his pretty model. "We're ready to shoot now," he said; "hold it while I switch on the lights." Expecting him to turn and walk to the distant wall switch, the model was understandably startled when he merely put his fingers to his lips and emitted a piercing whistle. But, in instant response to his signal, the great banks of lights overhead flicked on.

The photographer was using a variation of the "Whistle Switch." Responding to a whistle of the "puckered lips" variety, this unit will turn electrical equipment on or off from up to about 15 feet away. The range can be increased to about 50 feet by using a "lips and fingers" whistle, and mechanical whistles—such as the "police" type—will actuate the switch at distances up to about 100 feet.

Definitely more economical than the conven-

SWITCH

tional radio remote-control system, the Whistle Switch costs about $30.00 to build. And the price will be reduced materially if you already have some of the parts on hand.

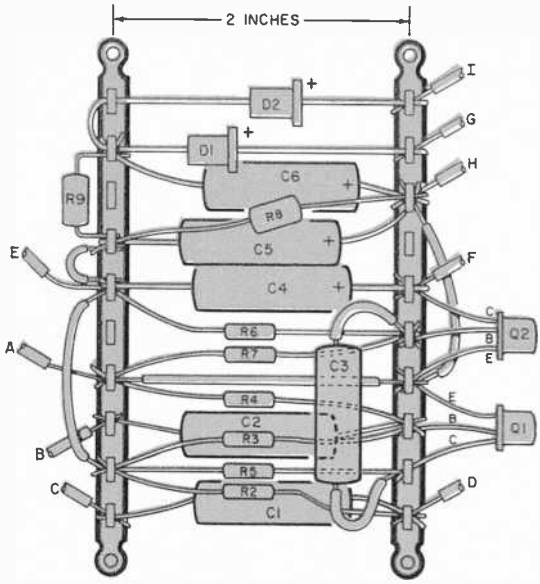
About the Circuit. The whistle command is picked up by the carbon microphone *(MIC)* and converted to an electrical pulse. Amplified by transistors *Q1* and *Q2*, the pulse charges capacitor *C4* (which is connected in *Q2*'s collector circuit). Relay *K1*'s coil, connected in parallel with capacitor *C4*, is then energized—and *K1*'s contacts close, connecting the 117-volt line to the coil of latching relay *K2*.

With *K2*'s coil energized, that relay's contacts switch from "off" to "on," or from "on" to "off," depending on which position they were originally in. Then, as soon as the whistle stops, capacitor *C4* discharges, opening *K1*'s contacts and de-energizing *K2*. The contacts of *K2*, however, remain locked in whichever position they were switched to.

Since *K2*'s contacts control the line voltage to outlet *J1*, any device plugged into that outlet will be "whistle-controlled." One whistle will turn it on, the next will turn it off, etc.

The sensitivity of the Whistle Switch is governed by potentiometer *R1*, which acts as a mike gain control. Resistors *R3/R4* and *R6/R7* are voltage dividers, supplying bias for transistors *Q1* and *Q2*, respectively. Coupling capacitors *C1*, *C2*, and *C3* also act (in conjunction with *R1*, *R4*, and *R7*, respectively) as high-pass filters. The filtering action reduces the circuit's response to low-frequency noises (voices, etc.), while having no effect on the response to whistles.

Power for the Whistle Switch comes from the a.c. line via low-voltage transformer *T1* and a rectifying and filtering circuit consisting of diodes *D1* and *D2*, capacitors *C5* and *C6*, and resistor *R9*. Resistor *R8* is a bleeder for the power supply.



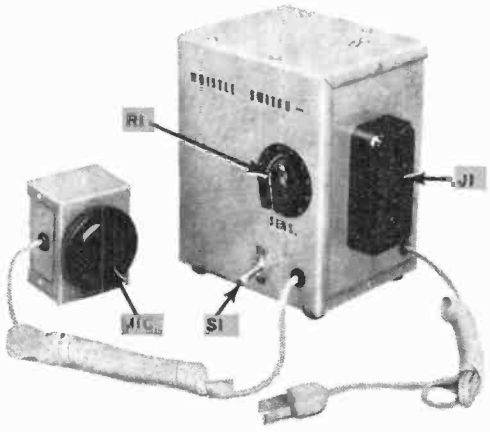
PARTS LIST

C1, C2, C3—0.1-μf., 200-volt paper capacitor
C4—2-μf., 25-volt electrolytic capacitor
C5, C6—50-μf., 25-volt electrolytic capacitor
D1, D2—SR-200 diode (Sylvania)
J1—Surface-mounted duplex outlet (household type)
K1—Sensitive relay; 2300-ohm, 4.6-ma. coil (Sigma 11F-2300-G/SIL or equivalent—see text)
K2—Ratchet-impulse relay, 115-volt a.c. coil (Potter & Brumfield AP11A or equivalent—see text)
MIC—Telephone-type carbon microphone cartridge—see text
Q1, Q2—2N631 transistor (Raytheon)
R1—10,000-ohm, 2-watt potentiometer, linear taper

Construction. All of the components within the dotted box on the schematic diagram are mounted between two 10-lug (none grounded) terminal strips. Begin construction by temporarily screwing these two strips (parallel to each other and 2″ apart) to a wooden board. Then wire the components to the strips as shown in the pictorial diagram of the assembly and in the schematic. Install a 6″ lead at all points where a wire must run from the assembly to another part of the circuit. These points are lettered "A" through "I" in both the pictorial and schematic diagrams.

The completed terminal strip assembly is removed from the board and mounted under the top of a 6″ x 5″ x 4″ aluminum

Begin construction by temporarily fastening the two terminal strips to a board. After wiring as shown at left, remove assembly from board and mount in utility box.



Completed Whistle Switch is shown above. Mike is in separate box to prevent pickup of relay noises.

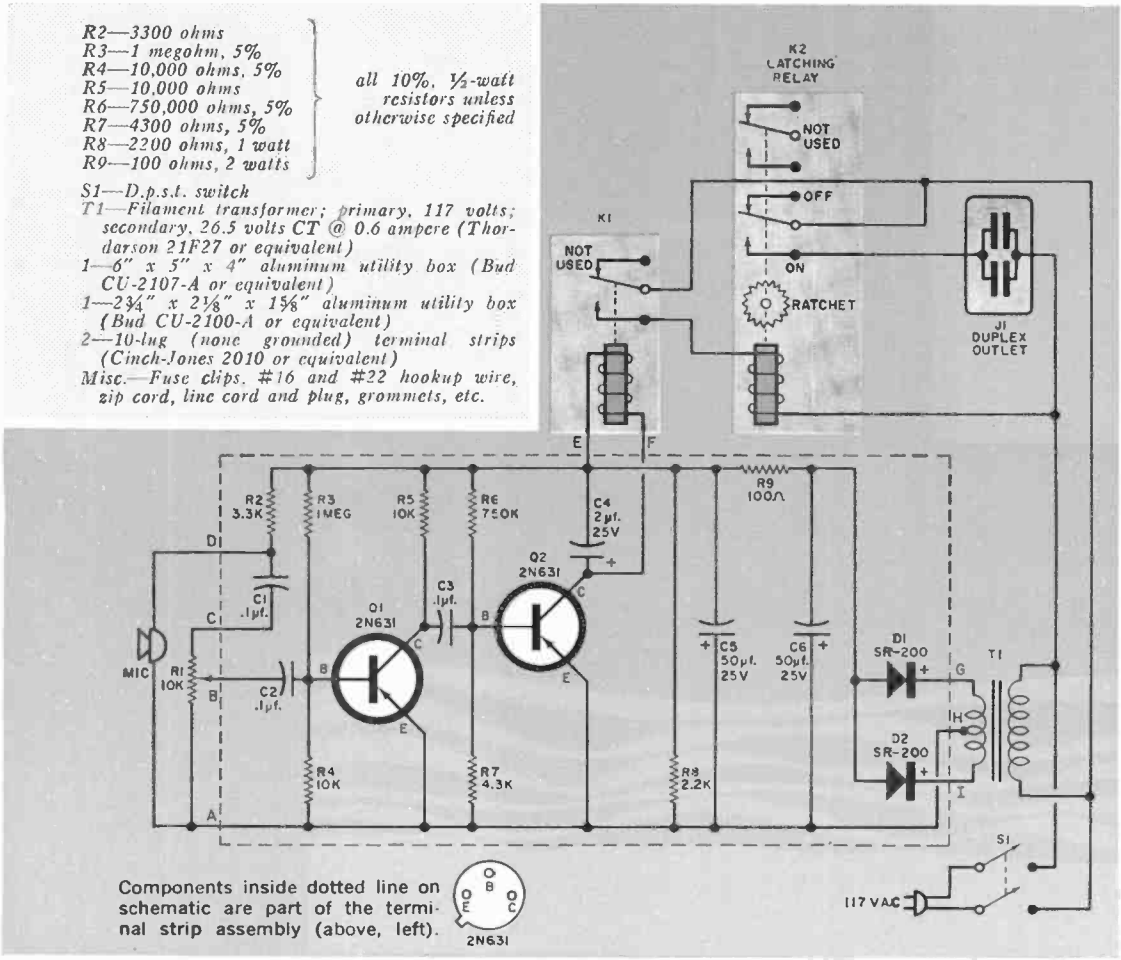
utility box (see photos). Transistors *Q1* and *Q2*, as used in this circuit, are quite temperature-sensitive. Therefore, they are snapped into a couple of fuse clips (which act as heat sinks) fastened next to the terminal strip assembly.

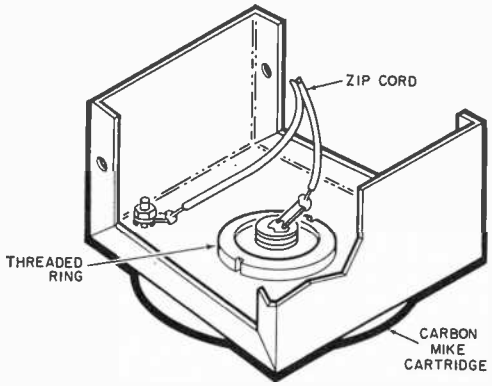
Potentiometer *R1*, switch *S1*, and relay *K1* are mounted on the front panel of the utility box. Since one side of the a.c. line will appear on the frame of relay *K1*, the latter must be insulated from ground. The author solved this problem by in-

R2—3300 ohms
R3—1 megohm, 5%
R4—10,000 ohms, 5%
R5—10,000 ohms
R6—750,000 ohms, 5%
R7—4300 ohms, 5%
R8—2200 ohms, 1 watt
R9—100 ohms, 2 watts

all 10%, ½-watt resistors unless otherwise specified

S1—D.p.s.t. switch
T1—Filament transformer; primary, 117 volts; secondary, 26.5 volts CT @ 0.6 ampere (Thordarson 21F27 or equivalent)
1—6" x 5" x 4" aluminum utility box (Bud CU-2107-A or equivalent)
1—2¾" x 2⅛" x 1⅝" aluminum utility box (Bud CU-2100-A or equivalent)
2—10-lug (none grounded) terminal strips (Cinch-Jones 2010 or equivalent)
Misc.—Fuse clips, #16 and #22 hookup wire, zip cord, line cord and plug, grommets, etc.





Method of mounting mike on box will vary with type of cartridge employed. Author's installation (see text) is illustrated here.

stalling *K1* on a small square of insulating material which, in turn, was fastened to the panel. If you prefer, you can use a Sigma 11F2-2300-G/SIL for *K1* instead of the unit specified in the Parts List; the two relays are identical, except that the former is already mounted on an insulated base.

Mount transformer *T1* and relay *K2* on the bottom of the box. The transformer is located as far as possible from sensitive relay *K1* so that *K1* won't be affected by the transformer's magnetic field.

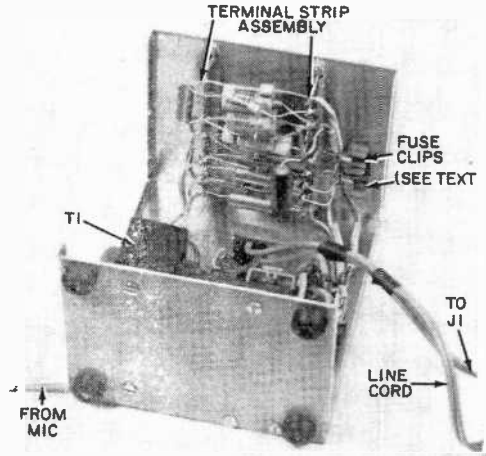
The relay specified for *K2* in the Parts List was used primarily because the author happened to have it on hand. It has two sets of s.p.d.t. contacts. One of these was not employed in this application; the other was used as a s.p.s.t. switch. Any similar relay will work in this circuit as long as it has a 117-volt coil and at least one set of s.p.s.t. contacts.

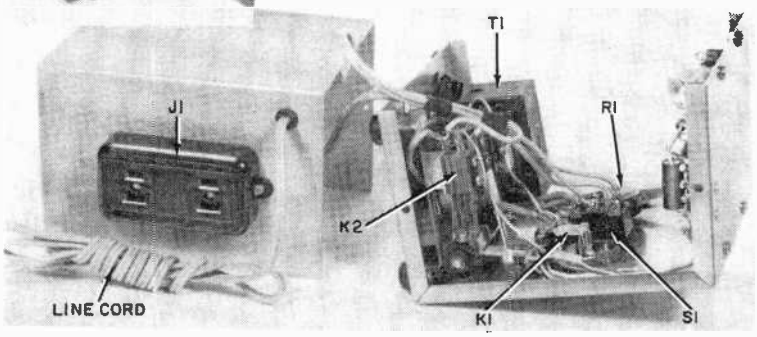
Outlet *J1* is located on one of the sides of the box cover, and both its cord and the line cord enter the box through grommeted holes near the outlet. A similar hole at the bottom of the front panel accepts the cord from the microphone.

To prevent the microphone from picking up noise from relays *K1* and *K2*, it is mounted in a separate utility box (2¾" x 2⅛" x 1⅝"). A carbon mike, salvaged from a government-surplus handset, was used by the author. The threaded ring sealing the carbon chamber was removed and re-installed as a retaining ring to hold the microphone in place on the box's front panel (see drawing). If you use this method of installation, be careful not to spill any of the carbon granules while you have the ring unscrewed.

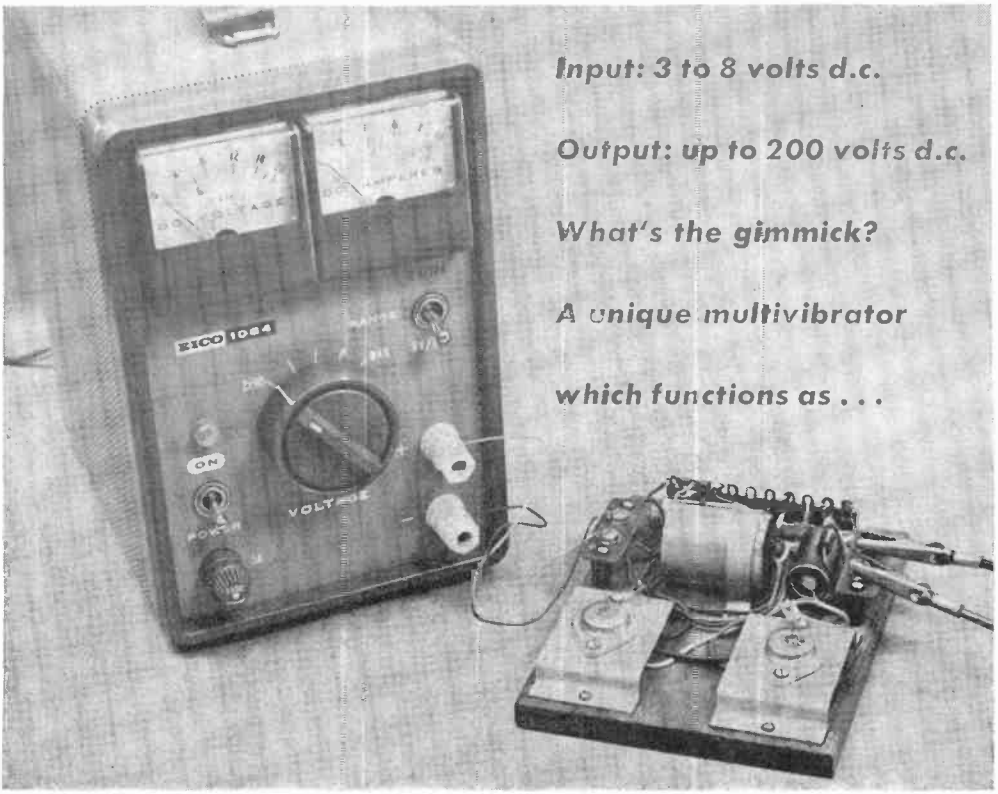
A 5′ zip-cord cable is attached to the microphone and run out of the utility box through a grommeted hole. In the model shown, one lead of the mike cable was grounded to the box because the threaded retaining ring (automatically grounded) also serves as one of the mike contacts.

(*Continued on page* 98)





Positioning of terminal strip assembly can be seen in the photo above (note fuse clips used as heat sinks for Q1 and Q2). View at right shows wiring associated with cover.



A TRANSFORMER FOR D. C.

By BEN RICHARDS

ONE of the drawbacks of vibrator-type power supplies stems from the fact that they usually have fixed input and output voltages, which may or may not be satisfactory in emergency applications. Not so with such gadgets as the d.c.-to-d.c. inverter discussed here, however—it's no trouble at all for this little unit to deliver 135 volts of B+ from a 6-volt auto battery charger (for powering your CB rig, say), or 67½ volts of B+ from a couple of flashlight batteries (for a portable radio).

Impossible as it may sound, this device actually "transforms" d.c. voltages. How? By changing the incoming d.c. to a.c., stepping it up in a transformer, and rectifying the output.

The circuit uses two transistors in conjunction with a sharply saturating transformer. When power is applied, one transistor will always conduct a little more heavily than the other. Due to feedback within transformer *T1*, the first transistor tends to turn full "on" and the other transistor to turn full "off." This condition prevails until the transformer core saturates.

