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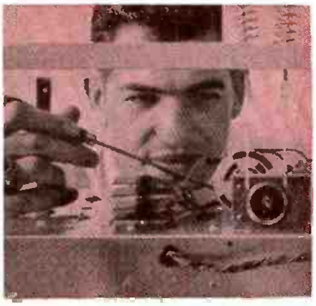

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This month's cover photo by Bruce Pendleton

VOLUME 18 MARCH 1963 NUMBER 3

Special Construction Feature

Electronic Construction Projects

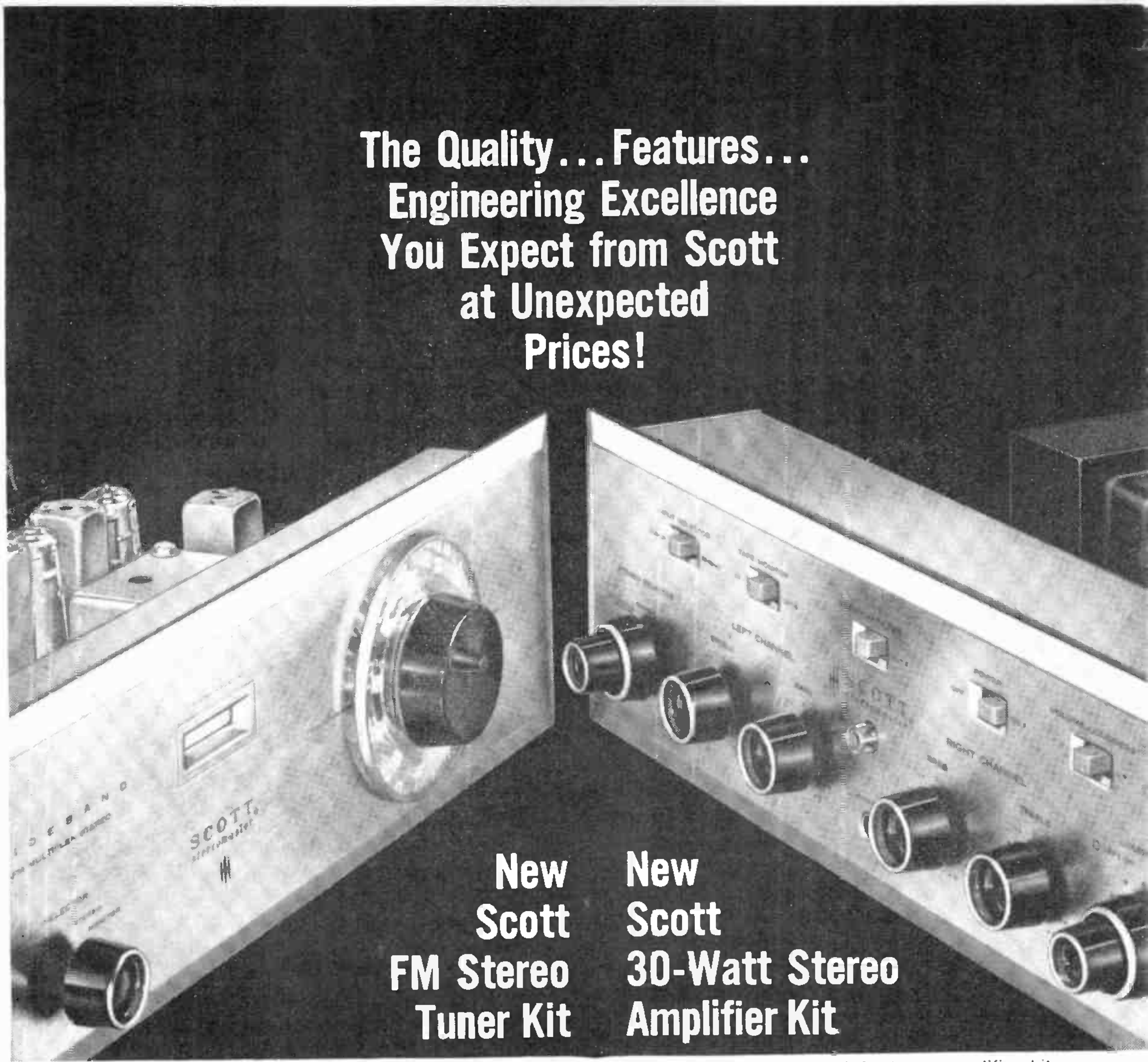
Audio and High Fidelity

Amateur Radio and Citizens Band

Short-Wave Listening

Electronic Features and New Developments

Departments



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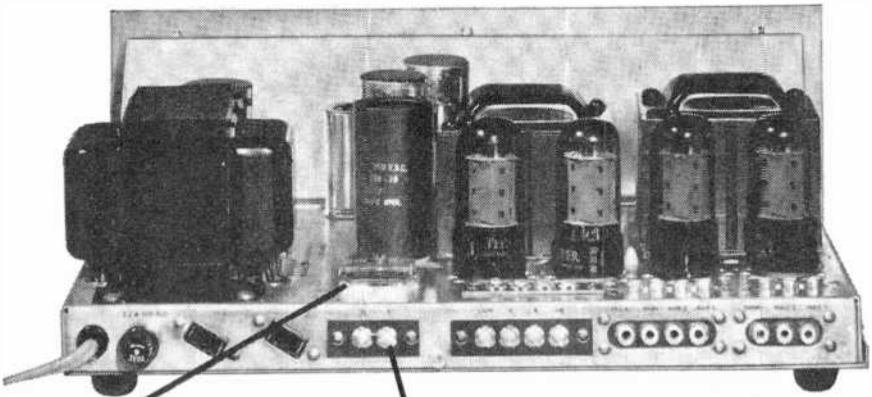

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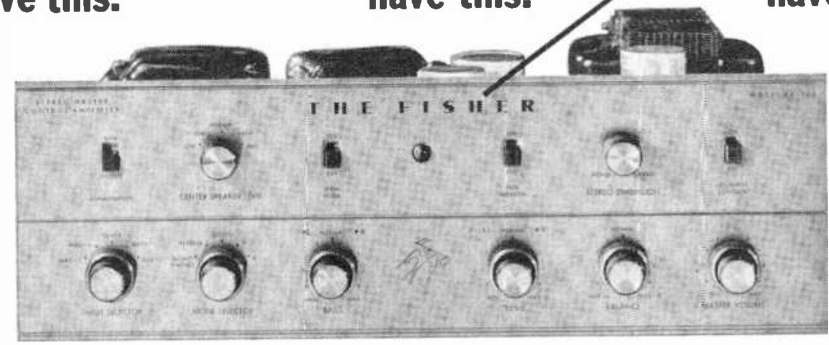

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POP'tronics NEWS SCOPE

SIMPLE ADDITION—Add together an electric typewriter, a high-speed electronic computer, and a ledger card with a built-in memory, and you'll come up with a magnetic ledger accounting machine—as some IBM engineers did. The ledger card in the new "desk-size" unit, tabbed the IBM 6400, employs a magnetic stripe on its reverse side which acts as a "memory device," since it stores alphabetic as well as numeric data appearing on the front of the card. In preparing a typical payroll, the 6400 can be programmed to compute and print an employee's earnings statement and payroll check, and it will post his earnings as well as deductions on the ledger card. During this process, all the operator need do is key in the hours worked by the employee.

ON THE AIR IN THE AIR—The U.S. Department of the Interior has gone "way out" to help the National Park Service handle the increased work load in Shenandoah National Park. General Electric's Communication Products Department, in Lynchburg, Va., was commissioned to install a new communications network consisting of eight base stations and 30 transistorized mobile units. This two-channel two-way radio system connects the park headquarters at Luray, Va., with outlying visitor centers, camping areas, ranger stations, and entranceways in a park that stretches 80 miles along the crest of the Blue Ridge Mountains. What's next? Smokey, the bear, wearing a Dick Tracy radio watch?

BEEPING BACK BIOMEDICAL DATA from an astronaut on the moon is the function of the "belt-pack" unit getting a down-to-earth check by the pretty miss at left. Designed by engineers at Bendix-Pacific, North Hollywood, Calif., it's a girth-circling device that will permit doctors on earth to check an astronaut's heartbeat, respiration rate, blood pressure, and body temperature via telemetry signals. Actually, a total of seven different types of physical information plus voice communications can be handled. All this will be done as the visitor from earth strolls along the lunar surface using a transmitter in the space ship for the needed moon-to-earth transmission power boost.

TILT, YOU'RE DEAD! An infrared "referee" mounted on a bazooka, rifle, or cannon, helps keep score in "war games." The impartial "ump," developed by Raytheon Company's Santa Barbara (Calif.) operation, bombards targets with coded invisible infrared rays instead of live ammunition. As the beam bombards a tank, truck, or other target, a tilt mechanism sets off a signal which tells the judges of the hit and the extent of the "damage." At the same time, the "casualty's" weapons are frozen from further action. Signals are coded for both weapon type and range, so that a beam from a rifle can't "destroy" a tank or an armored car.