When the core saturates, the feedback voltage drops, and the field in the transformer core starts to collapse, causing the feedback voltage to change polarity and thus reverse the "on-off" condition of the transistors. This basic action keeps repeating. The a.c. generated in the collector winding is stepped up by transformer *T1*, then rectified in the full-wave bridge circuit (*D1, D2, D3, D4*);

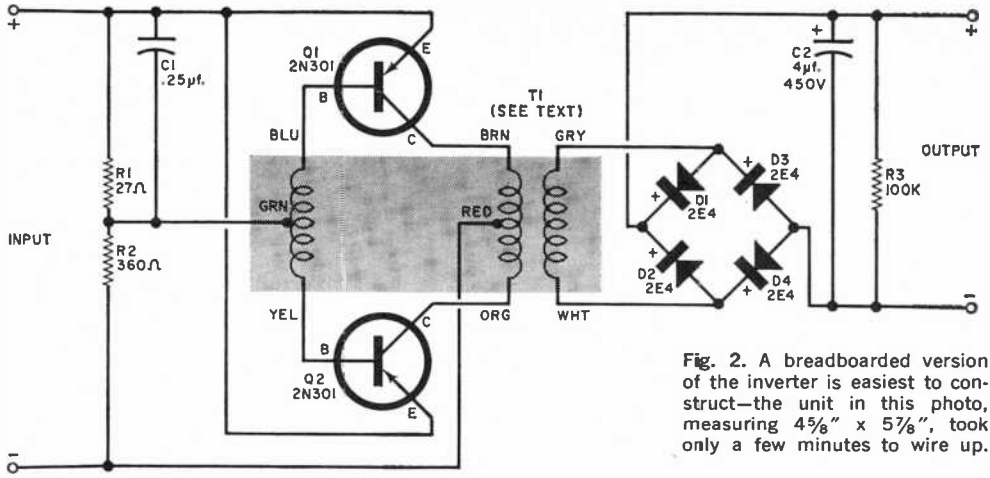


Fig. 1. Schematic diagram of inverter. See next page for circuit of optional hash filter.

Fig. 2. A breadboarded version of the inverter is easiest to construct—the unit in this photo, measuring 4⅝" x 5⅞", took only a few minutes to wire up.

PARTS LIST

C1—0.25-μf., 200-volt paper capacitor
C2—4-μf., 450-w.v.d.c. electrolytic capacitor
D1, D2, D3, D4—200-ma., 400-PIV silicon diode (International Rectifier Type 2E4 or equivalent)
Q1, Q2—2N301 transistor (RCA)
R1—27-ohm, 5%, ½-watt resistor
R2—360-ohm, 5%, ½-watt resistor
R3—100,000-ohm, 1-watt resistor
T1—Toroidal transformer (Milwaukee Electromagnetics Type PC005, available from Milwaukee Electromagnetics, P.O. Box 4476, Milwaukee, Wis., for $4.95, postpaid)
Misc.—Terminal strips, wire, hardware, chassis, etc.

Parts for Hash Filter

C3, C4—100-μf., 15-w.v.d.c. electrolytic capacitor
C5—0.1-μf., 400-volt paper capacitor
L1—50 turns of #16 enameled wire, close-wound in two layers on ¾"-O.D. insulated form
L2—2.5-μh., 125-ma. r.f. choke
Misc.—Shielded box, hardware, etc.

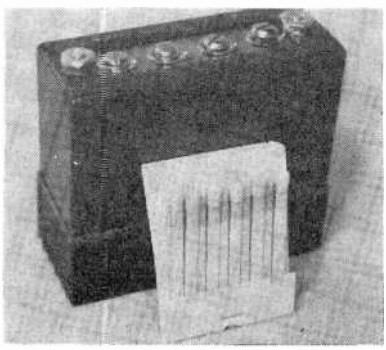
capacitor *C2* provides filtering, and resistor *R3* acts as a bleeder.

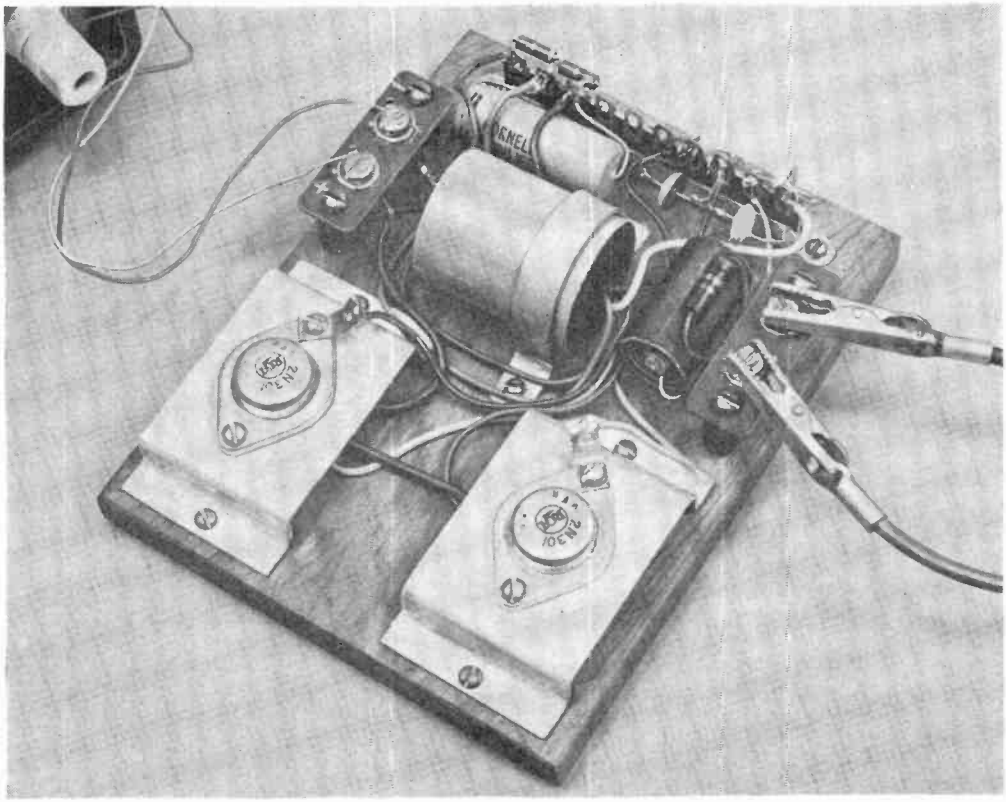
Construction. The wiring is extremely simple and not at all critical in the "surefire" circuit shown in Fig. 1. Although Fig. 2 shows most of the connections for a "breadboard" construction, the type of mounting is pretty much up to you. For example, Fig. 3 pictures the circuit "packaged" into a unit approximately 3" x 3" x 1", with all components except the transistors "potted" in an epoxy resin.

Regardless of how you assemble the inverter, be sure to mount the two transistors on separate aluminum or copper heat sinks at least 3 or 4 square inches in area. Since the cases of the transistors are connected to the collectors, mica insulators must be placed under the transistors if a metal chassis is used.

When wiring, pay particular attention to the polarity of the diodes and electrolytics as well as the color coding on transformer *T1*. Leads can be soldered directly to the pins of the transistors, but be sure to use a heat sink during soldering; gripping the pins with a pair of long-nose pliers close to the transistor body should do the trick.

Hash Filter. If the inverter is to be used in communications circuits, the hash filter shown in Fig. 4 should be added.





In this case, both the inverter and the filter can be built in a metal box. The leads to the battery should be kept as short as is practical and should be placed well away from antennas and other "inputs."

If desired, the negative input lead can be grounded to the chassis; components *C3*, *C4*, and *L1* can then be placed in the positive lead. Naturally, the polarity of both of the capacitors will have to be reversed.

Components *L2* and *C5* should be placed in the negative output lead and the positive output lead grounded to the chassis if a negative output voltage is desired. For a less stringent application, but one still requiring some hash filtering, *C4*, *L2*, and *C5* can be omitted.

Testing and Use. Apply 3 volts to the input terminals, being careful to observe polarity (improper polarity can damage the transistors). If the output voltage

(*Continued on page* 96)

Fig. 3. For a more professional appearance, the inverter can be housed in a wooden or metal box and suitably "potted."

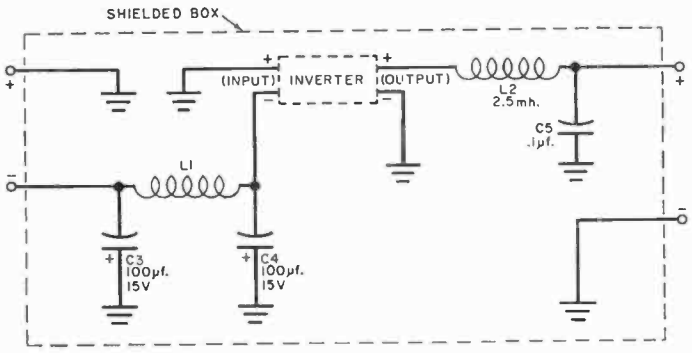
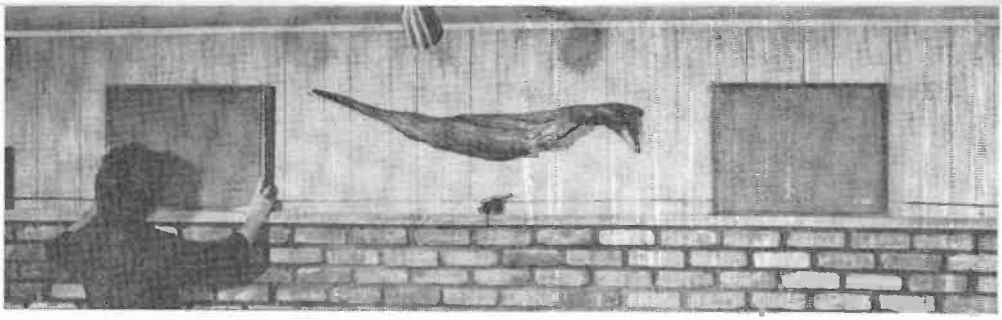


Fig. 4. This circuit shows an optional hash filter which may be required with r.f. circuits. See text for details.

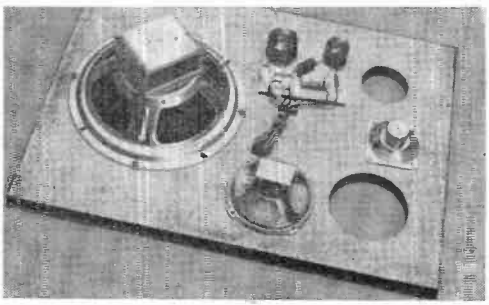


SLIM LINE SPEAKER KIT

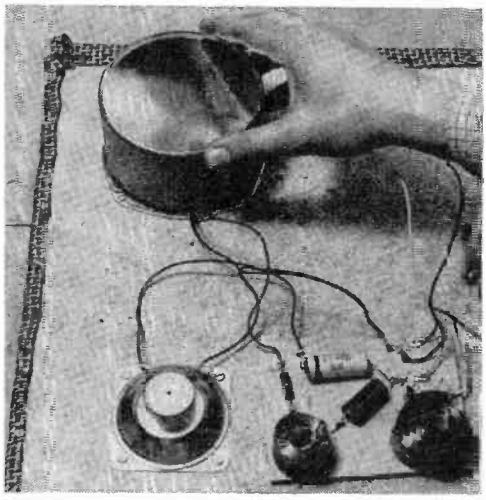
THE YOUNG LADY above has found a way to have stereo and make use of a fireplace mantle only 6" wide at the same time —her "hubby" just finished assembling a pair of KS-1 "Slim-Line" speaker kits. Selling for $59.50, the KS-1 kit is a member of the new StrataKit line introduced by Fisher Radio Corporation (21-52 44th Drive, Long Island City, N. Y.)

Capable of producing a smooth, well-balanced sound extending from about 45 through 18,000 cycles, two KS-1 speaker kits can be put together in under two hours. Although they are sealed enclosures, the KS-1's make up a relatively high efficiency speaker system, requiring very little amplifier power output.

If the wife decides she doesn't like the speakers on the mantle, she can obtain special legs for the system from Fisher at $2.50 a set. —30—

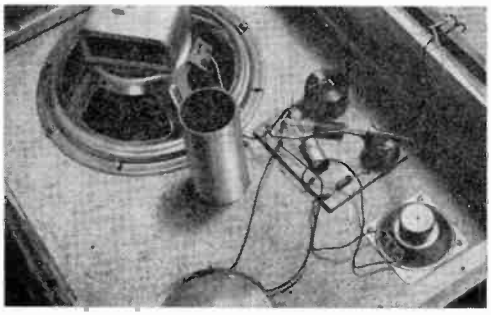


1 Each KS-1 "Slim-Line" kit contains 3 speakers and a prewired crossover network. The woofer arrives premounted.



2 Templates position holes for mounting tweeter and mid-range speaker. Housing prevents woofer/mid-range interference.

3 Preassembled wood frame is stained or painted before mounting front baffle with speakers and grille cloth attached.



4 Cardboard tube in center is not a bass reflex port, but a means of rigidly separating the front and back boards.

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

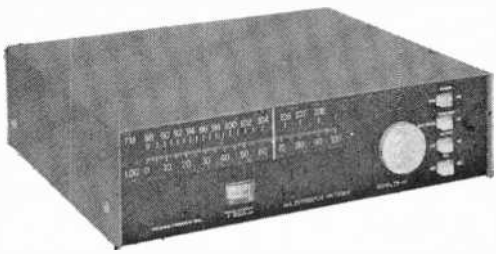
BACK in October, 1961, we discussed the Transis-Tronics Model S-15 transistorized stereo amplifier. Since the weather was quite mild at that time, we didn't emphasize one advantage of transistorized over tube-operated hi-fi/stereo equipment—*cooler operation*—which is a natural result of the higher efficiency of solid-state circuitry coupled with the elimination of red-hot tube filaments and heaters.

At this season, however, with temperatures soaring into the 90's in many areas, cooler operation becomes an *important* advantage. "Music of a Summer Night" can be much more pleasant if natural summer heat isn't augmented by excessive heat from the equipment that's reproducing the music. In addition, lower operating temperatures mean longer-lived capacitors and other components.

Today, a fully transistorized hi-fi/stereo installation is practical, for the firm which introduced the Model S-15 stereo amplifier (Transis-Tronics, Inc., 1601 W. Olympic Blvd., Santa Monica, Calif.) is now producing a companion FM stereo multiplex tuner (see Fig. 1). With an audiophile net price of $179.50, the instrument, Model FM-15MX, is the same size as the S-15, measuring approximately 3" x 10" x 8½". A clue to its cool operation is given by its rated power consumption of only ¼ *watts*—less than one-tenth that of comparable tube-operated tuners!

Covering the FM broadcast band from 88 to 108 mc., the FM-15MX has a specified sensitivity of 1.8 μv. for 20 db quieting, or 2.5 μv. for 30 db quieting. Its i.f. bandwidth is 270 kc. at the −6 db points, while its frequency response is 20 to 20,000 cycles ± 1 db. At 100% modulation, the tuner delivers an output of 1 volt, with the noise level down 66 db. A moderate output impedance is provided, permitting the use of shielded connecting cables up to 20 feet in length with little or no high-frequency roll-off.

A total of 20 transistors and 9 diodes is used in the complete tuner, with 8 transistors employed in the multiplex section. A built-in regulated power supply is provided, using a bridge rectifier,



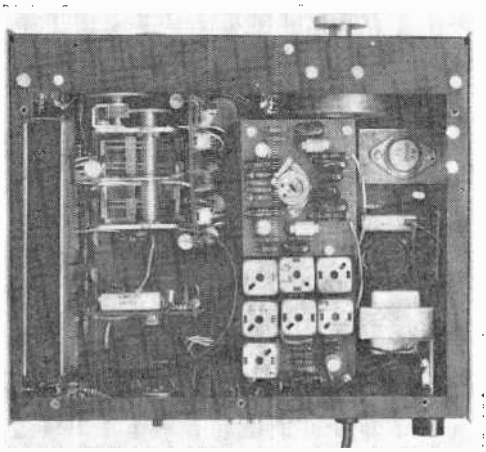


Fig 1. Transis-Tronics' Model FM-15MX FM stereo tuner draws astoundingly little power from the a.c. line, thanks to its completely transistorized circuitry. A perfect match for the company's Model S-15 all-transistor stereo amplifier, the FM-15MX uses 20 transistors and 9 diodes, and features its own built-in regulated power supply.

a pair of transistors, and a zener diode. Other features include a tuned r.f. stage, automatic frequency control, interstation muting, a "local-distant" sensitivity control, and a tuning meter.

New Breadboard. Newcomers to electronics often are puzzled by the expression "breadboard." This is actually a throwback to the early days of radio, when both receivers and transmitters were assembled on wooden breadboard "chassis." Major components were held in place with wood screws, and wiring was by means of stiff, bare busbar. Today, the word "breadboard" refers to an experimental circuit assembled for test purposes, even if wired semi-permanently on a conventional metal chassis.

When "breadboarding" circuits using semiconductor devices, it's generally a good idea to try to minimize the number of times that a component must be soldered in place (excessive heat can ruin transistors and diodes). One useful technique is illustrated in Fig. 2—the use of coil spring connectors as terminal points. They are mounted as needed on a perforated board, with component connections made by simply slipping the leads between individual spring coils. No soldering is required, and parts and connections may be changed easily as often as necessary.

A basic kit for this type of circuit breadboarding has been introduced by the Sheatz Electrode Co. (6506 Ridge Dr., Washington 16, D. C.). The kit includes a 5″ x 8″ perforated board, 15 spring electrodes, 4 rubber feet, and a metal inserter. Individual kits sell for $2.65, plus postage; additional kits, if ordered at the same time, are only $1.65 each (plus postage).

Readers' Circuits. The selectivity of a tuned circuit depends primarily on the *Q* of the coil. An almost infinite number of *L/C* combinations will tune to a specific frequency, but only a limited number will have optimum *Q*'s. Reader Don Stovicek (1190 E. 177th St., Cleveland 19, Ohio) decided to make use of optimum *Q*'s in the design of a simple AM broadcast-band receiver.

As shown in Fig. 3, Don used a tapped coil (*L1*) as well as a conventional tuning capacitor (*C2*) in the receiver's tuned circuit. Thus, both inductance and capacitance can be adjusted when tuning to different stations, permitting the optimum *Q* to be obtained. Emphasizing this feature, Don dubbed his set the "Super Selecto."

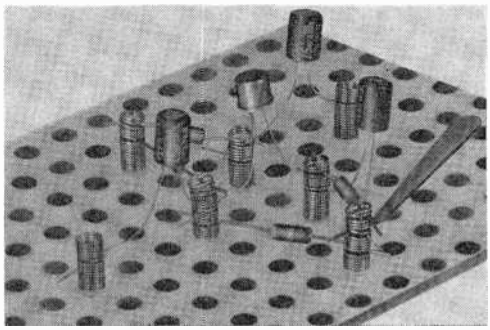


Fig. 2. Looking for an easy way to "breadboard" your semiconductor circuits? This is a typical circuit assembled from a Sheatz Electrode Co. kit.