FCC Report

By ROBERT E. TALL
Washington Correspondent

CB "Comment" Deadline Extended

AFTER an initial wave of indignation by CB'ers at the FCC's proposals to shift the country's CB operations to a more business-like footing, the situation is settling down somewhat. The result has been some well-reasoned arguments by CB'ers or their representatives as to how the Commission's stated aims in the proceeding can best be accomplished with minimum disruption to the presently "free-wheeling" radio service.

The seriousness of the proposed rule changes to Citizens Band enthusiasts is, of course, well known by now. And, rather than adopt a procedure which would cut off the chance for any CB'er to inform the FCC of his views, the Commission has extended the comment deadline to March 4, 1963. This means that any interested party will have more than ample opportunity to speak his piece.

Time is short, however, even with the comment date extension. If you want to express your opinions about the future course of CB, speak up now—or never. Mention the docket number—14843—of the rule proposals in your letter so your statement will get to the proper hands at the Commission, and file an original and 14 copies. Address your letter to: The Secretary, Federal Communications Commission, Washington 25, D.C.

CEMA Requests Time. Probably the most significant development to date in connection with the CB proposals has been the participation of the Communications Equipment Manufacturers Association (CEMA). While no single organization can really speak for each and every CB'er, the CEMA (formed late last year) comes closer than anything previously constituted. In fact, it's the first really effective organization with the money and the determination to take an overall look at the service and offer nationally representative views.

The CEMA's request to the Commission

FCC Report

(*Continued from page 8*)

for more time to submit reasoned and detailed comments on each point of the agency's proposed rule changes was apparently the decisional factor in the comment date extension by the FCC. While the extension was not as long as the CEMA had asked for—the Association requested an April 15 deadline—the compromise postponement of the deadline marks a significant decision by the Commission. At one point, the Commission was reportedly considering putting through the rule changes without regard for the normal rule-making "steps," in view of the widespread and acknowledged abuses of its present rules!

Charter members of the CEMA, who have promised to fully evaluate the proposed rule changes prior to submission of their statements to the Commission, are Browning Laboratories, Cowan Publishing Corp., Crater Lake Antennas, e.c.i. electronics communications, General Radiotelephone Co., Hallicrafters Co., Hammarlund Manufacturing Co., Heath Co., Hy-Gain Antenna Products Co., Metrotek Electronics, Osborne Manufacturing, Pearce-Simpson, Polytronics Laboratories, Sampson Co., Tram Electronics, Utica Communications Corp., and The Ziff-Davis Publishing Company (POPULAR ELECTRONICS).

The CEMA has billed itself as representing "in part, a new growth industry, which is currently marketing products, accessories, and services to more than one million users of citizens radio service frequencies, with an estimated dollar volume in excess of $50 million."

Try Your Hand. When you write the FCC, keep in mind that the FCC does not want merely a "vote" either in support or opposition of its stand; it wants some concrete help in working out a difficult problem. If you're going to suffer under what has been proposed—then either help or suffer! Even if you're happy with the proposals, the FCC would like to know exactly why!

In your comments to the FCC, contentions that "You can't do this to us" are not likely to be persuasive. The Commission has the clear authority to regulate radio in the overall public interest as it determines, barring reversal or instruction by the Congress on a specific point. And the Congress has proven reluctant to interfere with the Commission's operations, except in cases clearly indicated to be political problems

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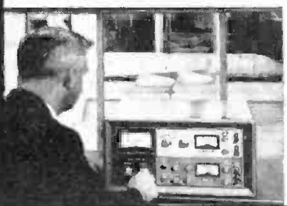

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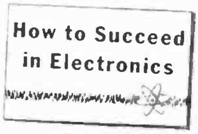

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FCC Report

(*Continued from page* 10)

which the Commission is not equipped to handle expeditiously.

The principal arguments with the Commission's proposals so far have been that:

(1) Five out of the 23 CB channels are not enough for interstation communications (between different licensees), as contrasted with 17 for intrastation communications (between different units of the same licensee).

(2) The split between channels should be on a day/night basis rather than a full-time basis—under which a small number of channels should be available for different-licensee communications during business hours, with a large number, or even all CB channels, being available for different-licensee communications after working hours.

(3) The five specific channels selected by the FCC for full-time different-licensee communications—27.105, 27.115, 27.125, 27.135, and 27.255 mc.—are not the best ones, if five is to be the maximum number.

(4) It is too late to change the emphasis of the CB service from a social radio "meeting place" to a business service, even though the Commission says this was the original intent of the service.

(5) The strict antenna height regulations proposed by the Commission are unrealistic.

(6) The different-licensee communications limitation of three minutes on, followed by five minutes off, is impractical.

(7) "Patching" between a CB setup and the telephone system should be allowed.

Interestingly enough, this seventh point has drawn by far the largest number of comments objecting to the proposed rule changes. However, "phone patching" has always been illegal from one standpoint or another. Telephone company tariffs have prohibited such a practice on a nationwide scale, and the fact that the telephone companies have looked the other way in enforcing their tariffs lends no authority to the otherwise unauthorized tying into their lines.

In Summary. If you don't like parts of the proposed rule changes, and would like to see revisions before the new regulations are finally adopted, our advice is for you to study the proposals carefully—but quickly. Then try to come up with something better, and attempt to prove to the Commission just how your suggestions are *more* in the "public interest" than their counterparts found in the Commission's proposals. —30—

IN THE MISSILE PROGRAM *at Vandenberg Air Force Base is CREI graduate Robert N. Welch. Moving ahead rapidly since enrolling with CREI, he is now a Philco TechRep Engineer and section leader in the Precision Measurement Equipment Laboratory.*

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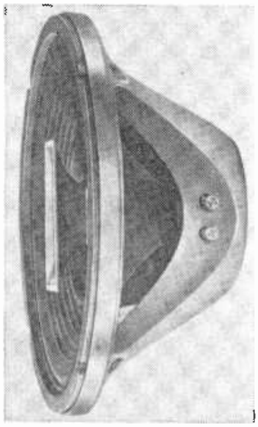
41

Hi-Fi Showcase

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

SMOOTH response from 40 to 18,000 cycles is yours with *Allied's* Knight KN-830 speaker—and at a budget price. A 12" 3-way unit, the KN-830 boasts two built-in crossovers and utilizes a 13-oz. ceramic magnet. A heavy, die-cast frame and a fiberglass coil form hold its edge-wound voice coil in precision alignment, and the "long-throw" design of the voice coil itself reduces distortion — especially at peak signal levels. Only 5½" deep, the KN-830 has a music power rating of 20 watts and an impedance of 8 ohms. Price, $26.95. . . . For audiophiles who shy away from soldering guns, Allied offers an AM/FM/-FM-stereo tuner that comes factory-wired and ready-to-go. A "size-as" match for the Knight 724A stereo amplifier, the Knight KN-170 incorporates a special indicator light to identify FM-stereo broadcasts, automatic frequency control, and built-in AM and FM antennas. Frequency response of its quality FM section is within 1½ db from 30 to 20,000 cycles, and its AM section achieves a 10-db signal-to-noise ratio from a 6-μv. input. The KN-170 sells for $89.95, complete with case.



Knight KN-830 speaker

New from *Altec Lansing* is a speaker system specifically designed for modern apartment living. Smaller than the company's other speaker systems (it measures only 30" x 18" x 14"), the 841A "Coronado" employs a Type 3000 sectoral horn and a Type 414 bass speaker for an overall response of 40 to 22,000 cycles. Finished in rich walnut, the Coronado makes an attractive addition to any audio installation, and it's a perfect match for a pair of "Carmel" speakers in a

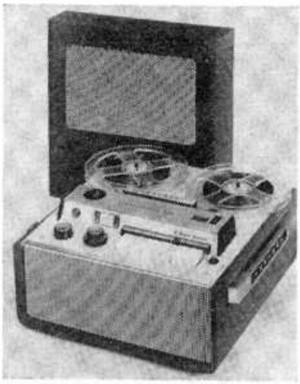
**Write to the manufacturers listed at the end of this column for more data on products mentioned*

Showcase

(*Continued from page* 14)

3-channel stereo system. Price, $199.50. . . . Three *Audio Dynamics'* speaker systems meet the requirements of just about any installation. All use a rectangular woofer designed by Britain's Raymond Cooke, and a treble unit which employs an extremely light 1½" Mylar diaphragm. The woofer's "expanded" plastic cone reputedly acts as a perfect piston throughout its range, with virtually no cone breakup or Doppler distortion. In addition, because of its extended radiating area, it is said to have very effective coupling to the air, requiring only small cone excursions for a large output even at very low frequencies. A special acoustic filter helps eliminate low-frequency resonance, thus removing the abrupt rise in impedance which is characteristic of some other speaker systems. The three systems—Models ADC-14, ADC-16, and ADC-18—are all housed in walnut cabinetry designed by Peter Quay Yang, ranging in size from 25" x 13½" x 12½" for the ADC-14 to 40" x 17" x 12½" for the ADC-18. Prices are $175.00 for the ADC-14, $220.00 for the ADC-16, and $250.00 for the ADC-18; an optional stand (Model ADC-SS1) for the ADC-14 and ADC-16 is priced at $6.95.