In operation, r.f. signals picked up by the antenna are coupled through *C1* to tuned circuit *L1/C2*, where the desired station is selected. The selected signal is detected by diode *D1* and coupled through *C3* to a common-emitter audio amplifier, *Q1*; transistor base bias is furnished through *R1*. After amplification by *Q1*, the audio signal drives the headphones used as *Q1*'s collector load. Operating power is furnished by a 3-volt battery, *B1*, controlled by *S2*.

Except for the coil, all components are standard and readily available through regular parts suppliers. Capacitors *C1* and *C3* can be disc, ceramic, or tubular types; *R1* is a ½-watt resistor; and *C2* a familiar 365-$\mu\mu$f. tuning capacitor. Diode *D1* is a 1N34 or 1N34A, and *Q1* a 2N233 *npn* transistor. Switch *S1* is a 5-pole rotary switch, and *S2* a s.p.s.t toggle or slide switch. Battery *B1* is a 3-volt unit made up by connecting two penlight or flashlight cells in series. The coil, *L1*, consists of 175 turns of #28 enameled wire, close-wound on a ⅜″ form, with taps at 50, 100, 125, and 150 turns. Standard, 2000-ohm headphones should be used.

The "Super Selecto" receiver can be assembled on a small plastic or metal chassis, depending on individual preferences. Neither layout nor lead dress should be critical, but care should be taken not to overheat the diode or transistor leads when these components are soldered in place.

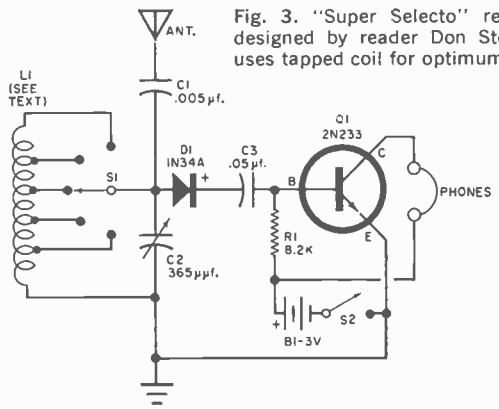
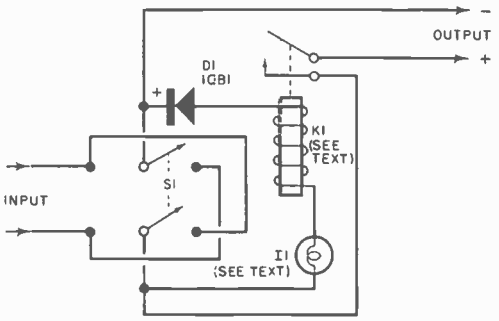


Fig. 3. "Super Selecto" receiver designed by reader Don Stovicek uses tapped coil for optimum "Q."

Fig. 4. Reader Don Petro's "Polarity Reverser" helps prevent damage to transistorized converters.



In use, a short to moderately long antenna will be required, depending on the number of stations in your area and how much of a DX'er you are. Both *S1* and *C2* should be adjusted when tuning individual stations to obtain optimum sensitivity and selectivity.

Recognizing the increased popularity of transistorized power converters and the problems encountered when they are installed in different boats, automobiles, and other vehicles, reader Don Petro (Alder Flats, Alberta, Canada) developed the "Polarity Reverser" circuit illustrated in Fig. 4. Placed between a transistorized converter and the d.c. power source, the unit permits the d.c. polarity to be reversed easily. In addition, it protects the converter against possible damage which may be caused by the accidental application of improper d.c. polarity.

Standard parts are used throughout. Switch *S1* is a 15-amp. d.p.d.t. toggle switch with a center "off" position, *D1* is an International Rectifier Type 10B1 silicon diode, *K1* a Potter and Brumfield Type SP11 relay, and *I1* a standard pilot lamp; the particular type of pilot lamp as well as the specific relay you use should be chosen on the basis of the d.c. source voltage.

The unit itself is assembled in a small Minibox and fitted with suitable input and output connectors, such as binding posts or heavy-duty screw terminals. Both sets of relay contacts are connected in parallel.

In use, the "output" terminals are connected to the power converter with indicated polarity and the "input" terminals to the power source. Switch *S1* is switched first one way, then the other, until the pilot lamp lights, indicating that proper d.c. polarity has been obtained. The connecting leads should be of adequate size to handle the currents encountered with minimum voltage drop, of course.

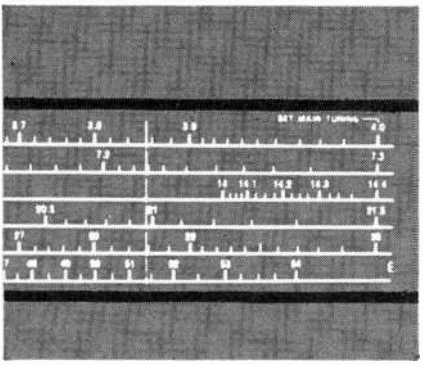
Product News. MED Electronics, Inc. (1200 First St., Alexandria, Va.) has just introduced a transistorized personal small arms detector. Worn by a detective or industrial security officer, it permits a suspect to be "frisked" without actual body contact and without his knowledge.

A new line of low-cost photoconductor devices has been introduced by Sylvania Electric Products, Inc. (730 Third Ave., New York 17, N. Y.). They consist of a cadmium sulphide cell on which "comb-shaped" electrodes have been deposited, and their spectral response closely approximates that of the human eye. These devices can be used in burglar alarms, industrial controls, garage-door openers, doorway annunciators, photographic equipment, etc.

Motorola, Inc. (5005 E. McDowell Rd., Phoenix, Ariz.) is now producing a series of eight germanium power transistors with junction temperature ratings of 110°C and maximum power dissipation ratings of 170 watts. Type numbers are 2N2075 through 2N2082, and specifications are available from the factory on request.

That about covers the semiconductor front for now. We'll be back next month with more info . . .

—*Lou*



Across the Ham Bands

By **HERB S. BRIER,** W9EGQ
Amateur Radio Editor

SWL "SOUVENIR HUNTERS" AND QSL CARDS

WE hams all know the thrill of receiving a QSL card from a new state or country. It adds to our "Worked All States" or "DX Century Club" collections and serves as a memento of a pleasant radio chat. Short-wave listeners are equally happy to receive QSL cards in reply to their reception reports. Most of them, however, are not too satisfied with the low percentage of replies they get from hams.

To remedy the deficiency, a few so-called SWL's have revived an old trick. Their gimmick is to write to the hams whose names and call letters appear in our "News and Views" section—especially the "rare" ones—with the story: "I'm new at the SWL game. Please send me one of your QSL cards."

There is nothing particularly wrong with such requests from real beginners, if they are accompanied by return postage (most of them are not), and if the hams involved are willing to give away their QSL cards as souvenirs. But some of these "SWL" characters are real "sharpies." They aren't satisfied with a mere souvenir; they want a full-fledged confirmation, based upon their claim of having heard the ham's station "often" or at some indefinite time.

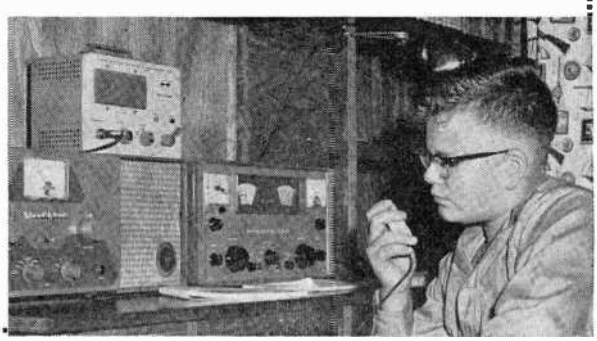
One Novice recently featured in "News and Views" received two fraudulent reports—one for 80 meters, and the other for 15 meters—from the same fellow. When the Novice demanded specific data on the alleged reception of his signals, he received a word-for-word copy of the item that had appeared in the "News and Views" section!

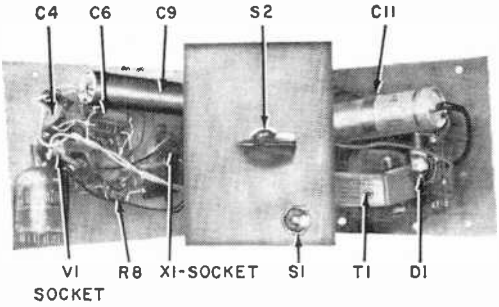
Probably the best thing a ham can do with such a report is to write across it: "Sorry, this report does not agree with my station log," and return it to the

Novice Station of the Month

Ronnie Blackwell, WN5AQG, Amarillo, Texas, sent in this prize-winning photo of himself and his rig. WN5AQG transmits CW on 80 meters with a Heathkit DX-40 and receives on a Hammarlund HQ-100; he also has a Heathkit Two-er transceiver. His 80-meter antenna is a half-wave dipole, and he feeds either a 10-element beam or a ground-plane vertical on "2."

Ronnie will be awarded a one-year free subscription to P.E. for his photo. If you would like to try for a similar award, send us a picture of your station—preferably showing you at the controls, and be sure to include with your entry some information about yourself, your equipment and your activities. You may be one of the lucky winners. Non-prize-winning photos will also be published as space permits. Entries should be sent to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana.





Most of the circuitry in the compactron frequency calibrator is mounted on the two covers of an aluminum utility box. The 6D10 compactron (V1) has been removed from its socket and placed in lower corner of cover shown at far left.

sender (*if* he furnished return postage). Don't yell "Fraud!" unless it positively is one. An incorrect report could be the result of an error in copying a call letter.

SWL/QSL Bureau. Here's a more pleasant item for SWL's who like to *earn* the cards in their collections. Many SWL's (especially those with WPE numbers assigned to them by POPULAR ELECTRONICS —see page 82), who have sent reports to hams outside the United States, may have a foreign confirmation or two waiting for them at the SWL/QSL Bureau. This bureau is manned by LeRoy Waite, WPE2AK, 39 Hannum St., Ballston Spa, N. Y.

A retired mail carrier, Roy started the SWL/QSL Bureau when he heard that the American Radio Relay League was receiving many foreign QSL cards for U.S. and Canadian SWL's. The ARRL QSL Bureaus could not handle these cards, and they were being returned to their senders. As Roy's service becomes better known, he is gradually distributing more and more QSL cards from overseas hams to North American SWL's.

If you are an SWL and would like to receive any cards which may have come in for you, send Roy a business size (Post Office #8), stamped envelope, addressed to yourself, along with your request. Include your WPE identification, if you have one. If there are no cards for you at the bureau at the present time, Roy will keep your envelope on file and send you any that might arrive there in the future. But remember: no stamped envelope, no cards.

We would like to stress the fact that Roy does *not* handle *outgoing* SWL cards to overseas hams. Also, incoming cards from overseas SWL's to United States and Canadian hams are still being handled by the ARRL QSL Bureaus.

Missing DX Cards. While we're on the subject of bureaus, if you're a ham who has worked a DX station and not received a QSL, the chances are better than even that the missing card is waiting for you at the ARRL QSL Bureau for your call area. In the K9/WA9/W9 bureau alone, there are over 7000 unclaimed DX cards on file addressed to hams—hundreds of them for Novices.

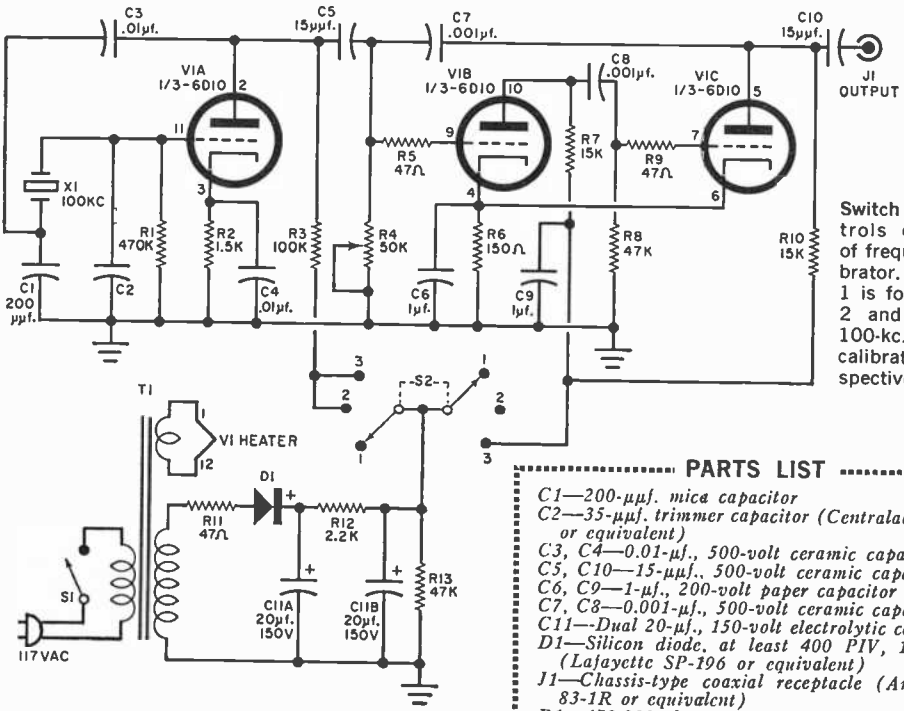
To pick up your DX cards from the bureau, print your call letters in the upper left-hand corner of a large envelope, address it to yourself, insert the envelope in another one, and send it to your call area QSL manager. His address is printed in most issues of QST and at the head of each U. S. and Canadian call area listing in the "Radio Amateur's Call Book Magazine."

COMPACTRON FREQUENCY CALIBRATOR

This crystal-controlled frequency calibrator is designed around one of the General Electric "compactron" tubes. The type used here, a 6D10, is equivalent to three 12AT7 triode units in a single envelope.

About the Circuit. In position 2 of switch *S2*, the calibrator produces marker signals, accurate within cycles, every 100 kc. across your receiver dial. The signals extend up to approximately 30 mc., thereby marking most amateur band edges and every 100 kc. within the bands.

In position 3 of *S2*, a multivibrator circuit modulates the basic 100-kc. signal to produce additional signals every 10 kc. across the receiver dial. This provides markers for the remaining band edges



Switch S2 controls operation of frequency calibrator. Position 1 is for standby, 2 and 3 select 100-kc. or 10-kc. calibrations, respectively.

PARTS LIST

C1—200-μμf. mica capacitor
C2—35-μμf. trimmer capacitor (Centralab 827-D or equivalent)
C3, C4—0.01-μf., 500-volt ceramic capacitor
C5, C10—15-μμf., 500-volt ceramic capacitor
C6, C9—1-μf., 200-volt paper capacitor
C7, C8—0.001-μf., 500-volt ceramic capacitor
C11—Dual 20-μf., 150-volt electrolytic capacitor
D1—Silicon diode, at least 400 PIV, 150 ma. (Lafayette SP-196 or equivalent)
J1—Chassis-type coaxial receptacle (Amphenol 83-1R or equivalent)
R1—470,000 ohms
R2—1500 ohms
R3—100,000 ohms
R4—50,000-ohm potentiometer, screwdriver-adjusted
R5, R9, R11—47 ohms
R6—150 ohms
R7, R10—15,000 ohms
R8—47,000 ohms
R12—2200 ohms, 1 watt
R13—47,000 ohms, 1 watt
All resistors ½-watt, 10%, unless otherwise noted
S1—S.p.s.t. switch
S2—2-pole, 3-position rotary switch
T1—Power transformer; primary, 117 volts; secondaries, 125 volts @ 15 ma., 6.3 volts @ 0.6 ampere (Stancor PS-8415 or equivalent)
V1—6D10 compactron (General Electric)
X1—100-kc. crystal (Bliley Type KV3 or equivalent)
1—4" x 5" x 3" aluminum utility box (Bud AU-1028 or equivalent)
Misc.—Sockets for V1 and X1, terminal strips, solder lugs, wire, etc.

below 30 kc. and for any other 10-kc. point within the bands.

Position 1 of *S2* is for "standby" operation. With the switch in this position, the plate voltage to the 6D10 is disconnected, but the heater remains on.

Construction and Adjustment. For ease of construction, the calibrator circuitry is built on the top cover of a 3" x 4" x 5" aluminum utility box (Bud AU-1028 or equivalent), and the power supply on the bottom cover. Switches *S1* and *S2* are mounted on the front of the box itself; the output connector (*J1*) is installed on the rear. Be sure to make the leads interconnecting the components on the covers with those on the box long enough to permit wiring all connections before closing up the box.

With the construction completed, connect output jack *J1* to the antenna terminal of your receiver using a length of coaxial cable. Then tune the receiver to Station WWV on 2.5, 5, 10, or 15 mc., shut off the receiver BFO, and turn switch *S2* to position 2. Capacitor *C2* is now carefully adjusted for a "zero beat" (no whistle or growl from the speaker) between the calibrator signal and that of WWV. This must be done during a period when WWV itself is not broadcasting a tone.

Next, locate two adjacent signals from the calibrator on the receiver dial, and turn switch *S2* to position 3. Finally, adjust resistor *R4* until you hear *exactly* nine steady signals between the 100-kc. points you have just located on the dial. Care must be used in making this adjustment, or you may set the multivibrator to 12.5 kc.—or some other submultiple of 100 kc.—instead of to the desired 10 kc.

(*Continued on page* 103)

On the Citizens Band

with **DICK STRIPPEL,** 2W1452, CB Editor

COMMUNITY service, without a doubt, is one of the most valuable functions an organized group of CB'ers can perform. The Citizens Band lends itself to this function because of the simplicity of CB equipment and its ease of operation, plus the fact that anyone authorized by a licensee can operate a CB transmitter. We're quite happy to note that many of the CB clubs we've heard from during the past year are dedicated to providing emergency communications for local authorities.

A fine example of a community service group is the Winnebago County (Iowa) Emergency CB Net. Organized by Frank W. Arnold, 17W2153 (346 West G St., Forest City, Iowa), the net boasts 24 base station units (two operated on a 24-hour basis), 31 mobile units, and 8 hand-held portable units.

Since Frank has been active in the local fire department and American Red Cross for a number of years, it's only logical that the net works closely with these two organizations. In addition to the CB units in Winnebago County, the net maintains contact with five nearby counties in Iowa and two across the Minnesota state line.

Channel 2 is strictly an emergency channel in the area; police, fire, and ambulance units continually monitor this channel. At the other end of the spectrum, channel 22 is used for general net communications. When the net is activated, Frank, as net controller, monitors both channels 2 and 22, plus the local 75- and 10-meter ham emergency nets.

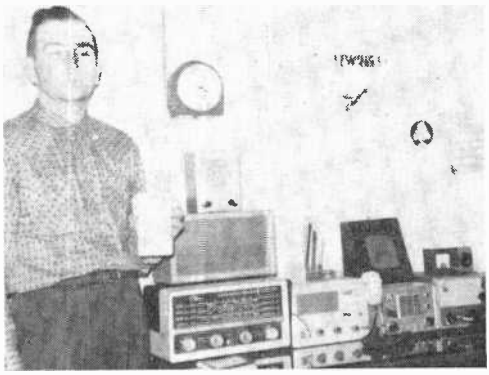
Our hats are off to the Winnebago County Emergency CB Net, and its net controller, for a top-notch job of organization.

Want a Rule Changed? Recently, we stated in this column that writing one's congressman to try to have some CB rules changed was like asking a local politician to fix a traffic ticket. As a result, our mail was quite heavy with letters of protest. It might be a good idea to clarify this point.

While the U. S. Congress indeed makes laws, it had nothing at all to do with setting up the Citizens Band. Many years ago, Congress enacted the necessary statutes which empowered the Federal Communications Commission to administer all radio transmitting activity in the United States. As we have said before, it was the FCC that gave us our band, and it will be the FCC that will take it away if abuses warrant it.

If you feel that certain CB rules need changing, there is a very slim chance that your congressman will even *try* to do anything for you. The FCC is under the executive branch of the government, while Congress is the legislative branch. Chances are that your congressman will just acknowledge your letter and possibly inform you of the proper way to submit your ideas to the FCC.

Contrary to some opinions, the FCC is



Frank W. Arnold, **17W2153,** net controller and organizer of the Winnebago County (Iowa) Emergency CB Net, is shown holding one of the net's eight portable CB units. Frank's equipment includes three CB rigs, an FM monitor, and a ham-band receiver for the 75- and 10-meter emergency nets.

not a monstrous, impersonal, governmental bureau. It has, in the past, changed rules pertaining to various radio services. These changes have made some rules more lenient and some rules tougher. One of the main criteria the FCC employs is that the changes must be in the best interests of the majority of all users of the various radio services.

Each licensee should have a general knowledge of the procedures involved, and easy access to the regulations pertaining to an FCC petition. Obviously, since the majority must profit by any change, the FCC will only consider petitions which are drawn up in a logical and legal manner.

In this nation of ours, the government is for, by, and of the people, and we certainly want to keep it that way. But if we feel that we should change some of the rules, let's go about it in the proper way. If our suggestions carry enough weight, we can definitely expect them to be heard.

Jamborees. With the warm summer weather encouraging out-of-door activities, many CB organizations are planning appropriate get-togethers.

One of the biggest on the docket for this month is the Mobile Civil Emergency Unit National Jamboree at the New York State Fairgrounds in Syracuse, N. Y., on July 6, 7, and 8. There will be lots of equipment on hand to examine, as well as plenty of fun, amusement, prizes, good food, and—best of all—good companionship.

The MCEU is the only truly national CB club. If you're interested in joining it, or attending its jamboree, get in touch right away with Chuck Satterlee, National Secretary, MCEU, 1203 Butternut St., Syracuse 8, N. Y.

Base Station Transceiver. As this is being written, we're giving the new Tram Electronics TR-27 transceiver a real workout. This unit is quite large—almost 16″ long and about 8″ high. It's specifically designed for base station use.

Employing a 5763 transmitting-type tube as its final amplifier, the TR-27 puts out a healthy 3.5 watts into our lab-quality output meter, something we've seen only a few other units do. On "Receive," dial calibration is excellent, selectivity more than adequate, and the unit's ability to stay set to a tunable channel is superb. Its extreme sensitivity is due in large part to the use of three dual triodes as r.f. amplifier, first and second mixers, and local oscillators. The oscillators, incidentally, are voltage-regulated.

Operating is a snap with the "touch-to-talk" Turner microphone supplied with the TR-27 and a completely adjustable noise limiter which really knocks out the stubborn ignition interference our location is plagued with. Six crystal-controlled receive and transmit channels

(*Continued on page* 101)

CB Sam was careful

CB Sam was careful
not to imitate the gang.
They didn't know procedure
nor did they give a hang.
He'd always mark the frequency
and check if it was clear
Before he'd switch to transmit,
so he wouldn't interfere.

Sam kept his station orderly,
and spoke with poise and ease.
He frowned on working "DX,"
and refused to shoot the breeze.
But do not be deceived
by his "Net Control" type drawl:
This blemish-free CB'er
sends with a bootlegged call.

by David Moore

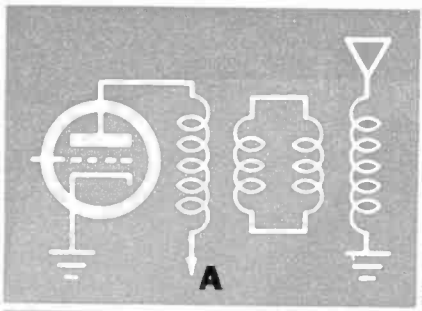
Hobnobbing with Harbaugh

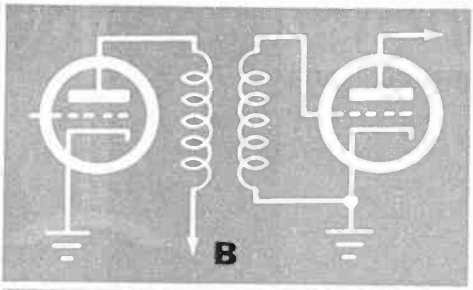
I Was Just Looking!

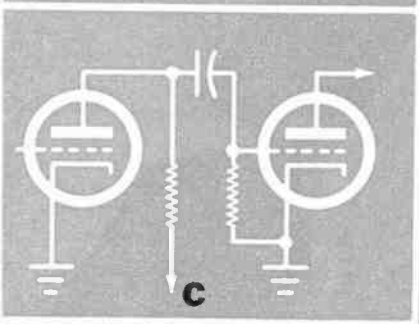
ELECTRONIC COUPLING QUIZ

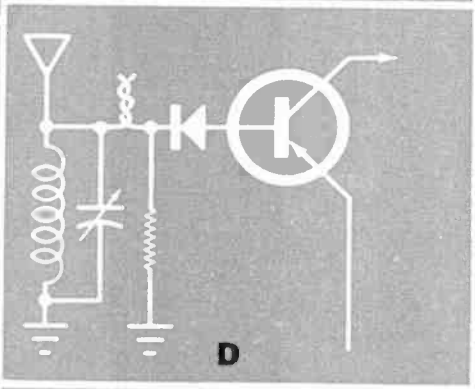
By ROBERT P. BALIN

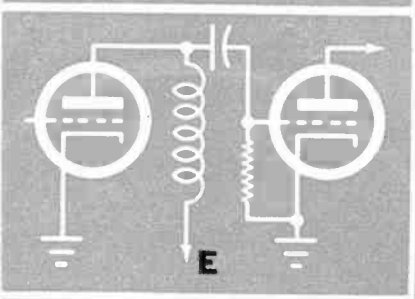
If you know your coupling circuits and terminology, you should be able to match the types of coupling listed numerically on the right with diagrams A through H below. Place your answers in the spaces provided, then turn to page 102 and find out how right (or how wrong!) you are.

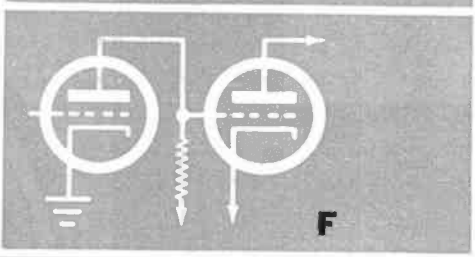


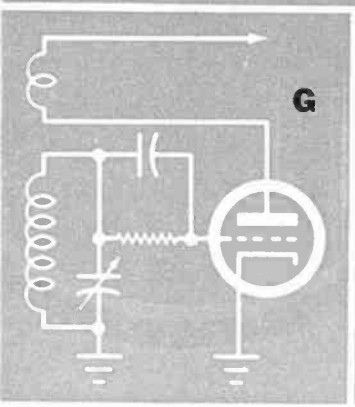


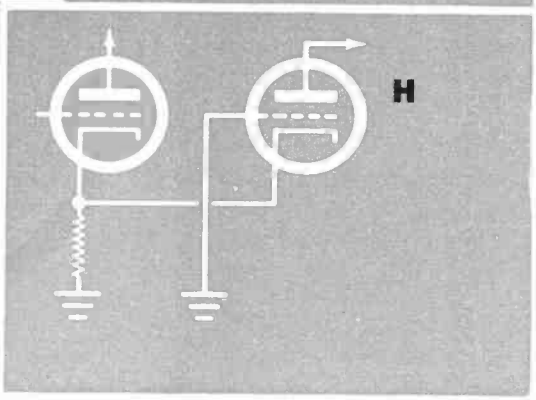












1 Direct coupling _____

2 R-C coupling _____

3 Tickler (inductive coupling) _____

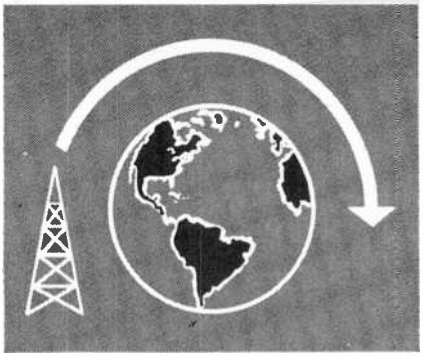
4 Impedance coupling _____

5 Cathode coupling _____

6 Link coupling _____

7 Gimmick (capacitive coupling) _____

8 Transformer coupling _____



Monthly Short-Wave Report

By **HANK BENNETT,** W2PNA/WPE2FT
Short-Wave Editor

POP'TRONICS "MAILBAG"

OUR recent columns featuring typical questions from readers on the various phases of short-wave listening (July and November 1961 issues) have been so well received that we plan to continue to use a question-and-answer format occasionally. While it's true that most of our readers are already well versed in the SWL hobby, there are also many newcomers every month. And our purpose is to serve the beginner as well as the veteran DX'er. Accordingly, here are a few more of the questions most frequently pulled out of the POP'tronics "Mailbag."

Q: Why don't you list schedules of stations within the continental United States in *Short-Wave Report?*

A: We feel that listings of the more distant stations make better use of the space available to us each month. A very large percentage of our readers are in the United States, and virtually everyone can hear our own stateside stations with little or no trouble.

Q: During periods of the year when Daylight Saving Time is observed in many areas, how should we show the times in our reports?

A: This column is based on Eastern Standard Time. Your reports, for the sake of convenience in the preparation of this column, should always be made in EST.

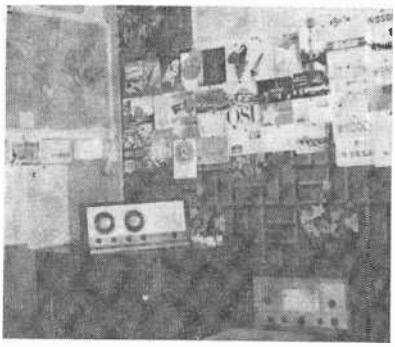
Q: Is it permissible to send reports to Iron Curtain countries?

A: There's no law against sending reports to stations behind the Iron Curtain,

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

All of the stations listed here specifically beam transmissions to the USA that contain newscasts. The times of the newscasts may vary within the periods indicated; those which are broadcast fairly regularly at specific times are shown in parentheses.

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Belgium	Brussels	9705	0000
East Congo	Leopoldville	11,755	1700-1715 (1700)
England	London	15,420, 17,810	1130-1245 (1200)
Finland	Helsinki	15,190	0630
Italy	Rome	11,905, 9575	1930-1950, 2205-2225 (1930, 2205)
Netherlands	Hilversum	11,730, 9590	1625-1720 (1630)
Portugal	Lisbon	6025, 6185	2100-2130, 2300-2330
Spain	Madrid	9360	2215-2300, 2315-0000, 0015-0100
Sweden	Stockholm	11,805	2215-2245
Switzerland	Berne	11,865, 9535, 6165	2030-2215, 2315-0000 (2030, 2215)
Turkey	Ankara	9515	1815
USSR	Moscow	Numerous	2000-0100
West Germany	Cologne	9640, 9575, 6100	1900-2200, 2200-0100
		6100, 9705	1715-1845
		6145, 9735	0000-0130
Yugoslavia	Belgrade	6100	1700-1715 (1700)



The listening post of Jon Louis Lenard, WPE9CSB, of Des Plaines, Ill., contains a Heath AR-3 receiver, and a Knight Span Master for standby use. Jon's antenna system consists of five dipoles. He has 37 countries logged, 29 verified.

nor is there any penalty for receiving verifications from them. However, you should watch out for possible propaganda which may follow in the mail; if it reaches you, it can be refused and returned to your local postmaster.

Q: Why do you give publicity to stations that place propaganda above entertainment?

A: Normally we give little or no room to stations in that category. But frequency and/or schedule changes are newsworthy items, and we try to treat them accordingly.

Q: Do all Russian stations verify?

A: According to a recent letter from *Radio Moscow,* it is the only Russian station that verifies. However, we know definitely that *R. Tashkent* has verified many reports. And *R. Kiev* just recently sent a verie to a reader in New York City, stating that reports are welcome but that the *R. Kiev* programs are intended mainly for Ukrainians living outside of the Soviet Ukraine.

Q: Why don't you list the receivers used by your many reporters? This might enable some of us to realize quickly whether or not we stand a chance of hearing any of those rare stations.

A: We are considering doing so, but this could result in fewer listings. You fellows with the lower priced receivers

(*Continued on page* 104)

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

To become a Short-Wave Monitor registered with POPULAR ELECTRONICS, just follow these simple directions:

1 Fill out the form below. (You must be a short-wave listener presently active in the hobby to be eligible for a Short-Wave Certificate.)

2 Send us 10 cents in coin to cover the cost of the certificate as well as the handling and registration costs. If you live outside the United States and cannot obtain U. S. coins, send either 15 cents in Canadian currency or two International Reply Coupons (IRC's).

3 Insert the application form, coins (or IRC's) and a stamped, self-addressed envelope in another envelope and mail it to:
Monitor Registration, POPULAR ELECTRONICS
One Park Avenue, New York 16, N. Y.

(Please Print)

Name ..... Ham Call-Area Prefix .....

Address ..... City ..... Zone ..... State .....

Receivers — Make ..... Model .....

Make ..... Model .....

Principal SW Bands Monitored ..... Number of QSL Cards Received .....

Type of Antenna Used .....

Signature ..... Date .....

TRAVELING?
Take your shaver with you

By WALTER ROBSON

IF you're like most men who do a lot of traveling, you'd probably find it very convenient to be able to shave in your car from time to time. Nowadays, of course, this is fairly easy to arrange—if you want to spend the money. Electric shavers that plug into the cigarette lighter are available, as are converters to change the six or twelve volts from a car battery to the 117 volts necessary to operate a standard shaver.

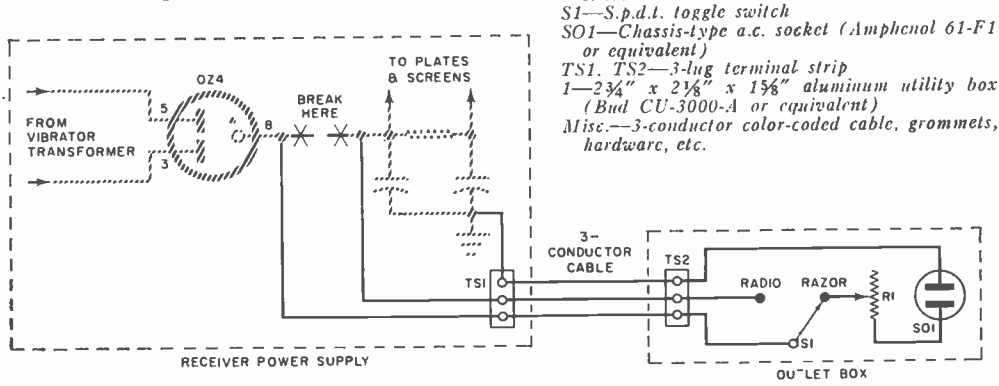
But if your car is equipped with a tube-type radio, you probably already own a converter that will supply more than enough voltage to run your home shaver! You guessed it—it's the receiver's B-plus supply. All you have to do is tap it and drop the voltage to the correct value. Interested? Then read on.

Preparing the Receiver. First make sure that your set has a high-voltage "B" supply. Models which are transistorized, and some models using tubes, employ low-voltage supplies and are not suitable. The easiest way to check is to turn on the set and listen for the telltale hum of a vibrator. If you hear it, you've got a high-voltage supply.

Now remove the radio from the car and locate the rectifier tube. This is usually an 0Z4 "cold-cathode" type as shown in the schematic diagram, but you might also encounter heater-type tubes such as the 6X4. Having located the tube, unsolder and remove the lead (or leads) from its cathode terminal (pin 8 if it's an 0Z4, pin 7 if it's a 6X4).

Install a 3-lug terminal strip (*TS1*) at

Wiring of shaver outlet box and connections between box and receiver are shown in diagram. Shaded areas indicate existing wiring in receiver power supply.



PARTS LIST

R1—1000-ohm, 10-watt, adjustable power resistor
S1—S.p.d.t. toggle switch
SO1—Chassis-type a.c. socket (Amphenol 61-F1 or equivalent)
TS1, TS2—3-lug terminal strip
1—2¾" x 2⅛" x 1⅝" aluminum utility box (Bud CU-3000-A or equivalent)
Misc.—3-conductor color-coded cable, grommets, hardware, etc.

some convenient spot near the rectifier tube. The lead (or leads) just disconnected are wired to one lug, the second lug is connected to the rectifier's cathode pin, and the third is grounded. Do not solder any of the connections at this time.

Constructing an Outlet Box. The shaver outlet (*SO1*), together with a s.p.d.t. switch for transferring high voltage from the receiver to the outlet and vice-versa, is housed in a small aluminum utility box. Also located in the box are voltage-dropping resistor *R1* and 3-lug terminal strip *TS2*.