A portable tape recorder from *Concord Electronics* records and plays back 4-track stereo and also records sound-on-sound. The Model 550 comes complete with dual 10-watt amplifiers, transistorized preamplifiers, two 6" speakers, a pair of dynamic microphones, and a variety of patch cords. Push-button-controlled, the 550 is also equipped with a device which disengages the idler wheel when it's not in use—thus preventing development of "flats" and subsequent "wow."



Concord 550 tape recorder

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.
Audio Dynamics Corp., Pickett District Rd., New Milford, Conn.
Concord Electronics Corp., 809 N. Cahuenga Blvd., Los Angeles 38, Calif.

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Only N.T.S. offers you ALL 8 PHASES in ONE MASTER COURSE

SUCCESS IS THEIRS; IT CAN BE YOURS TOO!

I cannot praise N.T.S. enough. I've just graduated and already I have started repairing radios and servicing TV's . . . At 53, I'm starting a new life and my diploma from National Technical Schools is my proudest possession.

William E. Eckenrod

As field director of Berean Mission Inc., I have complete charge of our radio work. With the expert advice and training I am receiving from you I can do my own repairs on our recorders and P.A. systems, besides keeping our radios going. My training from N.T.S. helps keep us on the air. I feel privileged to be a member of such a fine institution.

Rev. Enoch P. Sanford

Thanks to N.T.S. I have a business of my own right in my home. I have paid for all my equipment with money earned servicing TV sets. Yes, N.T.S. gave me my start in television.

Louis A. Tabat

I have a TV-Radio shop in Yorkville, Illinois, about 4 miles from my home, and it has been going real good. I started part-time but I got so much work that I am doing it full-time. Thanks to National Technical Schools.

Alvin Spera

SEE OTHER SIDE

ALL 8 PHASES IN ONE MASTER COURSE

PHASE 1
TELEVISION INCLUDING COLOR TV
90% of homes have at least one set. Color TV is becoming more popular daily. TV Stations grow in number, need technicians. Maintenance and repair offer big opportunities.

PHASE 2
RADIO—AM & FM
Radios in homes, cars, schools, all need expert upkeep. Stations expand as FM becomes popular. Now transistors boom entire field.

PHASE 3
INDUSTRIAL ELECTRONICS
Computers, Data-Processing machines, Electronic Controls, Guided Missile Systems are new fields where Electronics play a vital role.

PHASE 4
SOUND SYSTEMS
New popularity of Hi-Fi-Stereo, as well as industrial sound systems and business intercoms make this a highly specialized and important field.

PHASE 5
FCC LICENSE PREPARATION
FCC License holders have a wide range of top jobs open to them. FCC License now a requirement for most Communication jobs.

PHASE 6
RADAR AND MICROWAVES
These are the communications systems of the future, already used in tracking and contacting satellites.

PHASE 7
AUTOMATION & COMPUTERS
Automation and Computer electronics are the new tools of industry and commerce. Skilled Technicians in these fields are in great demand at top pay.

PHASE 8
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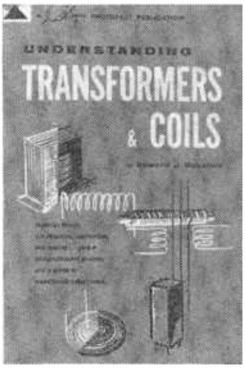
POP'tronics Bookshelf

UNDERSTANDING TRANSFORMERS AND COILS

by Edward Bukstein

For a thorough knowledge of electronics circuitry, a firm grasp of the principles and applications of inductors is required. *Understanding Transformers and Coils* is designed to help students and practicing technicians alike acquire the necessary information. The construction of various types of coils and transformers, the theory on which they operate, and their uses in electronic circuits are explained in five chapters. The remaining chapter covers measurement and testing methods, and there are two appendixes.

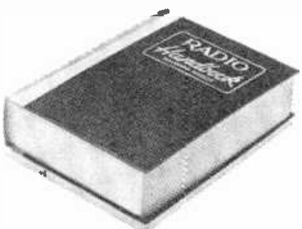


Published by Howard W. Sams & Co., Inc., 1720 East 38th St., Indianapolis 6, Ind. 96 pages. Soft cover. $1.95.

RADIO HANDBOOK (16th Edition)

Edited by William I. Orr

There is a tendency among ham radio experimenters to think of the *Radio Handbook* as the "second" handbook—the *ARRL Handbook* being "first" in their minds. But the *Radio Handbook* has a broader coverage, ranging as it does all the way from hi-fi circuitry to simplified mathematics. Also, the construction projects that appear in this handbook have not previously appeared in print. As edited by Bill Orr, W6SAI, this latest and largest edition is strictly "west coast" in flavor, with heavy emphasis on big transmitters, powerful mobile rigs, and beams that W6's love to raise. The theory is well-handled and probably represents a total of 100 pages. Tools and shop practices are thoroughly illustrated, and indexing is good.

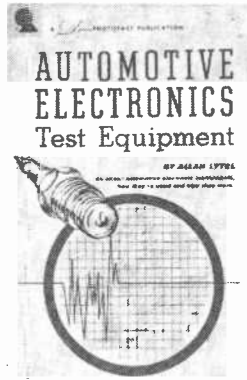


Published by Editors & Engineers, Ltd., Summerland 11, Calif. 808 pages. Hard cover. $9.50.

AUTOMOTIVE ELECTRONICS TEST EQUIPMENT

by Allan Lytel

Fully explained in this book are the specialized instruments available to the automotive serviceman for the testing and adjustment of present-day automobile carburetion and electrical systems. The volume not only serves as a handy reference guide for automotive technicians, but also as a servicing guide for electronic technicians called on to repair this type of instrument.

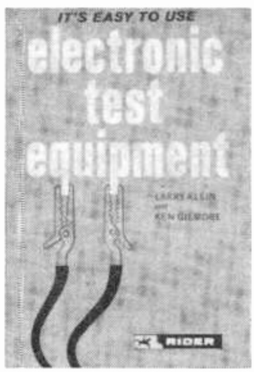


Published by Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind. 112 pages. Soft cover. $2.50.

IT'S EASY TO USE ELECTRONIC TEST EQUIPMENT

by Larry Klein and Ken Gilmore

Based on articles by the authors which appeared in POPULAR ELECTRONICS, this book is intended primarily for the service or laboratory technician and radio amateur. Assuming that the reader has a basic knowledge of electronics, the authors go right into the various types of test instruments available and the techniques of using them. Emphasis is on the practical



Bookshelf

(*Continued from page* 19)

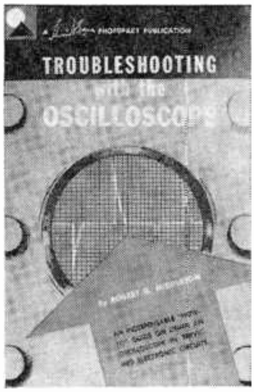
applications, with construction details and operation held to a minimum. The equipment covered ranges from simple VOM's and VTVM's to signal generators and oscilloscopes.

Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York 11, N.Y. 192 pages. Soft cover. $4.00.

TROUBLESHOOTING WITH THE OSCILLOSCOPE

by Robert G. Middleton

Ferreting out trouble in modern electronic circuits can be made a good deal easier for the service technician if he masters the proper use of the oscilloscope. And this book will aid even the beginner in understanding the fine points of this versatile instrument. Use of the scope is divided into two general categories: tracing circuits which are supplied with external test signals, and checking waveforms in stages which themselves generate signals. Among the topics discussed are which test signals to use, the type of waveform to expect, and the proper interpretation of waveforms. Though much of the book is devoted to TV-receiver servicing, chapters on the servicing of power supplies, radio receivers, and audio amplifiers are also included.



Published by Howard W. Sams & Co., Inc., 1720 East 38th St., Indianapolis 6, Ind. 128 pages. Soft cover. $2.50.

RADIOTELEPHONE LICENSE MANUAL

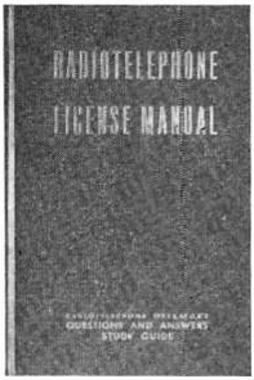
by Woodrow Smith

A radiotelephone first- or second-class operator license is recognized in all branches of the radio and television industry as proof of technical knowledge. This manual is

(*Continued on page* 22)

Bookshelf

(Continued from page 20)

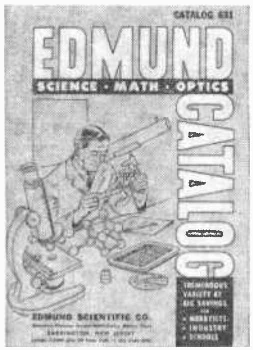


an aid in preparing for the examinations for such a license. The material is presented in question-and-answer form, and the answers are given in detail—assuring complete comprehension of all pertinent facts. The questions have been taken from the first four sections of the Government publication, *Study Guide and Reference Material for Commercial Radio Operator Examinations:* "Basic Law," "Basic Operating Practice," "Basic Radiotelephone," and "Advanced Radiotelephone."

Published by Editors and Engineers, Ltd., Summerland, Calif. 197 pages. Hard cover. $5.75.

New Literature

From a pack of cards for studying calculus to a color-beaded abacus board, the 1963 Edmund Scientific Co. catalog is packed with hundreds of items for the experimenter and hobbyist. "Science, math, optics" are the fields stressed, and there's plenty of war-surplus equipment — including many "hard-to-get" items. Books, training aids, and design kits are also described in detail, and many of them are illustrated. Your free copy of Catalog 631 can be obtained by writing to Edmund Scientific Co., Barrington, N.J.



All technical and styling details of Jensen's entire line of high-fidelity speaker and headphone equipment are covered in Catalog 165-H. In addition, suggestions for building a stereo system and an explanation of speaker principles are given. For your free copy of this 24-page, 2-color catalog, write to Jensen Manufacturing Co., 6601 S. Laramie Ave., Chicago 38, Ill. —30—

CB BREAKTHROUGH

UP TO 4 TIMES MORE POWERFUL—Now get every feature you've ever wanted in a 2-way radio—and the power to make it really meaningful. The new Regency "Range Gain" incorporates engineering developments that make the horizon line a perfectly reasonable operating range—base station or mobile. And even under the most difficult broadcast conditions you'll enjoy 2–3 times the coverage of previous units. There is nothing on the market to match it. If you have sampled citizens band in a lesser unit—or if you are a beginner willing to settle only for the ultimate (at less than the ultimate price, by the way)—see your Regency dealer now.

23 Crystal Controlled Channels —Transmit and Receive

*Double Side Band Reduced Carrier. Write for technical details.

12-months—one full year—warranty on unit and crystals

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LETTER TRAY

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

"Mello Monster" Really "Big"

■ Congratulations on the "Mello Monster" project (October, 1962). It took me two days to build, but I don't begrudge any minute of them. The "Monster" really gives "big speaker" performance to 8" speakers.

Jeremy Carter
Armonk, N. Y.

Thank you, Jeremy. The "Mello Monster," in one form or another, has been well thought of by

many people for a number of years. Welcome to the gathering throng of "Monster" idolizers.

"One for the Road" at Home

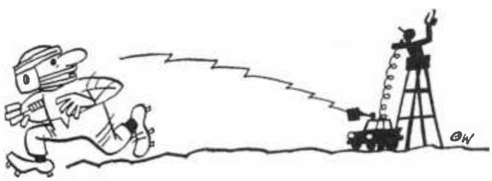
■ The little VHF receiver described in "One for the Road" (July, 1962) works like a real charm. Since I decided to set the rig up in my shack, I used a 12.6-volt transformer for the filament supply (one side of the secondary connected to pin #5 of the tube and the other side grounded) and one 9-volt and two 1½-volt batteries wired in series for the B+. With my 20" whip and coax feedline, reception is great.

B. Kirschenhofer, VE3PE1LS
Wolfe Island, Ont., Canada

Your 12.6-volt transformer plus battery supply sounds like a grand idea for other P.E. readers who like "One for the Road" but don't have cars.

CB Rig to PA System

■ Our "Executive" CB rig works fine as a P.A. system, thanks to P.E.'s modification ("CB Rig



Doubles As PA System," September, 1962). We use this setup at our high school football games—along with a Sonar "Model E" that we also converted;

REK·O·KUT

The first name in precision high-fidelity playback equipment!

First in quality! First in value!

STEREOTABLES

with *Hysteresis-Synchronous Motor* for perfect rotational accuracy even when there are current fluctuations.

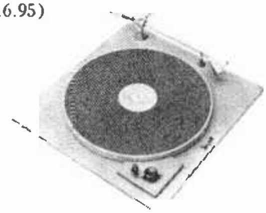
R-320A—Rondine 2—Combines the superiority of the single-play turntable with Rek-O-Kut's remarkable new tonearm. Auto-Poise* . . . gives you the world's only *true* turntable with fully automatic operation. Minus 57db rumble . . . even at full amplification.

R-320A with AP-320 Automatic Tonearm (illustrated)	$169.95
R-320 with S-320 Tonearm ...	129.95
R Stereotable only	79.95
R Base (oiled walnut finish)	14.95

N-34H. 2-speed stereotable. (33 & 45 rpm) Minimum noise and rumble level ever achieved in a 2-speed machine. Driven by cushion-soft Rekothane belt .... $89.95 (Walnut base, Model BW-1, $14.95)

B-12GH. 3-speed stereotable. Oil-grooved turntable shaft turned to extremes of precision tolerance. Provides unparalleled playback performance. Has single selector knob, neon pilot light $109.95

B-12H (not shown). 3-speed stereotable for the professional or dedicated audiophile. Features special, massive, custom-built hysteresis-synchronous motor, ideal for heavy-duty applications .... $149.95 (Walnut base for above: Model BW-1, $16.95)



B-16H—3-speed professional 16" stereotable. Self-lubricating, custom-built hysteresis-synchronous motor. At 33⅓ & 45 rpm, reaches full operating speed in ¼ turn. Permanently affixed Strobe Disc permits instantaneous checking of all speeds. $275.00

EASY-TO-ASSEMBLE

STEREOTABLE KITS

You save the cost of factory-assembly, get the same quality Rek-O-Kut features throughout. Same hysteresis-synchronous motor and Rekothane belt drive system.

K-34H—33 and 45 rpm stereotable in kit form. Similar to Model N34H $69.95

K-33H—Single-play stereotable in kit form. $59.95

S-320 Tonearm

with exclusive omni-balance*

- Acoustically isolated counterweight for static balance
- Micropoise for micro-adjustment of cartridge tracking pressure
- Omni-Balance for optimum bearing loads and lateral balance

Only with the S-320 tonearm can you adjust to perfect balance with any cartridge. The result is equalized output from both walls of the stereophonic groove, total elimination of "skating," reduction of distortion to an absolute minimum . . . increased life for records and stylus. $34.95

Build your own speaker system

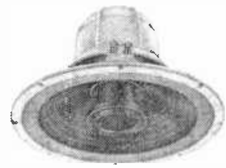
with these REK-O-KUT High-efficiency, Patented PARAFLEX* Component Speakers

A-80D 8" EXTENDED RANGE SPEAKER

Ideal for small enclosures and will deliver a surprising amount of clean bass in cabinets of the bookshelf type. *Specs:*
Frequency response: 45-13.000 cps.
Power handling: 20 watts maximum.
Impedance: 8 ohms. $29.95

A12-DX 12" CO-AXIAL SPEAKER

Designed for the highest quality reproduction, this co-axial is a woofer-tweeter combination which also incorporates a mid-range diffuser for "impact" presence. *Specs:*
Frequency response: 35-18.000 cps.
Power handling: 25 watts of program.
Impedance: 8 ohms. $49.95



A 150-X 15" 3-WAY SPEAKER

One of the finest "big" three-way speakers on the market. Capable of undistorted reproduction, this speaker is a *must* for the audiophile who prefers to build his own systems. *Specs:*
Frequency response: 20-18.000 cps.
Power handling: 35 watts integrated program.
Impedance: 8 ohms. $109.95
Model A150-SV (same as above with volume control) $119.95

FREE! Colorful 8-page booklet of "Construction Plans for Speaker Enclosures." Informative, valuable yet available without charge. Use coupon below.

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- ☐ S-320 Tonearm
- ☐ Component Speakers/Speaker Systems
- ☐ Rek-O-Kut professional recording and playback equipment
- ☐ Copy of "Construction Plans for Speaker Enclosures."
- ☐ Name of nearest dealer

*Name*__________
*Address*__________
*City*_____ *Zone*____ *State*____

*Pat. Pending

Letter Tray

(*Continued from page* 24)

for communications between a coach on the camera tower and coaches on the ground, a Cadre (made portable with dry cells) and a Heathkit GW-31 come in handy.

William Siegler, Jr., KBG2933
Tom Mulhall, KBG5295
Cornwall, N.Y.

Sounds like the only thing that CB doesn't do in Cornwall is play ball.