Mount these components and wire them according to the schematic. Then run one end of a short length of color-coded three-wire cable into the box through a grommet and connect it to *TS2* as shown. Don't replace the box cover when wiring is complete; resistor *R1* will have to be adjusted later.

Installation and Adjustment. Run the other end of the three-wire cable into the receiver through a convenient opening and wire it to *TS1*. If no opening exists, drill an appropriate hole and line it with a grommet.

The receiver, with the attached outlet box, is now placed in the car. Don't install the set in the dashboard until final checks are made, but temporarily connect the battery, antenna, and speaker wires. With switch *S1* in the "*Radio*" position, turn on the receiver; it should operate normally.

With the receiver in operation, set the slider on *R1* for maximum resistance. connect a d.c. voltmeter across *SO1*, and plug in your shaver. Caution: although no voltage appears across *R1* or *SO1* with switch *S1* in the "*Radio*" position, be careful! You can still get a shock from the wiring associated with *S1* or *TS2*.

Snap *S1* to the "*Razor*" position, transferring the B-plus voltage to *SO1*. If the voltage across *SO1* is less than 117, set *S1* at "*Radio*" again and move *R1*'s slider to a lower resistance position. Return *S1* to "*Razor*" and once again read the voltage across *SO1*. If it's still less than 117 volts, repeat the above procedure. Once you've adjusted the slider for a full 117 volts, the razor should operate—at its normal speed—whenever *S1* is set at "*Razor*."

If all is well, replace the receiver in the dashboard and install the cover on the outlet box. Then mount the box in some convenient spot under the dash, and you'll have shaving power whenever you want it. —30—

Third Eye for Space Explorers

The first astronaut to land on the moon may need an eye in the back of his head, and a new "Electrocular" headset (right) perfected by Hughes Aircraft may well provide it. The headset contains a miniature cathode-ray tube (A) to receive, say, a closed-circuit TV picture, as well as an internal mirror (B) to "bend" the image toward the viewing eyepiece (C). A microphone (D) for voice communications is optional. Since the monocle-type eyepiece is a transparent mirror, the wearer can look through the image, when necessary, to concentrate on what is actually in front of him. The apparent size of the image (up to eight feet in diameter) varies according to where he focuses his eyes. Many other applications are anticipated for the new device—it's being used by the pilot at left, for example, to receive pictured information from the control tower on air traffic and ground conditions.

The RIVER SNIFFER

By
JOHN T. FRYE
W9EGV

a Carl and Jerry Adventure

"THIS IS the life," Carl sighed contentedly; "no lessons, no exams, no ROTC drills, no nothin'!" He and his friend, Jerry, were sprawled on their backs on the river bank staring upward through the sycamore leaves at a buzzard sail-planing in the cloudless summer sky above. Down at the edge of the water, two fishing rods rested in a couple of forked sticks.

Before Jerry could answer, a slight splashing from the river attracted his attention. Raising himself on one elbow so that he could get a better look, he exclaimed, "Hey, Carl, look at those fish on top of the water!"

Two large bass were threshing about on the surface, obviously in their dying throes. Even as the boys watched, the splendid fish turned belly-up and floated quietly downstream; and, looking more closely, Carl and Jerry saw that the two were accompanied by other dead and dying fish of various sizes.

The throbbing of an outboard motor was heard downriver, and an aluminum boat carrying a young man dressed in a game warden's uniform came in sight around a bend in the stream. When he saw the boys, he ran the bow of the boat up on the bank, cut the motor, and stepped out.

"That's a mighty sorry sight," he remarked, motioning toward the floating fish. "I'd certainly like to catch whoever keeps dumping that fish-killing stuff into the river."

"You mean it has happened before?" Carl queried.

"About once a week all spring, but not always on the same day or night. When someone calls in and reports dead fish, I get right on it; but I never know how far the fish float after dying. How-

ever, this is the farthest upstream I've found them, and some of those fish are still wiggling. This time, at least, the stuff must have entered the river from this bank and not too far upstream; but I've covered every foot of the river for five miles in either direction without finding a single likely source of pollution. If only I had some way of knowing just as soon as the stuff hit the river—even before the fish began to die—I'd stand a chance of tracing it. At least I could collect a strong enough sample for accurate analysis before the polluting substance was too greatly diluted."

Jerry was looking very interested. "You mean you need some kind of a robot to sample the river water continuously and give some sort of alarm when an unusual amount of destructive chemical floats past it?"

"Exactly, but I guess there's no such gadget."

"Don't make book on it. I have an idea: if you'll take that glass jug lying in the weeds across to the other side of the river and fill it, my friend here and I will try to build such a robot for you. Electronics is our field. I can't promise anything, but you can give us your telephone number and we'll call you if we come up with something."

"Okay, what have I got to lose? But what do you want with the water?"

"We'll need a sample of normal, unpolluted river water to work with."

WHILE Bill Herber, the game warden, was collecting the water, Carl and Jerry reeled in their lines. A half hour later they were entering the coolness of their basement laboratory at Jerry's home, and Jerry went straight to a stack of papers resting on a shelf. He sorted through them until he found what he sought.

"Ah, here it is," he said. "I was sure I had saved the description of the River Robot Monitor that Mr. Edward J. Cleary, Executive Director of ORSANCO, sent me."

"Bully for you; so what is it?"

"It's a unit of a system of continuous automatic electronic river pollution monitors used by the Ohio River Valley Water Sanitation Commission to keep a continuous check on the Ohio River water. Eleven of these unattended robot devices are strung along the river. They constantly test the water for seven different variables: dissolved oxygen, chloride, hydrogen ion, specific conductance, oxidation-reduction potential, temperature, and solar radiation. The various sensors feed their information into a telemeter transmitter at each location, and all the transmitters are connected by telephone wires to a telemeter receiver in Cincinnati. At regular intervals this receiver calls each monitor for a report. Signals received actuate a transcriber which automatically types the information on tabulation sheets for diagnosis of river conditions."

"So that's why you told Mr. Herber not to bet there wasn't a river robot monitor! We're not going to try to build one of these robots, are we?"

"Hardly. They're quite complicated and cost a lot of money. But I'm hoping we can build a simple gadget based on a single sensing unit that will serve our purpose."

"How about the hydrogen ion measuring part? If I remember my chemistry, that's an indication of the acidity of a solution."

"Either the acidity or alkalinity of the solution," Jerry corrected. "If you recall, the potential hydrogen ion concentration, or pH factor, is measured on a 0-14 scale, with 7 being the number associated with 'pure water.' Numbers going downward from 7 indicate increasingly acid solutions. Readings going upward from 7 indicate increasingly strong base solutions. Since the number is actually the negative logarithm of the hydrogen ion concentration, each pH unit represents a tenfold change in solution strength. Compared to a pH 5 solution, a pH 4 solution is ten times more acid, and a pH 3 solution is a hundred times more acid.

"One way to measure the pH of a solution," he continued, "is to add special organic indicators and observe the color change that results. A better method, in many respects, is to employ an electrometric device that translates the pH of the solution into a reading on a meter whose scale is marked off in pH units. That's the kind of pH indicator our chemistry prof at Parvoo University used in his lectures last year."

"Fine. All we have to do is build a pH meter and let the meter-deflecting

current also operate a sensitive relay that will sound an alarm."

"It's not that easy," Jerry demurred. "Until I read this pamphlet called 'The Development of pH Instrumentation' by A. O. Beckman of Beckman Instruments, Fullerton, California, I had a hazy notion a pH meter was a relatively simple gadget that employed either a current conducted through the solution or a voltage produced by galvanic action on electrodes immersed in the solution to deflect a meter. Actually the latter principle is the one employed, but both the electrode used and the indicating meter are very special types.

"Oxidizing of ordinary metallic electrodes immersed directly in the solution prohibits their use; so a special 'glass electrode' is employed. Picture an electrode surrounded by a low-resistance, non-oxidizing solution in a test tube that's immersed in a solution being tested. The test tube wall keeps the solution being tested from oxidizing the electrode, but a voltage appears across this glass membrane which is proportional to the difference in hydrogen ion concentration of the solution on either side. As you can guess, this glass electrode is an extremely high resistance device, and special means are necessary to measure the voltage developed. In practice, a not-too-simple feedback amplifier translates this voltage into meter-deflecting current."

"Say no more; we'll not try to build a pH meter. Got any other ideas?"

"Yes. We know that the presence of acid greatly influences the conductivity of a solution. What say we build a simple bridge circuit in which two legs are fixed resistors, a third leg is the resistance appearing between two electrodes immersed in the river, and the fourth leg is a variable bridge-balancing resistor in series with a special temperature-sensitive resistor also in the water? We can drive the bridge with a few volts of a.c. produced by a simple transistorized chopper."

"Why the temperature-sensitive resistor and why the a.c.?" Carl wanted to know.

"D.c. would quickly polarize our electrodes and render them useless," Jerry replied. "Also, conductivity changes considerably with temperature, and we want our device to respond only to chemical change; so we must compensate the bridge for the effect of temperature change in the river water. A little battery-powered transistorized amplifier will

magnify any a.c. voltage resulting from bridge unbalance.

"This amplified output can be rectified with a diode," Jerry went on, "and used to drive a meter and a sensitive relay connected in series. An increase or decrease in the conductivity of the water flowing past the electrodes will unbalance the bridge and cause the relay contacts to close and the meter to read upscale. Closing of the contacts can sound an alarm."

"Sounds good; let's try it," Carl said, rubbing his hands impatiently.

LIKE most electronic devices, the "river sniffer," as the boys dubbed their brain child, was not nearly so easy to put into practice as it sounded in theory. They spent three full days building a really stable transistorized amplifier, finding the proper thermistor to keep the bridge balanced during a 20° temperature change in their jug of river water, and adjusting the sensitivity of the relay so that it remained open with the electrodes in a weak salt solution but closed when the solution was weakened with more water or strengthened with a little more salt. Finally, though, they were partially satisfied with the operation of their invention—a good technician is rarely completely satisfied—and they called Mr. Herber.

He drove them to a farmhouse where he kept his boat, about a quarter of a mile upstream from where they had met him. The river sniffer, housed in a weatherproof box, was installed on the river bank; and the sensing electrodes were placed well out in the current. Jerry carefully balanced the bridge with the aid of the indicating meter.

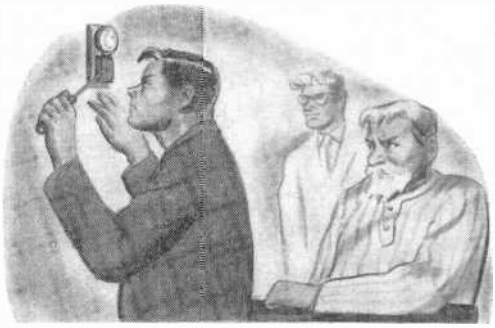
A bell was installed in the farmer's house and connected with a bell transformer and the contacts of the sniffer's relay so that the closing of the contacts would ring the bell. Then, after extracting a promise from the farmer to call Mr. Herber immediately if the bell rang, they left the robot to its sentry duty.

It was shortly after midnight that same night when Jerry's telephone rang.

"Hi," said the voice of Mr. Herber, "the farmer says that gadget of yours is ringing the bell off his wall. Want to go along and see what's up?"

"Sure," Jerry answered. "I'll get Carl, and we'll be out front waiting for you."

It did not take long to reach the farm. The farmer, clad in his nightshirt, was sitting in his kitchen malevolently eying the clanging bell on the wall. Jerry disconnected it; the farmer went back to



bed; and the boys and the game warden walked down to the river sniffer.

"Wow!" Jerry exclaimed as he lifted the lid and glanced at the meter reading with the aid of his flashlight. "Something is really boosting the conductance. What say we take the sniffer with us in your boat and see if we can't run down the source of the pollution?"

IN A FEW MINUTES they were heading upstream. Jerry was in the bow with his sniffer; Carl was in the middle; and Bill Herber operated the outboard motor at the stern. As the boat moved to the middle of the river, the meter reading declined; but swinging back toward the bank pushed it higher than ever. It continued climbing slowly until they were about a quarter of a mile upstream; then suddenly it dropped to the bridge-null value.

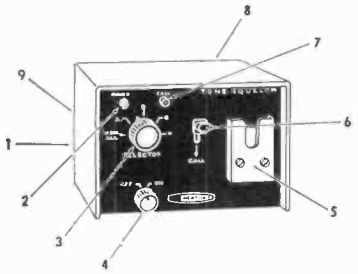
"Back up," Jerry said; "we've run out of it."

Mr. Herber reversed the boat's direction, and the meter reading shot upward. The game warden then maneuvered the boat under Jerry's direction until it became apparent the polluting substance was coming from beneath some low-hanging bushes growing on the bank. Suddenly he revved up the motor and headed straight for these bushes. As the boys ducked, branches scraped along the metal hull and the boat emerged in a shallow creek whose mouth had been concealed by a thin screen of willows.

"Better watch your propeller," Jerry warned as he peered over the side with

First new concept in citizen's band equipment in two years! . . . Heathkit 4-Position Selective-Call kit

an exclusive with Heath, this inexpensive unit converts your CB station from "party line" confusion to "private line" calling convenience



FEATURES

(1) squelch time-delay control, **(2)** power indicator, **(3)** tone selector switch (4 tones plus "monitor all" position), **(4)** tone squelch "defeat" switch for normal operation **(5)** "lift-to-operate" microphone bracket, **(6)** "call" lever **(7)** "call" indicator, **(8)** external alarm contacts to signal received call, **(9)** input and output level controls.

Here's welcome news for the serious user of Citizen's Band two-way radio. Heath's new Selective-Call Kit with tone squelch makes it possible for you to enjoy the calm of a CB station that is completely silent, yet ever alert for a personal call . . . makes it possible for you to call your choice of four specific units in your system at the touch of a button.

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To call another unit, just select the correct one of four tone frequencies, press the lever, and the called station will be waiting for you. Nothing could be simpler or more convenient. A "defeat" switch allows normal transceiver operation at any time. Equip all your CB units now with this economical new advance in communication ease . . . instructions included for installation with most popular CB transceivers using PTT.

Kit GD-162A (AC), no money down, $5 mo. **$33.95**; **Kit GD-162D (DC) $37.95**

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GW-12 Single channel all crystal controlled transceiver from $39.95

GW-31 Low Cost "Walkie-Talkie" from $24.95

GW-21 Superhet. "Walkie-Talkie" from $44.95

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Benton Harbor 10, Michigan

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his flashlight; "the water's not more than a foot deep."

"No sweat," Mr. Herber replied. "This motor doesn't have a propeller. It operates on a jet principle and will run in four inches of water."

At this moment Jerry spied a trickle of water dribbling from a large tile set in the bank of the creek, and a little checking with the river sniffer confirmed that the water pollution was coming from this tile.

Bill Herber stepped out of the boat and motioned for the boys to follow him toward a large concrete building a short distance away. A light was shining from the windows and through the open door, and inside they found a young man busily pouring some liquids from carboys into a large vat.

When Mr. Herber explained the reason for their visit, the young man shook his head ruefully. "I'm afraid I'm the one you're looking for," he admitted. "The first of the year I started a little plating business here. I use sulphuric acid to clean the parts before putting them in the plating bath. About once a week I flush the dirty and weakened acid down that sewer that leads into the crick and mix up a new batch, as I'm doing now. I never thought about killing fish or causing any other trouble, and I can assure you it won't happen again."

"I'm sure it won't," Mr. Herber said kindly, "but I'll have to report it, and there's a fine for river pollution. I hope they go easy on you. Come on, boys; let's get back to town."

AS the game warden drove Carl and Jerry home, he declared, "I sure do appreciate what you fellows did for me. I don't know how to thank you. I wish I had brains enough to build something like that river sniffer of yours."

"We lucked out," Jerry said modestly. "Had it been something other than a strong acid that was killing the fish, the sniffer might not have worked so well. And as for paying us, how about showing us a spot where we really can catch some fish?"

"That I can do. Be ready with your rods and a can of stinkworms about four o'clock tomorrow afternoon, and I'll show you the best channel-cat fishing east of the Mississippi!" -30-

New Products

TRANSISTORIZED SIGNAL GENERATOR

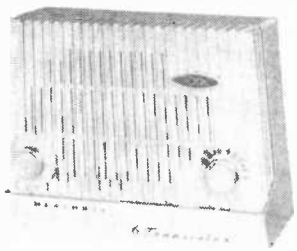
The Model 36-564 lightweight signal generator produced by GC Electronics facilitates the repair of radio receivers and audio equipment. Designed for trouble-shooting by the signal-injection method, the 16-ounce transistorized unit feeds an approximately 400-cycle tone into r.f., i.f., or audio stages. An output volume control is provided, as well as two 18" test leads. The "ground" test lead is terminated in an insulated alligator clip, the "hot" lead in a thin test probe for maneuvering freely in crowded circuitry. Power for the two transistors (a 2N363 and a 2N483) is supplied by an internal, 6-volt battery. Price, $9.95. (*GC Electronics, Inc.*, 400 S. Wyman St., Rockford, Ill.)

CONTACT CLEANING KIT

"Contacare II," developed by Standard Kollsman, is a kit for cleaning and protecting the contacts of TV tuners. Included in it is a bottle of non-flammable contact cleaning solution, a lint-free cloth to apply the solution, and a tube of non-evaporating lubricant. The lubricant is used to protect the contacts as well as to lubricate the mechanical parts of the tuner. Also supplied in the compactly boxed kit is an instruction sheet outlining the recommended step-by-step procedure for tuner contact servicing. Price, $1.25. (*Standard Kollsman Industries, Inc.*, 2085 N. Hawthorne Ave., Melrose Park, Ill.)

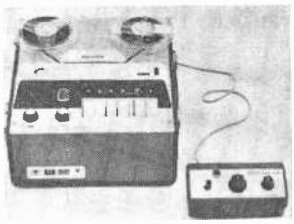
"CORDLESS" AM RADIO KIT

The new Heathkit six-transistor "cordless" AM table radio is intended for either indoor or outdoor use. Known as Model GR-131, its leakproof "cathodic envelope" battery pack provides 500 to 1000 hours of operation, and the push-pull output stage and 4" x 6" PM speaker make for "big set" tone quality. Other features are a built-in ferrite rod antenna and a special "overload diode" for preventing distortion of signals from strong local stations. The set covers the standard broadcast band (535-1620 kc.) and is housed in an ivory and pastel-green plastic cabinet. Price, $19.95 without battery; the battery pack (Model GRA-131-1) sells for $1.10 extra. (*Heath Co.*, Benton Harbor, Mich.)