Fraternity Hams

■ I am compiling a directory of amateur radio operators who are members of the Sigma Alpha

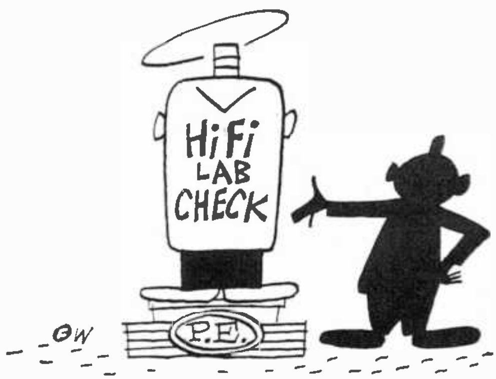
Epsilon fraternity, and would appreciate your publishing an announcement to this effect.

Stan Head, Jr., K8MMZ/8
4383 Keeler Drive
Columbus 27, Ohio

Good luck with your project, Stan; we hope every SAE brother ham will contact you.

"Hi-Fi Lab Check" Welcomed

■ Thank you for making "Hi-Fi Lab Check" a permanent feature as of the September, 1962, issue. I'm sure many P.E. readers, in addition to myself, have a special interest in hi-fi and stereo



as well as other fields. In my opinion, your magazine thoroughly covers all fields of electronics.

Marc R. Joondeph
Ridgewood, N. J.

Thank you, Marc; and we'll try to continue to give our readers what they want.

(*Continued on page* 28)

Letter Tray

(Continued from page 26)

Educational Sleep

■ Those P.E. readers studying for a Novice license will find Jerry's idea (*Carl and Jerry*, "Substitute Sandman," November, 1961) a great aid in learning code or theory. All you need is a tape recorder, an

inexpensive continuous-loop tape cartridge, a time switch, and a pillow speaker. You record the code, theory, or both, on the tape, and play it back while you're sleeping.

ANDREW DEMARTINI, WPE2GEK
Cresskill, N. J.

It is possible to learn while sleeping, Andrew, but the only way to learn to send code is by practice.

What Will Short?

■ In the article entitled "Folded Dipoles" (December, 1962), you didn't state what kind of material to use for the shorting bars. Could you please tell me what these bars should be made of?

TERRY SAWYER, WPE4FAD
Centerville, Tenn.

Actually, any conductor from silver, copper, gold, and aluminum, on down to steel will do the trick. However, the easiest thing to use is a piece of the same wire used in constructing the antenna. —30—

Out of Tune

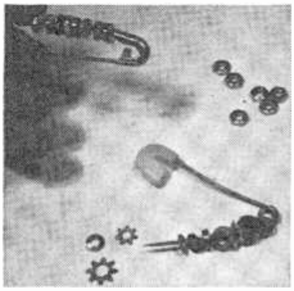
Beam On Wildlife (*December*, 1962, *page* 92). There were two errors in the values given in the circuit diagram of the miniature transmitter. The resistor should be 22,000 ohms and the battery a 1.35-volt miniature mercury cell.

Transistor Tester Roundup (*January*, 1963, *page* 70). The Sencore Model TR110 transistor checker is not only an in-circuit tester as indicated in Table 2, but it also performs out-of-circuit tests showing leakage, shorts, and gain. As a matter of fact, the TR110 will function as a voltmeter, milliammeter, and signal generator, as well. —30—

Tips and Techniques

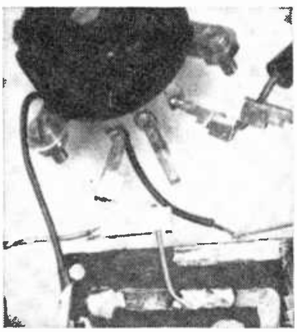
NUT FINDING MADE EASY

If you keep assorted nuts, grommets, washers, etc., in a small box, large safety pins will help you find the particular nut or grommet you're after. Putting these tiny parts on safety pins will make it much easier to locate the proper size needed. Going a step further, the safety pins may be hung by their eyes on small finishing nails set in your tool board. —*Robert E. Kelland*



BREADBOARDING WITH FLEA CLIPS

"Fleas" are handy little things to have around when you're hooking up experimental circuits. The "fleas" in question are flea clips, of course, and they're especially useful for breadboarding. Solder some of these clips to potentiometers, capacitors, resistors, and other components—as well as to wires of various lengths—and you won't need a soldering gun during your experimenting. When you want to try out a new circuit, you can quickly connect and disconnect the leads. And there's almost no limit to the parts these can be used on—tube sockets, for example, can have a clip for every pin connection. In addition, a stiff wire equipped with "fleas" can serve the dual purpose of acting as both a jumper and a support for components. —*Francis J. Leyva*

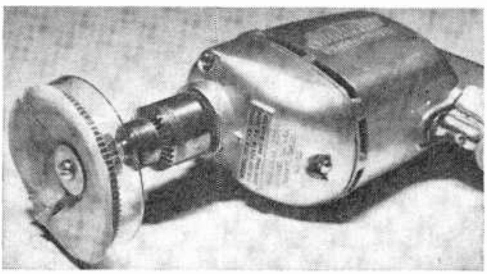


BITS HOLDER FROM CORRUGATED CARDBOARD

A handy container for drill bits can be made from any small box—a flip-top cigarette box will do nicely—which is just large enough to hold your longest bit. Once you have the box, cut a number of pieces of corrugated cardboard—sized so that they will fit snugly inside the box and still allow the tips of the bits to protrude slightly. You'll find that bits up to ¼" in diameter will easily slip into the open ends of the cardboard sections. Larger-size bits can be accommodated by cutting the smooth surface covering one of the corrugated channels on two pieces of cardboard so that they are opposite each other when placed in the box. —*Augusto R. Azanza*

HOMEMADE DISC SANDER

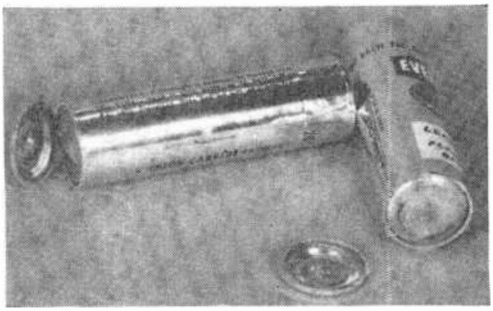
Next time you need a disc sander—but feel that the investment is hardly worth the occasional use the sander will get—construct your own. Pick up a large TV tuning knob and a flat-head bolt—with matching nut and washer—at your local parts store, and you have the makings of a good disc sander. Drill out the shaft-hole so that you end up with a hole clear through the knob. Now place a sandpaper disc over the front of the knob, push the bolt through the washer and sandpaper into the hollowed-out knob, and tighten the nut on the bolt. Be careful not to apply too much pressure to



the bolt and nut, as you might crack the knob. Place the bolt in the chuck of your drill, and you have your disc sander.
—*Homer L. Davidson*

BETTER CONTACT FOR PENLIGHT CELLS

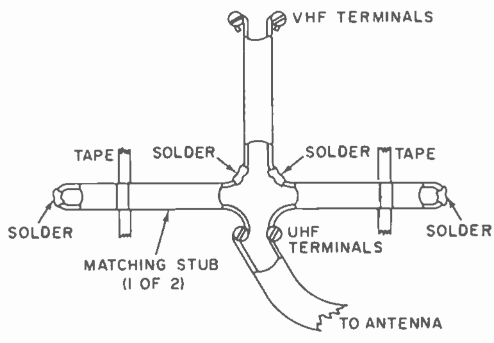
Did you ever wire up a number of penlight cells in series, only to find that they didn't work as you intended them to? Well, if they were Eveready No. 915 cells—or perhaps some similar type penlight cells—there was probably a good reason for their erratic operation. Connection to the base of a 915



cell is made through a metal disc; and, since these cells weren't made for soldering—but rather for a pressure connection—you may get an intermittent contact if you solder them together. All is not lost, though, since you just have to cut around the base of the cell's cardboard casing and remove the metal disc (see photo) to expose a flat solid contact area.
—*Martin H. Patrick*

UHF RECEPTION WITH VHF ANTENNA

If you haven't gotten around to installing a UHF antenna—but are otherwise all set to pick up standard VHF stations—try the



hookup shown here. The two 3¼" matching stubs are made from 300-ohm TV twin-lead, and each has the leads on one end shorted and soldered together. Attach your antenna lead-in to the UHF terminals on your TV set, and hook up one lead of each matching stub to these terminals as well. Now solder the remaining lead of each stub to the leads of another piece of twin-lead—the other end of which has been connected to the set's VHF terminals.
—*Kent A. Mitchell*

DISASSEMBLY PROCEDURE ASSURES CORRECT REASSEMBLY

The next time you're repairing some equipment and have a number of parts to remove, keep track of, and then replace when the job is finished, why not give this procedure a try? Simply put a fairly large sheet of white paper near the unit you're working on, and place the parts on the paper in the precise order in which they are removed. In addition, identify the parts by numbering each one consecutively on the paper as you put it down. Now, when assembly time comes around, just take the part with the highest number first, and work your way back. This technique is especially handy when the equipment being worked on has a number of screws differing in length only.
—*Homer L. Davidson*

OPERATION "ASSIST"

THOSE of you who like to work on "antique" radios and other aged electronic gear need no longer despair because you lack a schematic diagram, alignment instructions, or parts information. Now you can call upon the vast audience of POPULAR ELECTRONICS (over 420,000) to help you. Just jot down the information you want on the back of a 4¢ postcard, giving the complete name and model number of the unit in question. Include your name and complete address, with zone number, and send the card to:

OPERATION "ASSIST"
POPULAR ELECTRONICS
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Listed below are recent requests for help that POP'tronics' Editors hope will not go unanswered. Check the requests, and if you can help, please write directly to the readers. You never can tell—you yourself may require some information in the future, and Operation "Assist" may be your answer in time of need, too!