SOUND FOR HOME MOVIES

Any silent home-movie projector becomes a sound projector with the help of an "Audio Sync" unit made by Concord Electronics. Narration, music, and sound effects can be added to existing film, or sound can be recorded while shooting new film with any movie camera. Designed for use with the Concord Model 220 tape recorder, the device is simpler and less expensive than other methods of sound synchronization. The price of the "Audio Sync" is under $30.00, while the companion tape recorder costs less than $160.00. Write to the manufacturer for a free booklet explaining the system. (*Concord Electronics Corp.*, 809 Cahuenga Boulevard, Los Angeles 38, Calif.)



CB NOISE SUPPRESSION KITS

Ignition and generator noise interfering with reception on mobile Citizens Band equipment can be suppressed with one of two new kits developed by Raytheon. And, by lowering the threshold of background noise, each will increase the effective range of the equipment. For ordinary interference problems, a "standard" kit provides generator and ignition-coil capacitors, distributor and spark-plug suppressors, and the neces-

Products

(*Continued from page* 91)

sary mounting hardware. The "de luxe" kit, providing a greater degree of noise reduction, includes everything in the standard kit plus two additional capacitors, an *RC*

network, and shielded generator wires. (See photo.) The standard kit retails for $10.95, the de luxe kit for $24.95. (Distributor Products Division, *Raytheon Company,* 411 Providence Turnpike, Westwood, Mass.)

SHORT-WAVE RADIO KIT

Youngsters learn the principles of transistor electronics while they assemble the G.E. Model EF-150 short-wave radio kit. Five transistors and three pretuned i.f. transformers are used in the 6-18 mc., AM or CW set, and the chassis is of the printed-board type. Sensitivity is 50 microvolts on voice, 5 microvolts on CW; a 12-to-1 ratio vernier tuning dial provides extra station selectivity. The kit comes complete with 35′ of antenna, soldering iron, solder (a special low-melting point type for extra safety), short-wave log, broadcast-band spectrum chart, and timetable of international broadcasts. Price, $29.95. (*General Electric,* 4505 E. Genesee St., De Witt, N.Y.)

CIRCUIT BREADBOARDING SYSTEM

An electronic-circuit breadboarding system, known as "Pin Up," is available from Photographic Instruments. The system utilizes removable pins which are inserted in elastic grommets to make common contact with up to eight leads. A 6¾″ x 13½″ x 2″ 16-gauge steel chassis, incorporating over 1000 perforations, provides flexibility in the locations of terminals and components. Heavy components can be readily accommodated, and both top and underside wiring can be employed. The system's parts are available separately, but a kit (No. CX-500) for breadboarding the average 6-tube circuit sells for $16.50. (*Photographic Instruments Co., Inc.,* 1163 West Walnut St., Des Plaines, Ill.)

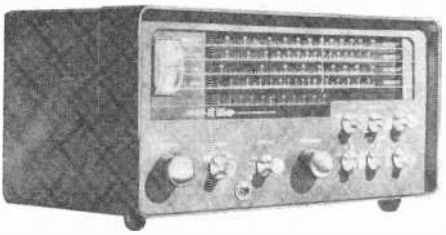
DEPTH SOUNDER KIT

One of a new line of electronic kits for marine enthusiasts, the Daystrom Model DM-234 depth sounder has a range of from 0 to 200 or more feet. Ideal for detecting submerged obstacles, schools of fish, etc., the transistorized instrument operates from its own built-in battery supply or from the boat's 12-volt system.

The transducer connects to the indicating unit via a watertight coaxial connector and may be mounted through the hull, transom mounted (with a special accessory bracket), or temporarily outboarded. Like the other kits in the line, the Model DM-234 is designed for the "first time" builder. Priced at $79.95 in kit form, it is also available factory-assembled (Model DMW-234) for $119.95. Accessory mounting bracket, $9.95. (*Daystrom Products Corp.,* P.O. Box 167, St. Joseph, Mich.)

S.W. RECEIVER FOR HI-FI FANS

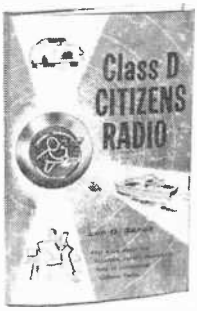
Said to be the first short-wave receiver designed for use with a hi-fi system, the National NC-105 is equipped with a tuner output jack. The set covers 550 kc. to 30 mc. in four bands and comes with a Q-multiplier, noise limiter, and BFO. Also featured are a bandspread scale, illuminated S-meter, earphone jack, and separate r.f. and audio gain controls. When not being



played through a hi-fi system, the NC-105 can be used with its own built-in speaker. Price: $119.95 in metal case (illustrated); $139.95 in walnut case. (*National Radio Co., Inc.,* Dept. P, Melrose, Mass.) -30-

The most informative books for the experimenter and electronic hobbyist

VACUUM-TUBE CIRCUITS FOR THE ELECTRONIC EXPERIMENTER by Julian M. Sienkiewicz. At last in one book—all the basic diagrams, schematics, and other vital information on vacuum-tubes and their circuits. 192 pgs. 100 illus. **$4.95**



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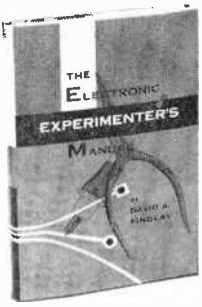

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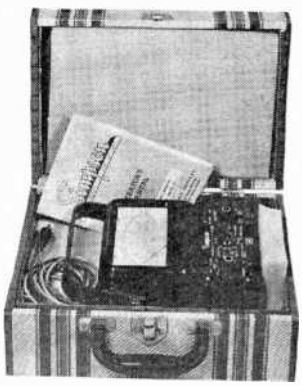
Tips and Techniques

CARRYING CASE FOR TEST INSTRUMENTS

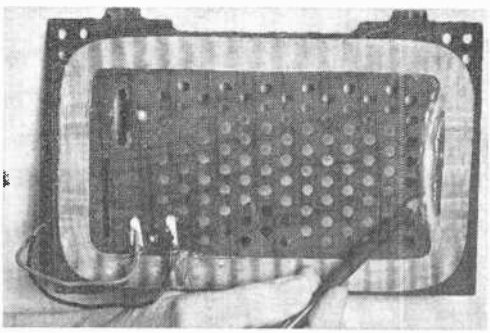
An excellent test instrument carrier can be improvised from an inexpensive cardboard suitcase. These suitcases are available at most "5-and-10's" in a variety of sizes and need only be lined with appropriate padding. Foam rubber or plastic makes an ideal material for this purpose; just cut it to size with a scissors and glue it to the top, bottom, and sides of the cardboard suitcase.



—H. Leeper

EASY ADJUSTMENT FOR REPLACEMENT LOOPS

Replacement loop antennas are usually supplied with extra turns so that they can be "trimmed down" to the proper inductance after installation. In cases where the inductance is just a bit too high, it's usually easier to spread the turns than to trim the

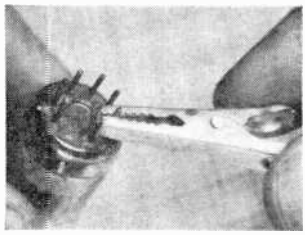


wire. Just melt the wax at one point on the loop and move the turns apart until the stations appear at the proper dial settings.

—Art Trauffer

SMALL ALLIGATOR CLIP CLEANS CORRODED TUBE PINS

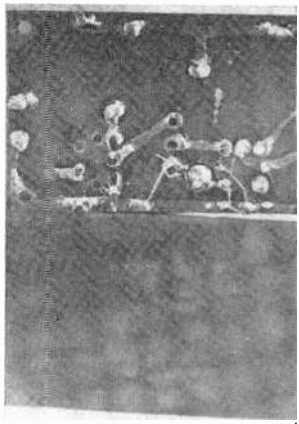
Next time you're faced with the problem of cleaning corroded tube pins, try rubbing them between the jaws of a small alligator clip. The narrow "nose" of the clip fits easily into tight corners, and the sharp, spring-loaded jaws have an excellent abrasive action. You'll find this a much faster and easier method than using sandpaper or a pocket knife.



—John A. Comstock

MINIATURE CHASSIS FROM DEFECTIVE PRINTED BOARD

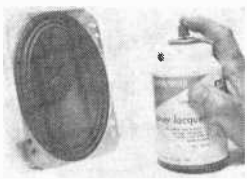
A printed-circuit board that has been discarded because of an open circuit or some other defect has by no means reached the end of its usefulness. With the printed wiring and solder removed (see "before and after" photo), it makes a fine chassis for a piece of miniaturized equipment. You can remove the wiring with printed-circuit etching solution and the solder can be melted off. The "stripped" board should then be cleaned up with a light sanding.



—H. L. Davidson

SPRAYING CONE MAKES SPEAKER MORE "BASSY"

Apply a few light coats of spray varnish or lacquer to the cone of a small speaker and a more "bassy" sound will be produced. The spray treatment lowers the cone's resonant frequency and at the same time cuts down on its high-frequency response. A greater ratio of bass to treble output is thus produced. Spraying also protects the cone from dampness, lengthening its life.



—Robert Hertzberg

ELECTRONICS DATEBOOK

AUG. 13-16
Pacific Energy Conversion Conference
Fairmont Hotel,
San Francisco, Calif.

AUG. 14-16
International Conference on Precision Electromagnetic Measurements
NBS Boulder Labs, Boulder, Colo.

AUG. 21-24
Western Electronics Show & Convention (WESCON)
Statler Hilton Hotel & Memorial Sports Arena, Los Angeles, Calif.

AUG. 31-SEPT. 9
World's Fair of Music and Sound
McCormick Place, Chicago, Ill.

SEPT. 1-3
National ARRL Convention
Memorial Coliseum,
Portland, Oregon

SEPT. 19-20
Industrial Electronics Symposium
Hotel Sheraton, Chicago, Ill.

OCT. 2-4
National Symposium on Space Electronics & Telemetry
Fontainbleu Hotel,
Miami Beach, Fla.

OCT. 7-12
American Institute of Electrical Engineers Fall General Meeting
Pick-Congress Hotel, Chicago, Ill.

OCT. 8-10
National Electronics Conference (NEC)
McCormick Place, Chicago, Ill.

OCT. 15-19
Audio Engineering Society Fall Convention & Exhibit
Barbizon-Plaza Hotel,
New York, N. Y.

NOV. 28-DEC. 2
International Communications Fair
New York Coliseum, New York, N. Y.

One for the Road

(*Continued from page 47*)

your car should be sufficient. The same antenna will do for weaker signals if you hold the receiver out of a window, but for best results you should mount a good VHF antenna on the outside of your car.

Very little "trimming" or adjusting will be required, although in some cases it may be necessary to vary the location of the point where antenna coupling capacitor *C1* is tapped onto the tuning coil in order to get the detector to oscillate. It's a good idea to make this connection at the grid end of the coil as a start. Then, if the detector refuses to oscillate even with the regeneration control at maximum, move the tap one turn closer to the center of the coil.

The ideal method of checking the frequency range covered by the receiver is to feed in signals of known frequencies from a signal generator. Lacking a signal generator, the range can be checked with an absorption-type wavemeter or a grid dip meter, since the detector is of the oscillating type. And, even if you don't have either of these instruments, it's always possible just to tune in "known" stations and use the dial settings as marker points. Some "squeezing" or "pulling" of the coil may be required in order to get the set to tune the intended range.

If speaker operation is desired, it should be an easy trick to feed the output of the circuit in Fig. 1 into the audio portion of your car radio, as mentioned earlier. Just be certain that you have a coupling capacitor at the input to the amplifier in order to keep the small amount of d.c. at the output jack from being fed into the audio amplifier.

Since a superregenerative detector also produces frequencies just above the audible range, an amplifier capable of passing these frequencies—a hi-fi unit, for example—may be inclined to "howl" when connected to the receiver. This noise can usually be stopped by placing a 0.01-μf. capacitor across the output of the circuit in Fig. 1.

Ready to Go. However you use this little receiver, you'll find that it boasts a sensitivity equal to that of units costing many times as much. On the other hand, the output of a single tube with less than a milliampere of plate current can't give more than medium headset volume when used by itself, so don't expect the impossible. As we said before, this *is* an auxiliary receiver—just "One For The Road." -30-

Transformer for D.C.

(*Continued from page 69*)

is approximately 80 volts with no load, the inverter is working properly.

Ohm's law can be used to relate power output, load resistance, and output voltage: $P=(E_{out})^2/R$. Thus, if we have 130 volts out and a resistive load of 3000 ohms, the power output would be 5.63 watts. The maximum allowable load in watts is numerically equal to 1.4 E_{in} —2.1, and the load resistance drawing maximum allowable power will be approximately equal to 800 $\times$ $(E_{in})^2/P$ — 1600. For example, with 6 volts input, the maximum load is 6.3 watts, as provided by a resistor of approximately 3000 ohms. The input voltage may range from 3 to 8 volts.

The approximate output voltage for any input between 3 and 8 volts and any load resistance equal to or larger than that drawing maximum allowable power can be calculated using the simple formula and equivalent circuit shown in Fig. 5. With a 6-volt input and a 5000-ohm

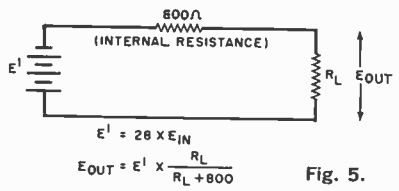


Fig. 5.

load, for example, the output will be 28 x 6 x 5000/5800, or about 145 volts, and the power output will be $(E_{out})^2/R$, or approximately 4.2 watts.

A word of warning: this inverter can provide a nasty shock if you're not careful, so treat the output terminals with respect! -30-

The Fish Finder

(*Continued from page* 60)

will remain. And, when adding hot or cold water to make adjustments, always mix well so that the temperature will be uniform throughout the liquid.

Now set potentiometer *R5* at mid-range and place *RT1* in the water. Wait several seconds for the temperatures of the Thermistor and surrounding water to equalize, and depress *S2*. Then adjust potentiometer *R2* so *M1* reads "Zero."

Prepare another jar of water as above, but this time set the temperature at 90°F (or at the upper limit of the temperature range you desire). Place *RT1* in the water and wait several seconds. Then depress *S2* and adjust *R5* for a reading of exactly full scale on *M1*.

If you have used both the specified meter and the temperature range employed by the author, this just about completes the calibration procedure.

It is not really necessary to make up a new face for *M1* as the author did; the meter, as supplied, has exactly 50 divisions, so each division represents one degree. Since the resistance change of *RT1* is not exactly linear with respect to temperature, however, there will be a slight error around the mid scale of the meter (the 40° and 90° points, of course, remain accurate). For most purposes, this error is small enough to be ignored.

Should you use a different model meter (any 0-1 ma. unit will work) or temperature range, though, you might find it impossible to use the meter face supplied. In this case, after setting *R2* and *R5* as above, you must gradually vary the temperature of the water in your calibrating bath, marking each degree on the meter as indicated on your thermometer.

With the temperature adjustments taken care of, only one more step remains before the Fish Finder is ready for service. Just press *S1* and *S2* simultaneously (the temperature of *RT1* makes no difference here) and note the meter

reading. This is the battery voltage reference point (see below) and should be marked by a small dot on the meter face.

Using the Fish Finder. All you have to do is lower the Thermistor to the desired depth, wait a bit, and press *S2* to take a reading. Continuous readings may be taken by holding *S2* in the depressed position and slowly lowering *RT1* from the surface. Be sure you allow enough time for the temperature change to register at each level before you move on.

From time to time, depress *S1* and *S2* simultaneously and check to see that *M1*'s reading corresponds to the battery voltage reference point. If it does not, adjust *R5* until it does. When *R5* will no longer perform this adjustment, it's time to change the battery. —30—

The Whistle Switch

(*Continued from page* 66)

Now run the mike cord and a heavy-duty line cord into the main box and complete the wiring. Trim each lead from the terminal strip assembly, as you come to it, to an appropriate length. Use #16 hookup wire for the leads running from *S1* to *J1* and the contacts of *K2*. Elsewhere, #22 wire may be used.

Operation. Plug the apparatus to be controlled into *J1*, plug the Whistle Switch into the line, and close *S1*. Set the microphone well away from the main unit. The sensitivity control (*R1*) should be adjusted so that the relays just respond to your whistle under actual operating conditions.

Because of manufacturing variations in the transistors, the sensitivity of your unit may vary from that of the author's model. If the sensitivity is too high (relays respond to extraneous noise regardless of the setting of *R1*), increase resistor *R3* to 1.5 megohms. Should the sensitivity be too low (relays don't respond at all), try reducing *R3* to 750,000 ohms.

The power-handling capacity of the Whistle Switch depends primarily on the rating of relay *K2*'s contacts. With the relay specified here, loads up to about 600 watts can be safely controlled. —30—

First Aid for Printed Circuits

(*Continued from page* 56)

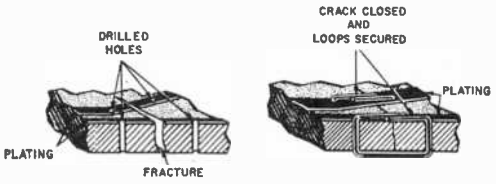
in a "down" condition until a replacement board can be obtained.

If you do decide to repair a cracked board, simply drill two small holes (1/16" or less in diameter) about ¼" on either side of the crack. These holes will allow the insertion of a loop of wire to hold the cracked board together; naturally, the loop should be located where it will not interfere with the wiring of any of the components.

The cracked board should then be drawn tightly together and the loop secured. In some cases, you may want to make more than one loop, depending on the length of the crack as well as the precise amount of open board area you happen to have at your disposal.

After the loops have been secured, use the point of a sharp knife to form a slight channel along the course of the crack, then fill this channel with household or epoxy cement. When the cement has set, the board is again ready for use.

Summing Up. Although this discussion of printed-circuit repair is by no means exhaustive, it should help you understand some of the principles involved. For just as printed boards represent a distinctive type of wiring, so, too, they require a distinctive type of repair with a specialized approach.



With one or two loops of fine wire and some cement, it's easy to repair cracked printed-circuit boards.

Actually, an extensive survey has indicated that printed-circuit boards require far less servicing than circuits with conventional wiring. But when servicing is needed, the techniques outlined above should prove helpful. -30-

Radiation Fallout Monitor

(*Continued from page* 41)

Operation. First of all, remember that this is not a precision instrument. Nor will it respond to extremely high levels of radiation (about 60 counts per second, as mentioned earlier, is the maximum). For this reason, it's not suitable for use in locating areas of heavy contamination during emergencies. What it will do is provide an approximate indication of the normal level of background radiation in your area, giving positive evidence when the count varies excessively.

To operate the device, just plug it into the line. (No on-off switch is provided because the current drain is so low that the unit can be left running continually.) After the thyratron heater has warmed up, the instrument will begin to respond to background radiation. This activity will be sporadic—there may be no pulses for several seconds, then several at once.

To get an idea of the counts per minute at any given time, always make your observations over a period of several minutes and take an average. The author has measured rates ranging from a low of 30 counts per minute to a high (during a period of fallout from the Russian bomb tests) of over 100. In the P.E. editorial offices, as this article is being prepared for publication, the instrument registers about 15 counts per minute.

Small variations in the rate are not significant (they may be due, in part, to variations in line voltage). But if the radiation level begins to drive *V2* at a frequency close to its maximum ability to respond, chances are that something unusual has occurred.

If you find your instrument counting at a very high frequency, don't be immediately concerned about radiation injury (even luminous watch dials, when placed close to *V1*, will produce quite high rates). You'd better check your radio, though, to see if there's anything going on. We hope that a radiation emergency situation will never arise, but if it does, remember that official information and instructions will be broadcast (via Conelrad) over 640 or 1240 kc. on your AM dial. -30-

On the Citizens Band

(*Continued from page 78*)

are available, in addition to full tunable coverage of all 23 channels.

Julian M. Sienkiewicz, 2W5115 (Managing Editor of POP'tronics), tied in his TR-27 with the "Gabble Killer" described in the April 1962 issue. The

base station (see photo) is the pride of his XYL, who reports no QRM to interfere with the hi-fi set.

Call-Sign Auto Licenses. Back in the April issue, we reported that there was an outside chance of CB'ers being able to obtain call-sign auto license plates, and that the state of Wisconsin had already approved several applications for these plates. This was a false rumor. The Wisconsin Motor Vehicle Department has since informed us that Wisconsin does *not* issue license plates with Citizens Band call-signs. The confusion was probably due to the fact that the state *does* issue plates incorporating amateur call letters, provided that the hams have the necessary receiving and transmitting equipment permanently installed in their cars.

Club Notes. The 5-11 Radio Club of Pittsburgh (868 Glass Run Rd., Pittsburgh 36, Pa.) has celebrated its third anniversary. This organization gained national recognition and local promotion through a series of radio programs on station WYRE and a feature article in the Sunday *Pittsburgh Press*. . . . Jack Leach, Publicity Chairman of the 27 Meggers C.B. Club (1814 Beaconwood, South Euclid 21, Ohio) was the winner of the Browning Golden Base Station which was on display at the NCRL convention at Chicago recently. . . . Four members of the Qui-Co Citizens Radio League (1748 Centre Ave., Reading, Pa.) participated in a mock alert with the 9209th Air Force Reserve Recovery Squadron, providing back-up communications. . . . The CB Socialites, in Massachusetts, is a unique organization in that its primary purpose is strictly social. Perhaps this is the secret of its success. It does provide emergency mobile communications, and has been called upon in the past to do just that, but the club is best known for its outings, trips, and picnics. Contact Frank W. Marshall, 7 Newton Ave., Haverhill, Mass., if you're interested in joining. -30-

THE CLUB PAPER

Does your CB club want to start a newspaper? If you're not sure how to go about it, you'll be interested in a 56-page booklet entitled "The Club Paper" which tells the would-be editor exactly what to do. Written by Ralph Anderson, W3NL, who has been editor of a club newspaper himself for many years, it discusses duplicating methods, offset, preparation of copy, assembly, addressing and mailing methods and procedures, inexpensive do-it-yourself printing and photographic equipment. If you'd like a copy, send 50 cents (in coin or stamps—*no checks*) to cover handling costs to Ralph V. Anderson, W3NL, 2509 32nd St., S.E., Washington 20, D.C. The supply of copies available is limited, so don't delay.

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Coupling Quiz Answers

(*Quiz on page* 80)

1 — **F** Direct coupling feeds the output from the plate of one stage directly to the grid of another. It is the only type of coupling that has a frequency response without lower limit.

2 — **C** R-C coupling (for resistor-capacitor coupling) requires a coupling capacitor and a grid resistor in addition to the plate load resistor. It is the most popular type for voltage amplifiers, since the cost, size, and weight of the necessary components are very low, and frequency response is broad.

3 — **G** A tickler winding on a coil makes use of inductive coupling to permit signals from the plate circuit to be fed back to the grid circuit.

4 — **E** Impedance coupling provides a method of obtaining a high value of plate load impedance with a corresponding low d.c. voltage drop. The inductor has little d.c. resistance but a high reactance at the frequencies tc be handled.

5 — **H** Cathode-coupling results in a circuit which is essentially a cathode follower driving a grounded-grid amplifier. It provides a high degree of isolation between the input and output circuits.

6 — **A** Link coupling is a variation of inductive coupling, since it effectively produces inductive coupling between two coils having no mutual inductance. Its chief use is in r.f. circuits.

7 — **D** A gimmick consists of two insulated conductors twisted together to provide a capacitive coupling sufficient to pass a small amount of signal.

8 — **B** Transformer coupling provides a low d.c. voltage drop as well as proper impedance matching. A high-quality unit is required for good frequency response.

Across the Ham Bands

(*Continued from page* 76)

News and Views

Bob Read, WNØAGF, 103 Arcadian Ct., McPherson, Kansas, excites a 40-meter dipole antenna with a home-brew transmitter sporting a pair of 807's in the output stage. With a war-surplus BC-312 to do the receiving, Bob's 40-meter total is 41 states worked. He also works 2 meters with a Gonset IV Communicator, plus a surplus T-23 transmitter and a 2-meter converter in front of the BC-312. States are far apart in the west, so he has only two states worked on that band. . . . **Bob Plechaty, K9CGD,** 2427 Westover Ave., North Riverside, Ill., works both phone and CW on 2 meters. A home-built transmitter running 12 watts input to the 6360 final tube (featuring "controlled-carrier" modulation of his own design) drives a Hy-Gain 210, 10-element beam in the attic. A Hallicrafters SX-101A, plus a home-built converter ahead of it, takes care of bringing the signals in. "Not many states worked, but a lot of swell contacts" covers Bob's record. . . . **James John W. Laing, KN7PRS,** 2540 E. Heatherbrae, Phoenix, Ariz., uses a good portion of the wide-open spaces in the west for his antenna farm; it contains a 3-element, wide-space, 15-meter beam antenna, dipoles for 80 and 40 meters, and a 20-element beam for 2 meters, all 25′ high. A Harvey-Wells T-90 transmitter handles the 15-, 40-, and 80-meter bands, while a Johnson 6N2 and a home-built transceiver take care of 2 meters. A Hammarlund HQ-170 receiver, plus a "W7RVX" home-brew, 2-meter converter, does the receiving. Forty states and 11 countries make up John's brag list, but he's still waiting for QSL cards from some of them. His favorite bands are 15 and 2 meters. . . . **Sid Bondurant, WN5AIX,** Box 215, Forest, Miss., envies those Novices with walls full of QSL cards. His first seven months as a Novice were spent getting his equipment and then replacing burned-out components in it. But he worked Minnesota on his first CQ—not bad for 80 meters and an antenna 12′ high. Watch him go now. Sid's transmitter is a Heathkit DX-35, and his receiver is a Hallicrafters S-20R.

Bob Stewart, WV2WIU, 1459 Lombardy Blvd., Bayshore, L. I., N. Y., says he works nights and hams all day—sometimes to the disgust of his wife. In five months on the air, this system has put 36 states and 11 countries into Bob's logbook. A Globe Chief 90A transmitter feeds his 40-meter dipole antenna on both 40 and 15 meters. Bob must like receivers; he has three of them—a Hammarlund HQ-140X, a Hallicrafters S-20R, and an RME 69. . . . **Rog, KN1SPM,** 62 Mark St., Springfield, Vermont, offers to sked any Novice who needs a Vermont contact. Better make the sked on 40 or 80 meters; his receiver doesn't work on 15 at present. Rog's "monster" is a Globe Chief 90A feeding separate dipoles 50′ high on each Novice band. The receiver is a National NC-109. Twenty-seven states and GI6YM, Northern Ireland, are what Rog talks about when asked "What have you worked?"

Walt Pinner, **WN8BHK,** Novi, Mich., uses homemade equipment except for the receiver, a Knight R-100, which he put together from a kit. Walt operates on 80 and 40 meters, has worked 36 states and Canada.

Bill Harding, WA6SMD, Box 424, Westwood, Calif., disagreed with my comments in the February column that fellows with an inexpensive receiver and an inefficient antenna often get better results on the lower frequency amateur bands than on 15 meters. Running 40 watts to his transmitter with one crystal and receiving on a "$10.00 regenerative receiver," Bill reports working 11 states east of the Mississippi on 15 in three days. He didn't mention the type of antenna he was using. . . . **Allen Jones, K9DZE,** 211 S. Roeske, Michigan City, Ind., used a home-brew 25-watter during his Novice career. Now he has both a Heathkit DX-35 and a Globe Chief 90A transmitter to go with his General license. He uses the VFO described in our December 1961 column to drive them.

Let's hear from YOU for the next *Across the Ham Bands.* Send all mail for the column to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana, 73.

Herb, W9EGQ

ATTENTION WESTERN NOVICES!

The Northwest Slow Speed Net (NSN) meets every night except Sundays on 3700 kc. at 0500 GMT (9:00 p.m. PST). At least one member tunes the entire 80-meter Novice band for calls from "rock-bound" Novices who want to report into the net. All new members receive an attractive net QSL card, and a request accompanied by a stamped return envelope will bring a sheet explaining NSN operations. Address the request to: Jim Cassidy, K7IWD, 4224 S. E. View Acres Rd., Milwaukie 22, Oregon.

Short-Wave Report

(*Continued from page* 82)

can still log many of the rare stations by careful tuning and infinite patience.

Q: Why not publish a list of "materials" that are available from the short-wave stations, such as leaflets on antenna tips, reception ideas, and the like?

A: Unfortunately, we do not have such a list at hand. If you'll work one up, we'll be glad to include it in a future column.

Q: In a recent column, you suggested that Swan Island might not be the actual location of *Radio America,* formerly known as *Radio Swan.* Exactly where is this station?

A: We have no positive proof as to whether this station is or isn't on Swan Island, since we continue to receive conflicting reports. During the past week alone, one report stated in no uncertain terms that the station was on Swan Island, while another report—from an airline pilot equipped with a direction-finder—claimed that the station was aboard ship, apparently in an eastsoutheastward direction from Miami. In his letter, the pilot said that he had flown over the ship.

If you have any questions which you think might be of general interest, send them in. We'll try to answer them in a future POP'tronics "Mailbag."

Current Station Reports

The following is a résumé of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Please send all reports to your Short-Wave Editor, P. O. Box 254, Haddonfield, N. J., in time to be in our hands by the eighth of each month. Be sure to include your WPE call letters.

Andorra—*R. des Vallees d'Andorre,* 6305 kc., is noted at times at 0104-0130 with variety music and a good signal.

Austria—The latest schedule for Vienna as

read over the air is as follows: 21,475 kc. at 0500-0700; 17,865 kc. at 0800-1100; 17,765 kc. at 1100-1300; 15,305 kc. at 0300-0500; 11,785 kc. at 0300-1200; 9770 kc. at 0600-1200 and 1800-2300; 9610 kc. at 0100-0400; 9540 kc. at 1900-2300; 7245 kc. at 0900-1500; 7200 kc. at 0100-0900; and 6155 kc. at 2330-1700 and 1800-2000. Most of the programs are made up of music and the ID is usually given in Eng., Ger., and French. Reports go to Austrian Shortwave Service, Vienna 50, Austria.

Brazil—"Don't destroy your radio set yet," said a Ger. language advertisement in a Brazilian newspaper. It suggested that the readers tune to *R. 9 de Julho*, 9620 kc., for "Melodian de Ultramar" daily at 1900-2000 and "Klassiche Meistermusik" on Sundays and holidays at 1300.

Ceylon—The Commercial Service continues to be noted at times on 15,265 kc. around 2030-2230 with Eng. news, records, and ads. Another outlet is 9560 kc., noted at 1030 with a soap commercial and "Musical Medicine" program in English. The *Voice of America* has opened up on 11,725 kc. at 0700-0800 in English.

Chile—*R. Corporacion*, Santiago, is heard on 15,150 kc. at 1830-1930 with sports, news at 1900, a play at 1910. This station was also heard at 0700 with news. All programs are in Spanish.

CE1190, *R. Cooperativa Vitalicia*, Valparaiso, 11.900 kc., was noted with Coca-Cola ads at 1855, news at 1900.

Colombia—HJGF, *R. Bucaramanga*, 4845 kc., has an Eng. program daily at 2200-2300. They verify with a pennant, letter, and some Colombian stamps.

Congo—A station reported on 10,690 kc. is *R. Bukavu*, according to *Sweden Calling DXers*. Reception time was given as 1300, with local time given as GMT plus 2½ hours.

Cuba—This appears to be the latest schedule from Havana: to North, Central, and South America in Sp. at 0600-1245 on 5990, 6017, 9765, and 15,340 kc., at 1600-0115 on 6017 and 9765 kc., at 1600-2200 on 5990 kc.,

Bill Rogers, WPE4DJQ, of Asheville, N. C., listens with a Knight Ocean Hopper and an Echophone receiver, aided by a 50′ long-wire antenna. To date he has 18 countries logged, 10 of which are verified. Bill also holds the amateur call WN4EMB.

SHORT-WAVE CONTRIBUTORS

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Joe Brown *(WPE9DTO)*, Chicago Heights, Ill.
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Marlin Field *(MF)*, Benton Harbor, Mich.
Harley Rutstein *(HR)*, Englewood, N. J.
G. Schmeisser *(GS)*, Lindenhurst, N. Y.
Sweden Calling DXers Bulletin

at 1600-1800 on 15,340 kc., at 1815-2245 on 11,760 kc., and at 2300-0115 on 6060 kc., Eng. at 2200-2330 and 0000-0100 on 5990 kc., Fr. at 2330-0000 on 5990 kc.; to Europe on 15,290 kc. at 1400-1445 in Fr. and to 1545 in English; to Mediterranean areas at 1300-1430 in Fr. and to 1545 in Sp. on 15,140 kc. (varies to 15,190 kc.) and in the 16-meter band, exact frequency not definite.

A new station with the call-sign CMKX is noted well at 1700-2300 on 5563 kc. in the midst of the aero channels.

Czechoslovakia—Prague has opened on 7438 kc. with uninterrupted Czech and classical music at 2000, then into Sp. at 2100. This is apparently a crude attempt to block *R. Libertad* on the same channel. Programs in Eng. are noted to N.A. at 2200-2300 and 0000-0100 on 5930, 7345, 9550, 9795, and 11,990 kc., and to New Zealand, Australia, Japan, and Far East areas at 1300-1355 on 11,725, 15,285, and 21,450 kc.

Egypt—Cairo is heard on 12,050 kc. at 1330-1400 in Persian beamed to the Middle East; on 11,745 kc. in Arabic at 2215-2230 (this is the Home Service); and on 17,750 kc. at 0830-0930 with Eng. news, talks, and native music.

Fiji Islands—Suva will soon be testing the second 10-kw. xmtr on 4785 kc. This is to be used for Eng. programs. The first 10-kw. unit operates in Fijian on 4755 kc. and has been heard at 0230-0300 with native language and music.

Germany (West)—Here is the schedule for *Die Deutsche Welle*, Cologne: to Eastern N.A. at 1900-2200 on 6100, 9575, and 9640 kc., and at 1715-1845 on 6100 and 9605 kc.; to Western N.A. at 2200-0100 on 6100, 9575, and 9640 kc., and at 0000-0130 on 6145 and 9735 kc.; to Central America at 2045-2345 on 6145 and 9735 kc., and at 1900-2030 on 6145 and 9605 kc. A Persian service has been started at 0500-0525 on 17,845 kc. in parallel with 15,405 and 11,795 kc.

Italy—Rome has opened on 11,905 kc., dual to 9575 kc., and has dropped 6010 kc. for the 1930-1950 and 2205-2225 broadcasts to North America.

Japan—The latest schedule from Tokyo reads: to N.A. at 1930-2030 on 17,895, 15,390, and 15,135 kc.; to N.A. and L.A. at 2200-0000 on 15,235, 11,780, 11,705, and 9505 kc.; to Hawaii at 0030-0200 on 17,725 and 15,235 kc.; to Europe at 0115-0345 on 15,135 and 17,895 kc.; to Australia and New Zealand at 0430-0530 on 15,235 and 11,875 kc.; to Philippines and Indonesia at 0730-0930 on 11,780 and 15,135 kc.; to S.E. Asia at 0800-1100 on 9675 and 11,705 kc.; to South Asia at 1000-1130 on 9525 and 11,780 kc.; to Middle East and North Africa at 1145-1345 on 7195, 9525, and 11,780 kc.; to Africa at 1500-1600 on 9525 and 11,875 kc. The General Overseas Service is broadcast at 2000-2030, 2100-2130, 2200-2230, 2300-2330, and 0000-0030 on 15,105, 15,195, and 17,755 kc.; at 0100-0130, 0200-0230, 0300-0330, 0400-0430, and 0500-0530 on 11,725, 15,195, and 11,855 kc.; and at 0600-0630, 0700-0730, 0800-0830, 0900-0930, 1000-1030, and 1100-1130 on 11,725, 11,815, and 11,855 kc.

Kuwait—The present schedule for Kuwait Broadcasting and Television Service is 2130-0200 and 0400-1600 on 4967.5 kc. (10 kw.) and 0400-1600 on 15,150 kc. (50 kw.) in Arabic only. A letter from the station mentions the near-future beginning of test xmsns on 6055, 9520, and 15,150 kc. with announcements in "other than Arabic languages" — which should make ID easier.

Leeward Islands—A French-speaking station being reported on 830 kc. in the broadcast band during evening hours has been positively identified as *Radio Caribe Nacional*, St. Lucia. Their schedule reads 0600-0800 and 1000-2115, with Eng. given (and being reported) at 1500-1700. Verification is by letter and colorful travel folder. Do not confuse this station with *R. Caribe*, Santo Domingo, D. R., on 860 kc.