SCHEMATIC DIAGRAMS

Rutland (Model 46) record-player/amplifier, 1938 vintage. (Thomas Bugaj, 197 Boston Rd., Middletown, Conn.)

"Metropolitan" (Model HB 11) radio-phonograph, made by Electrical Mfg. Co. for Hudson's Bay Co. of Canada. (John Main, 307 6th Ave., St. Eustache Sur Le Lac, Quebec, Canada.)

E.H. Scott "two-piece" radio receiver, of 1937 vintage. (Gene Fair, W8OZS, RFD 2, Apple Creek, Ohio.)

EQ Radio (Model 142073). (David Carr, WPE2IZX, 255 McKinley Ave., Kenmore, N.Y.

Radio Mfg. Engineers (Model RME-84) receiver, about 1947 vintage. (Leon A. Savidge, Jr., WPE3EFS, 1100 W. Lynn St., Shamokin, Pa.)

Howard Communications Co. (Model 435, #2513) communications receiver. (Dr. E. J. Bernet, 2104 Twyman Rd., Charlottesville, Va.)

(*Continued on page* 109)

Amateur / CB / Industrial 2-Way Radio Operators...

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When You Talk...

these E-V microphones guarantee smooth, carefully tailored response that eliminates power-robbing peaks—allows maximum useful modulation to better cut through noise and interference. For highest effective output from your transmitter, select one of these Electro-Voice microphones.

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MODEL 729SR Ceramic Cardioid Microphone

Improves base station performance at remarkably low cost. Cardioid pickup pattern cuts out room noise, improves VOX action, permits greater working distance from microphone. Ceramic element rugged enough for mobile use. Handsome case fits easily in hand, or slips quickly into desk stand or floor stand adapter provided. DPST switch. Hi-Z output -60 db. Net price $15.90. Without switch (Model 729) $14.70.

When You Listen...

an E-V communications loudspeaker adds useful volume and articulation to your fixed or mobile receiver. Carefully controlled band-pass of compression driver and horn improves efficiency, cuts distortion and overloading, eliminates unwanted noise.

MODEL PA15 Communications Loudspeaker

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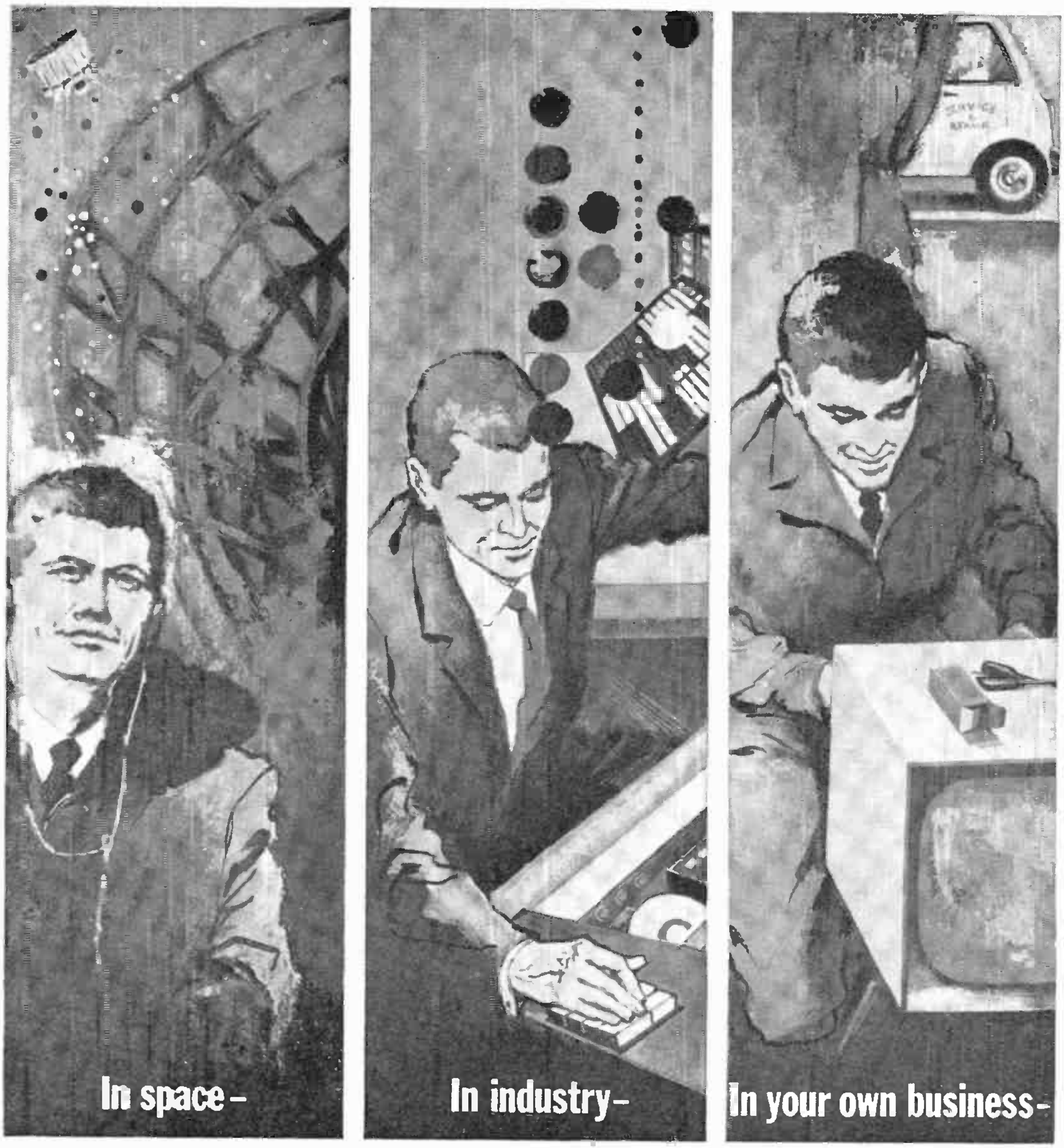

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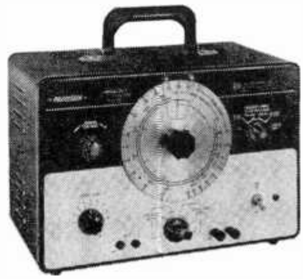
New Products

SINE- AND SQUARE-WAVE GENERATOR

Facilities for both sine- and square-wave outputs on the Precision Model E-330 signal generator eliminate the need for two separate units. Frequency accuracy is ±5% and sine-wave distortion is less than ¼% from 20 to 20,000 cycles. Both the sine- and square-wave sections have a range of 7 cycles to 750 kc.; the sine-wave output is 0-10 volts r.m.s. across a 600-ohm load, while the square-wave output is 20 volts peak-to-peak, high impedance. The 8½" x 13" x 7", 11-lb. unit operates from a 117-volt, 50-60 cycle source. Price, $129.95. (*Precision Apparatus Co., Inc.,* 70-31 84th St., Glendale 27, L.I., N.Y.)



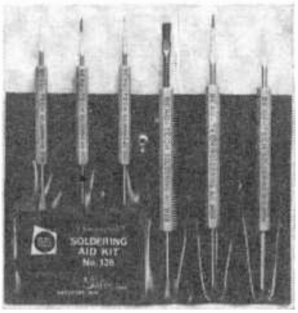
COLOR-CODED TV DATA

Now available from local electronic parts distributors is a new color-coded circuit diagram "package" designed to speed TV servicing. Called the "TV Colorgram Service Pak," it consists of a number of 8½" x 11" "Colorgram" charts—including a color-keyed

master schematic as well as key circuit schematics, with signal flow paths in color. Also supplied is a "Rapid Repair Manual" which contains manufacturer's service notes, circuit modifications, parts lists and numbers, pictorial tube and component location charts, etc. The "Service Paks" cover the most popular TV chassis made by Admiral, Emerson, GE, Magnavox, Motorola, Philco, RCA, and Westinghouse—there is a Pak for each chassis. Price of single Pak, $1.95. (*Colorgrams, Inc.,* Mineola, N.Y.)