Liberia—ELWA, Monrovia, now operates on 9655 kc., dual to 11,825 kc., on Tuesdays at 2145 to North America. The former is a new frequency.

Luxembourg—*The Station of the Stars* is operated by Compagnie Luxembourgeoise de Telediffusion on 6090 kc. with 5 kw. at 1300-2100. Programs are almost entirely in Eng. and feature American records and many commercials. Reports go to *R. Luxembourg*, 38 Hertford St., London, W. 1, England.

Pakistan—Karachi has Eng. dictation news at 0835-0850 to the Middle East on 11,672 kc. A dual channel, though not heard, may be 21,590 kc.

Pitcairn Island—VR6AC has verified, giving the schedule as "around 2130" (EST) on 14,000 kc. Broadcasts are mostly religious in nature and intended for nearby islands.

Rumania—Bucharest is scheduled to N.A. at 2200-2230 and 2330-0000 on 15,380, 11,885, 11,810, 9570, 9510, 7195, and 6190 kc., and at 2030-2130 on all of these channels except 9570 kc. Other broadcasts areas include Europe at 1430-1500, 1600-1630, and 1730-1800 on 9510 and 7195 kc. (1430-1500 only on 9570, 7195, and 6190 kc.); the Near and Middle East at 1400-1430 on 9570, 7195, and 6190 kc.; Asia at 1000-1030 on 15,250 kc.; Africa at 1000-1030 on 15,380 and 11,810 kc.

SHORT-WAVE ABBREVIATIONS

Eng.—English	L.A.- Latin America
Fr.—French	N.A. North America
Ger.—German	R.—Radio
GMT—Greenwich Mean Time	s/off—Sign-off
	Sp.—Spanish
kc.—Kilocycles	xmsn—Transmission
kw.—Kilowatts	xmtr—Transmitter

Sarawak—Kuching has been noted at 0719-0815, with Eng. news at 0800, on 4950 kc. This is a poor signal and may be extremely difficult to copy.

South Africa—*Springbok Radio*. Paradys, has been heard on 3356 kc. from 2310 to 2330 s/off with recordings and commercials. The 15,275-kc. channel is tuned at 1221-1245 with news, music, science programs.

Spanish Guinea—*R. Ecuatorial*, Bata, 7847 kc., has music and announcements from 1650 with s/off at 1707. Signal is generally poor but it gains towards s/off time.

Tonga Islands—Another very elusive broadcast-band station is ZCO, 1020 kc. Their schedule is 0100-0430 and 1300-1515 Monday through Saturday. There is a mailbag on the first Thursday of every month at 0345, and reports are eagerly welcomed. The address:

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July 1962

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Mr. R. Geoff Hagget, Manager, The Tonga Broadcasting Commission, P. O. Box 36, Nuku'alofa, Tonga Islands.

Upper Volta—*R. Ouagadougou,* Haute-Volta, operates weekdays at 0100-0300, 0700-0830, and 1200-1700 (Sundays at 0300-1800) on 4815 kc. (25 kw.) and 7230 kc. (4 kw.) in Fr., Eng., and vernaculars. No mention was made of 11,630 kc., reportedly being tested.

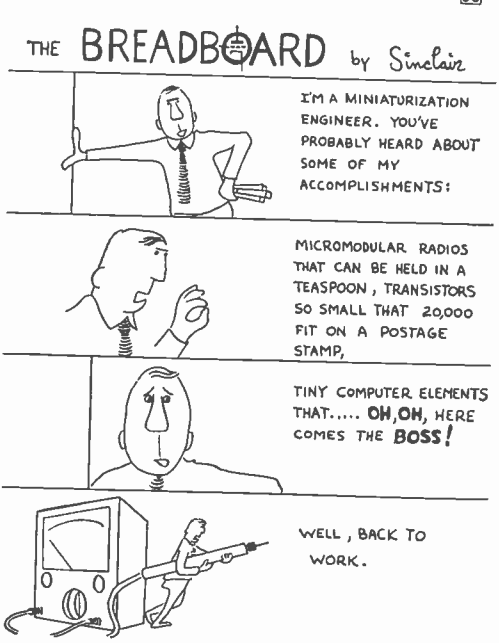
USSR—*R. Khabarovsk* was noted on 6115 kc. at 0400 with a time signal and talk in Russian. This is dual to 7210 and 9377 kc., and both of these broadcasts were also heard.

Windward Islands—Grenada is noted at 1500-2115 on 3280 and 9815 kc.; also to 1300/ close to England on 15,400 kc. The 3365-kc. outlet is not in use at present.

Clandestine — *R. Espana Independiente* (Spain-?) has been heard again on 6980 kc. (varies) from 1530 to 1830 s/off in Sp. with long talks.

R. Portugal Libero is on 11,672 kc. at 0915, interfering with *R. Pakistan.* This one reportedly moves to the 31-meter band, exact frequency not known, during late afternoons and/or evenings.

-30-



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SMALL set builder's big information catalog—25¢, refundable. Laboratories, 1131-L Valota, Redwood City, California.

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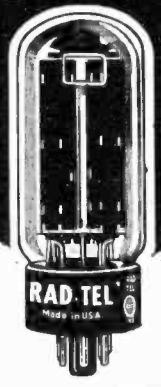

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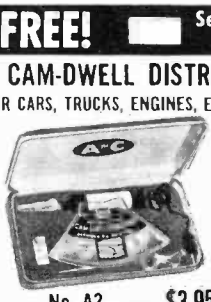

No. A2..... $3.95

Now, anyone can set distributor points. It's done electronically and automatically. No other equipment needed, no outlet. You don't have to remove the distributor. Pocket-sized, precision-engineered, high quality testing instrument for use on cars, trucks, marine engines, industrial equipment, tractors, farm machinery and road equipment. It's accurate . . . It's portable . . . It's LOW priced!

RAD-TEL TUBE CO.

TV, RADIO AND HI-FI

Dept. PE7 55 CHAMBERS STREET, NEWARK 5, NEW JERSEY

TERMS: 25% deposit must accompany all orders, balance COD. Orders under $5: add $1 handling charge plus postage. Orders over $5: plus postage. Approx. 8 tubes per 1 lb. Subject to prior sale. No COD's outside continental USA.

EACH TUBE INDIVIDUALLY & ATTRACTIVELY BOXED & BRANDED RAD-TEL

Qty.	Type	Price	Qty.	Type	Price	Qty.	Type	Price	Qty.	Type	Price
	0Z4	.79		6AU4	.82		6J6	.67		12CX6	.54
	1AX2	.62		6AU6	.52		6K6	.63		12D4*	.69
	1B3	.79		6AU7	.61		6C6	1.06		12DB5	.69
	1DN5	.55		6AU8	.87		6N7	.98		12DE8	.75
	1G3	.79		6AV6	.41		6S4	.51		12DL8	.85
	1J3	.79		6AW8	.90		6SA7GT	.76		12DQ6	1.04
	1K3	.79		6AX4	.66		6SG7GT	.41		12DS7	.79
	1R5	.62		6AX5	.74		6SH7GT	.49		12DT5	.76
	1S4	.59		6AX7	.64		6SJ7	.88		12DT7	.79
	1S5	.51		6AX8	.92		6SK7GT	.74		12DT8	.79
	1T4	.58		6BA6	.50		6SL7GT	.80		12DU7	1.01
	1U4	.57		6BA8	.88		6SN7GT	.65		12DW8	.89
	1U5	.50		6BC5	.61		6SQ7	.73		12DZ6	.56
	1X2B	.82		6BC7	.94		6T4	.99		12ED5	.69
	2AF4	.96		6BC8	.97		6T8	.85		12EG6	.54
	2BN4	.64		6BD5	1.25		6U8	.83		12EK6	.56
	2EN5	.45		6BE6	.55		6VG6T	.54		12EL6	.50
	3AL5	.42		6BF5	.90		6W4	.60		12EM6	.79
	3AU6	.51		6BF6	.44		6W6	.71		12EN6	.78
	3AV6	.41		6BG6	1.66		6X4	.39		12EZ6	.53
	3BA6	.51		6BH6	.65		6X5GT	.53		12F8	.66
	3BC5	.54		6BH8	.87		6X8	.80		12FA6	.79
	3BE6	.52		6BJ6	.62		7A8	.68		12FM6	.43
	3BN6	.76		6BJ7	.79		7AU7	.61		12FR8	.91
	3BU8	.78		6BK7	.85		7B6	.69		12FX8	.85
	3BY6	.55		6BL7	1.00		7EY8	.73		12GC6	1.06
	3BZ6	.55		6BN4	.57		7F8	.90		12J8	.84
	3CB6	.54		6BN6	.74		7N7	.90		12K5	.65
	3CS6	.52		6BQ6	1.05		7S7	1.01		12L6	.58
	3DG4	.85		6BQ7	1.00		7Y4	.69		12SA7	.92
	3DK6	.60		6BS8	.90		8AU8	.83		12SF7	.69
	3DT6	.50		6BU8	.70		8AW8	.93		12SH7	.49
	3Q4	.63		6BX7	1.02		8BQ5	.60		12SJ7	.67
	3Q5	.80		6BY5	1.15		8CG7	.62		12SK7	.74

RAD-TEL TUBE CO. NOT AFFILIATED WITH ANY OTHER MAIL ORDER TUBE COMPANY

	3S4	.61		6BY6	.54		8CM7	.68		12SL7	.80
	3V4	.58		6BYB	.66		8CN7	.97		12SN7	.67
	4BQ7	1.01		6BZ6	.55		8CS7	.74		12SQ7	.78
	4BZ7	.96		6BZ7	1.01		8CX8	.93		12U7	.62
	4BZ8	1.10		6BZ8	1.09		8EB8	.94		12V6	.53
	4CS6	.61		6C4	.43		8SN7	.66		12W6	.69
	4DT6	.55		6CB6	.55		9CL8	.79		12X4	.38
	5AM8	.79		6CD6	1.42		11CY7	.75		17AX4	.67
	5AN8	.86		6CE5	.57		12A4	.60		17BQ6	1.09
	5AQ5	.52		6CF6	.64		12AB5	.55		17DQ6	1.06
	5AS8	.86		6CG7	.61		12AC6	.49		17W6	.70
	5AT8	.80		6CG8	.77		12AD6	.57		18FW6	.49
	5AV8	1.01		6CK4	.70		12AE6	.43		18FY6	.50
	5BC8	.79		6CL8	.79		12AE7	.94		18FX6	.53
	5BE8	.83		6CM6	.64		12AF3	.73		19AU4	.83
	5BK7	.82		6CM7	.66		12AF6	.49		19BG6	1.39
	5BQ7	.97		6CM8	.90		12AJ6	.46		19C8	1.14
	5BR8	.79		6CN7	.65		12AL5	.45		19T8	.80
	5BT8	.83		6CQ8	.84		12AL8	.95		21EX6	1.49
	5CG8	.76		6CR6	.51		12AQ5	.60		25AV5	.83
	5CL8	.76		6CS6	.57		12AT6	.43		25AX4	.70
	5CM8	.90		6CS7	.69		12AT7	.76		25BK5	.91
	5CQ8	.84		6CU5	.58		12AU6	.51		25BQ6	1.11
	5CZ5	.72		6CU6	1.08		12AU7	.60		25C5	.53
	5EA8	.80		6CY5	.70		12AV6	.41		25CA5	.59
	5EU8	.80		6CY7	.71		12AV7	.75		25CD6	1.44
	5J6	.68		6DA4	.68		12AX4	.67		25CU6	1.11
	5T8	.81		6DB5	.69		12AX7	.63		25DN6	1.42
	5U4	.60		6DB6	.51		12AY7	1.44		25EH5	.55
	5U8	.81		6DE6	.58		12AZ7	.86		25L6	.57
	5V3	.90		6DG6	.59		12B4	.63		25W4	.68
	5V6	.56		6DK6	.59		12BA7	.84		32ET5	.55
	5X8	.78		6DN6	1.55		12BD6	.50		32L7	.90
	5Y3	.46		6DQ6	1.10		12BE6	.53		35B5	.60
	6A8G	1.20		6DT6	.53		12BF6	.44		35C5	.51
	6AB4	.46		6DT8	.79		12BH7	.77		35L6	.57
	6AC7	.96		6EA8	.79		12BK5	1.00		35W4	.42
	6AF3	.73		6EB5	.72		12BL6	.56		35Z5	.60
	6AF4	.97		6EB8	.94		12BQ6	1.06		36AM3	.36
	6AG5	.68		6EM5	.76		12BR7	.74		50B5	.60
	6AH4	.81		6EM7	.82		12BV7	.78		50C5	.53
	6AH6	.99		6EU8	.79		12BY7	.77		50EH5	.55
	6AK5	.95		6EW6	.57		12BZ7	.75		50L6	.61
	6AL5	.47		6EY6	.75		12C5	.56		70L7	.97
	6AM8	.78		6F5GT	.39		12CN5	.56		7025	.69
	6AQ5	.53		6FE8	.75		12CR6	.54		807	.70
	6AR5	.55		6GH8	.80		12CU5	.58		117Z3	.61
	6AS5	.60		6GK6	.79		12CU6	1.06			
	6AS6	.80		6GN8	.94						
	6AT6	.43		6H6	.58						
	6AT8	.79		6J5GT	.51						

BIG SAVINGS ON PARTS IN CATALOG

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LOWER THE COST OF FUN
WITH VERSATILE TARZIAN TAPE

Talk Long Distance for Only 10¢ per Hour

You can record a 24 minute conversation (at 3¾ i.p.s.) on a 225-foot reel of Tarzian Tape and mail it anywhere in the U.S. for 4¢ postage. No one worries about the telephone bill...and the same reel can be used again and again with no decrease in sound reproduction quality. That's a lot of friendly communication—the easy Tarzian Tape way. And you get a handy mailing carton as well!

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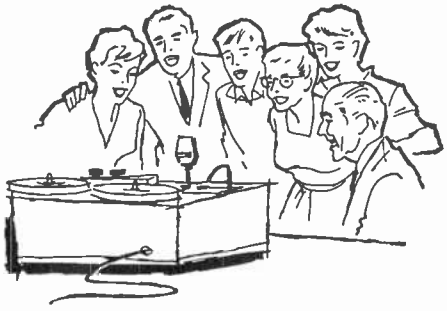
Have you an AM or FM radio, or a TV set? If so, you can tape music and variety programs being broadcast every day—or, for that matter, borrow your friend's records and put them on tape. You'll pay for your tape recorder with the money you save on records—one inexpensive 1200 foot reel of high fidelity Tarzian Tape holds a full hour of music recorded at 7½ i.p.s.



Make a Priceless Family Heirloom—*The Easy Tarzian Way*

Next time the family gets together for a special occasion... and everytime a high point comes along in the lives of the children and grandchildren...be sure to record the events on long-lasting Mylar*-base Tarzian Tape. The tape will last indefinitely—and so will your pleasure—with a priceless heritage of voices and events unique to your family. Such moments can seldom be repeated, but thanks to Tarzian Tape they can always be remembered.

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Buy, borrow, or beg a reel of Tarzian Tape —either Mylar or acetate base, on a 3, 5, or 7-inch reel, and compare its sound reproduction to that of *any other tape* on the market. Your own ears will tell you why Tarzian is the best buy for modern tape recording. While you're at it, send for our free 32-page booklet, "The Care and Feeding of Tape Recorders".

*DuPont trademark for polyester film

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MAGNETIC TAPE DIVISION • BLOOMINGTON, INDIANA

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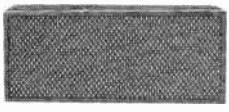
C-25. IN-CIRCUIT CAPACITOR TESTER KIT. Reveals shorted or open capacitors in the circuit, including electrolytics. Also reveals dried-out electrolytics through the Electrolytic Capacitance Dial. Kit: $19.95; Factory Wired, ready to operate: $29.95.

V-70. VACUUM TUBE VOLTMETER KIT. Uses stabilized bridge circuit to provide measurements on 7 DC and 12 AC voltage ranges, plus 7 decibel and 7 wide-spread electronic ohmmeter ranges. Kit: $31.95; Factory Wired, ready to operate: $49.95.

G-30. RF SIGNAL GENERATOR KIT. Highly accurate, stable. Also designed for use as a Marker Generator in sweep-alignment procedures. Eight frequency ranges: 160 kc to 240 mc. Kit: $32.95. Kit with Prealigned Tuner: $39.95; Factory Wired, ready to operate: $44.95.

MX-100. STEREO MULTIPLEX ADAPTER KIT. All critical circuitry factory adjusted and prealigned. Maximum stereo separation between 20-15,000 cps, with low distortion. Stereo switch permits either front-panel separation control or maximum separation adjusted at factory. Kit: $49.95; Factory Wired, ready to operate: $69.95.

ST-26. FM TUNER/AMPLIFIER KIT. Low-cost combination hi-fi FM music system. Requires only the addition of external speaker (see L-3) to complete system. Pre-Built Front End fully adjusted and prealigned at factory. Kit: $54.95; Factory Wired, ready to operate: $69.95.



L-3. SPEAKER SEMI-KIT. Ultra-compact, graciously styled system. Lifelike response from high-efficiency speakers. Walnut-finished cabinet. Size: 13¾" L x 6½" H x 7¼" D. Semi-Kit: $19.95.

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In timed, competitive tests, twin brothers — with twin backgrounds and skills — proved that Paco kits are faster, easier and more fun to build than almost-identical kits sold by other kit makers. They discovered that there's no guessing with Paco: parts are neatly packaged and precisely labeled; instruction books are complete and easy to follow. Accurate drawings to actual scale and fold-out diagrams are printed right next to step-by-step directions. ■ The twins also proved that Paco pleasure doesn't end with the wiring. The ST-25 MX FM Stereo Multiplex Tuner*, for example, looks and performs like twice the price: frequency response is 30 to 20,000 cps within 2 db; sensitivity is 1.5 μv for 20 db quieting. It features self-contained, prealigned and fully shielded front end, FM Stereo multiplex circuitry, dual limiters, AFC with panel switch for AFC defeat and "eye"-type tuning indicator. Why not put Paco to your test. Kit: **$69.95** net, (factory wired, ready to operate: $99.95). See your dealer or write today for details to Paco Electronics Co., Inc., 70-31 84th Street, Glendale 27, New York, a division of Precision Apparatus Company, Inc. Export: Morhan Corporation, 458 Broadway, New York 13, New York. In Canada: Atlas Radio Corporation, 50 Wingold Avenue, Toronto, Canada.

*AS PICTURED ABOVE

PACO KITS

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