SOLDERING AID KIT

A new BEAU-TECH kit consists of three 8" standard and three 5½" miniature soldering aids, with a variety of scraper, reamer, forked, and brush ends. Each double-ended tool comes in its own pocket in a flexible plastic case, and the aligned and polished ends of the tools are insulated from each other. All of the tools are made from spring steel, are heat-treated, and are chrome-clad to shed solder; the handles are varnished maple. Price, under $5.00. (*BEAU-TECH Tools,* Lakeport, N.H.)



MINIATURE BEAM ANTENNA

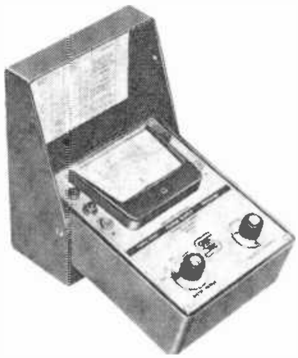
The Mini-Products Model B4010 2-element beam antenna—operating on both 40 and 10 meters—has 20'-long elements, supported by a 10' boom. A single 50-ohm line feeds the antenna, which boasts a power capability of 1 kw. AM. The SWR on 40 meters is less than 1.5:1 and on 10 meters it's less than 1.2:1. The B4010 features the company's patented end-loading principle—permitting miniaturization without loss of efficiency. Price, $79.50. (*Mini-Products, Inc.,* 1001 W. 18th St., Erie, Pa.)

TRANSISTORIZED TACHOMETER KIT

Adaptability is the keynote of Heath's new MI-31 tachometer kit. An easy-to-build unit using printed-circuit electronics, the MI-31 works with 1-8 cylinder, 2-cycle engines, or 1-16 cylinder, 4-cycle engines. A range switch on the back makes it adaptable for inboard or outboard craft, standard or sports cars. And since the triggering pulse is taken across the distributor points, it makes no difference whether you have a "positive" or a "negative" ground. As an added "bonus," a zener diode maintains a constant operating point to eliminate errors caused by voltage variations. Price, $22.95. (*Heath Company,* Benton Harbor, Mich.)

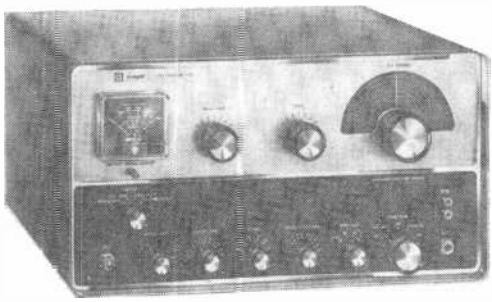
VARIABLE POWER SUPPLY

With a continuously variable output to 30 volts d.c., the Seco Model RPS-5 power supply has a zener-regulated, transistorized circuit which maintains a constant output voltage under wide variations in loads. Output voltage is metered in three ranges—0 - 1.5, 0 - 15, and 0 - 30 volts; output current in two ranges—0 - 30 and 0 - 150 ma. Bias taps for 0 - 1.5 and 0 - 7.5 volts are also provided for simultaneous use with the main supply. The output impedance is 1 ohm, response time is 2 μsec., and the unit delivers up to 4 watts. Price, $69.50. (*Seco Electronics, Inc.,* Dept. 114, 1201 S. Clover Drive, Minneapolis 20, Minn.)



AM/CW TRANSMITTER KIT

The Knight-Kit T-150 transmitter operates with 150 watts peak AM/CW input on 80 through 10 meters, and with 100 watts on 6 meters. Incorporated in the 8-tube, 28-pound transmitter is a specially designed VFO that provides highly stable frequency control on all bands. A meter switch allows quick reading of buffer grid current, final grid current, final plate current, and relative power output. Antenna impedances from 40 to 600 ohms are matched by an adjustable pi-network output circuit, and provision is made for crystal operation. Price, $119.95. (*Allied Radio Corp.,* 100 N. Western Ave., Chicago 80, Ill.) —30—




BEST BUYS IN STEREO AND MONO HI-FI
Transistorized Stereo/Mono 4-Track Tape Deck RP100
Semikit (electronics in kit form) $299.95 Wired $399.95
New Stereo FM Multiplex Tuner ST97
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Kit $99.95 Wired $149.95
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Kit $69.95 Wired $109.95
FM Tuner HFT90
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70W HF87A: $74.95 $114.95
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Kit $42.95 Wired $54.95
Peak-To-Peak VTVM #232 & Uni-Probe® (U.S. Pat.)
Kit $29.95
Wired $49.95
VTVM #221
Kit $25.95 Wired $39.95
DC—5 MC 5" Scope #460
Kit $79.95
Wired $129.50
General Purpose 5" Scope #427
Kit $69.95 Wired $109.95
Tube Tester #625
Kit $34.95 Wired $49.95
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Kit $28.95
Wired $39.95
1000 Ohms/Volt V-O-M #536
Kit $14.95
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Kit $29.95
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Kit $39.95 Wired $49.95
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ULTRASONIC SNIFFER

Here's an old circuit with a new twist—basically a superheterodyne, it brings the not-so-audible world above 16,000 cycles to human ears

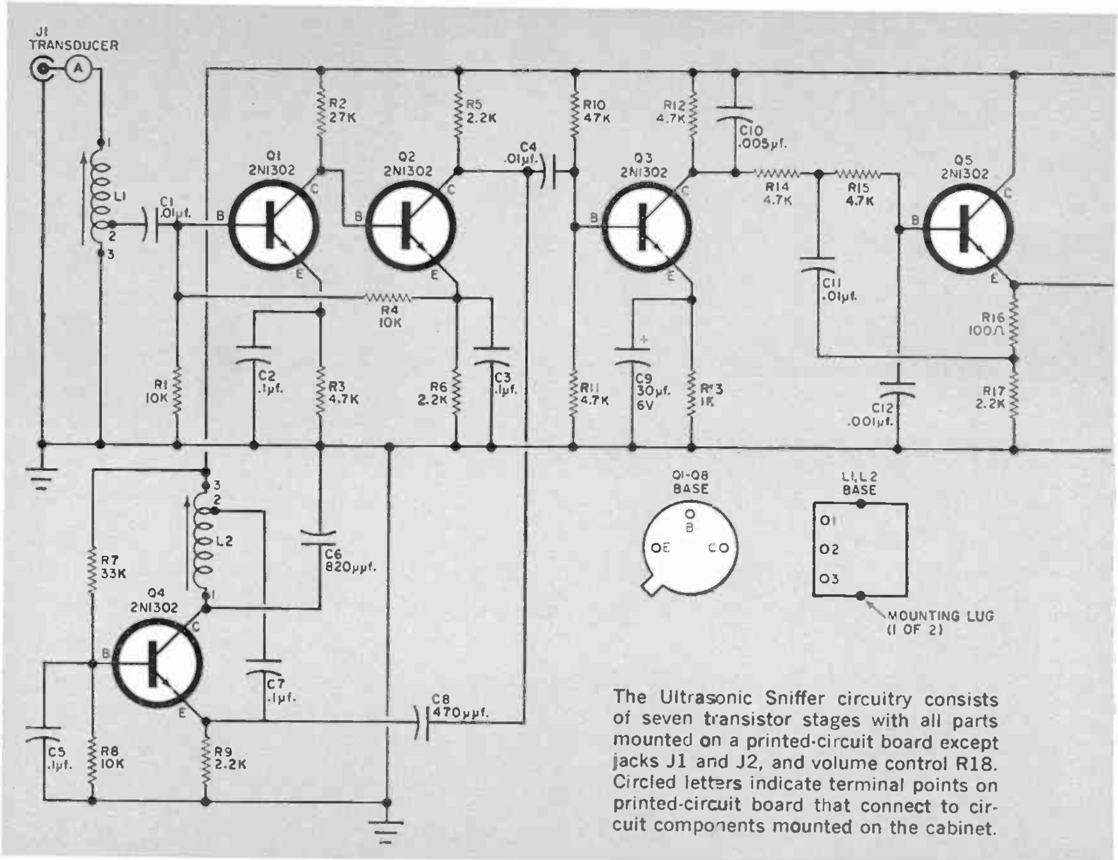
By DANIEL MEYER*

ARE YOU AWARE that a dog can hear sounds which, if you relied on your ears alone, you probably wouldn't even know existed? This is because human ears—unlike dogs' ears—aren't sensitive to sounds much above 16,000 cycles. But even though you can't normally hear these sounds, don't assume that they aren't worth listening to. Tune in on the "ultrasonic" frequencies between 38,000 and 42,000 cycles, for example, and a burning cigarette sounds like a forest fire; the "secret" noises of animals and insects are clearly audible; and a tiny leak in your car's exhaust system becomes a steam whistle.

If the idea intrigues you, you'll want to build the "Ultrasonic Sniffer" de-

*Research Engineer
Southwest Research Institute
San Antonio, Texas

COVER STORY



The Ultrasonic Sniffer circuitry consists of seven transistor stages with all parts mounted on a printed-circuit board except jacks J1 and J2, and volume control R18. Circled letters indicate terminal points on printed-circuit board that connect to circuit components mounted on the cabinet.

scribed on these pages. Its ingenious transistorized circuit picks up sounds in the 38 - 42 kc. range and "translates" them into frequencies low enough to be perfectly audible.

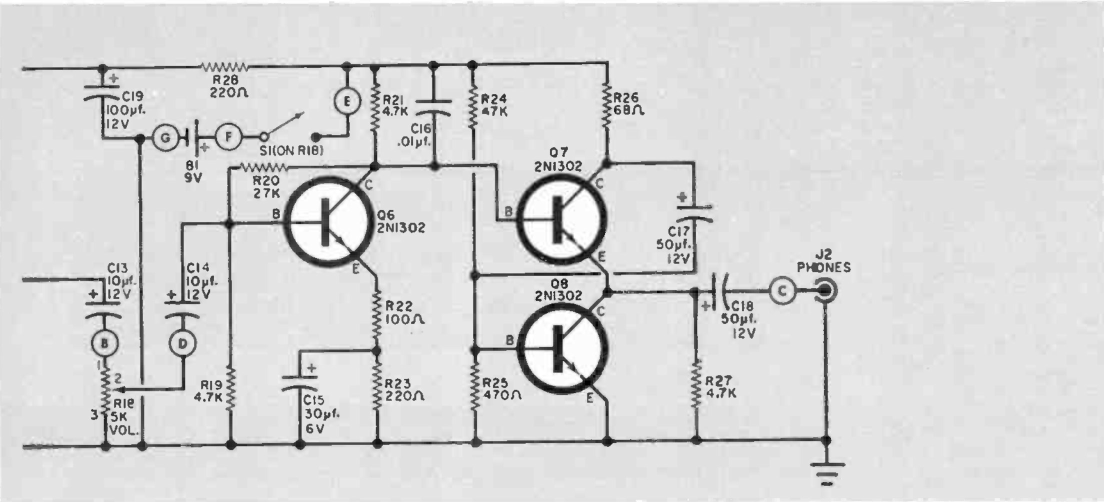
As you can see on our cover, one of the first things we did after receiving the prototype model was to point it at a Bulova "Accutron" electronic watch. Appropriately (if startlingly) enough, we heard a periodic booming which sounded very much like Big Ben's chimes. Similar surprises await you, so why take a back seat to Rover? Get out your soldering gun and start that flux flowing now!

About the Circuit. The Ultrasonic Sniffer is similar in design to an ordinary superheterodyne receiver. Taking the place of the antenna is an ultrasonic transducer, or "microphone," of the type used in TV remote-control systems.

When the transducer is plugged into jack *J1*, it forms a tuned circuit with coil *L1*. The circuit, analogous to a radio set's r.f. tuning coil and capacitor, resonates between about 37.5 and 42.5 kc. All sounds that the transducer picks up within this range are passed along to transistor *Q1*. Transistors *Q1* and *Q2*, equivalent to the r.f. amplifiers of our hypothetical superhet receiver, amplify the 37.5 - 42.5 kc. ultrasonic signals.

Oscillator *Q4* provides a 37.5-kc. signal which is coupled to the base of mixer *Q3* along with the 37.5 - 42.5 kc. signals from *Q2*. These signals combine in the mixer to generate "difference" frequencies between 0 and 5 kc. Capacitor *C10* partially filters the "sum" frequencies from the output of *Q3*, but it leaves the 0 - 5 kc. "difference" frequencies virtually untouched.

The "difference" frequencies retain the basic "sound pattern" of the original, inaudible, ultrasonic signals. They lie well within the normal audio range, however, and need only amplification to be heard. Here the analogy to a superhet

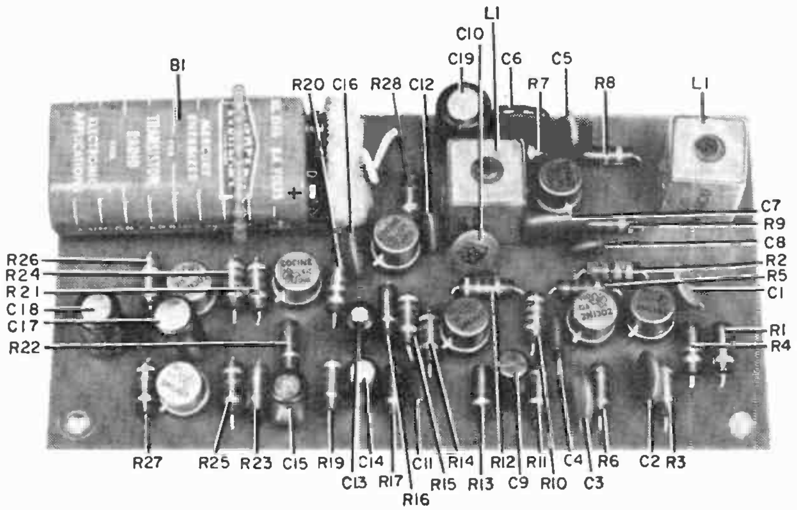


PARTS LIST

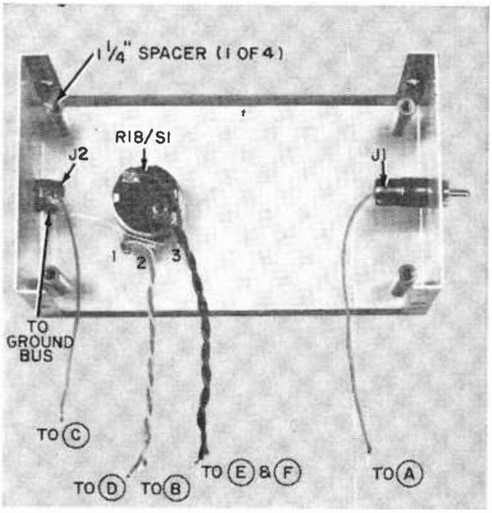
B1—9-volt battery (Burgess 2MN6 or equivalent)
C1, C4, C11, C16—0.01-µf., 150-volt ceramic disc capacitor (Centralab DM-103 or equivalent)
C2, C3, C5, C7—0.1-µf., 10-volt ceramic disc capacitor (Centralab UK10-104 or equivalent)
C6—680-µµf., 300-volt silvered-mica capacitor (Elmenco DM-15-681J or equivalent)
C8—470-µµf., 1000-volt ceramic disc capacitor (Centralab DD-471 or equivalent)
C9, C15—30-µf., 6-w.v.d.c. subminiature electrolytic capacitor (Lafayette CF-167 or equivalent)
C10—0.005-µf., 150-volt ceramic disc capacitor (Centralab DD-M502 or equivalent)
C12—0.001-µf., 1000-volt ceramic disc capacitor (Centralab DD-102 or equivalent)
C13, C14—10-µf., 12-w.v.d.c. subminiature electrolytic capacitor (Lafayette CF-173 or equivalent)
C17, C18—50-µf., 12-w.v.d.c. subminiature electrolytic capacitor (Lafayette CF-176 or equivalent)
C19—100-µf., 12-w.v.d.c. subminiature electrolytic capacitor (Lafayette CF-177 or equivalent)
J1—Shielded phono plug (Lafayette MS-593 or equivalent)
J2—Phone jack to match plug on headset
*L1, L2—Special ultrasonic coil (Admiral 69C251-1-A)**
Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8—2N1302 transistor (Texas Instruments, G.E.)
R1, R4, R8—10,000 ohms
R2, R20—27,000 ohms
R3, R11, R12, R14, R15, R19, R21, R27—4700 ohms
R5, R6, R9, R17—2200 ohms
R7—33,000 ohms
R10, R24—47,000 ohms
R13—1000 ohms
R16, R22—100 ohms
(All resistors ½-watt, 10%, unless otherwise specified)
R18—5000-ohm potentiometer, audio-taper (with s.p.s.t. switch S1)
R23, R28—220 ohms
R25—470 ohms
R26—68 ohms
S1—S.p.s.t. switch (on R18)
1—5¼" x 3" x 2⅛" aluminum utility box (Bud CU-2106-A or equivalent)
*1—Special printed-circuit board***
*1—Ultrasonic transducer (Admiral 78B147-1-G)**
1—100-to-1000 ohm headset (Telex HFX-91 or equivalent)
Misc.—1¼" spacers, battery connector, knob, wire, solder, etc.

*Available at your local Admiral TV parts dealer. Current New York City prices are $2.15 each for the coils and $6.50 for the transducer.

**Available from Daniel Meyer, 430 Redcliff Dr., San Antonio 16, Texas. Price, $1.50.



Only those parts specified in the Parts List or exact replacements with the same physical size should be mounted on the printed-circuit board. Any odd replacement parts will make the board look sloppy.



Parts mounted on chassis cover are prewired with extra long leads. Circled letters indicate connection points so indicated on schematic diagram.

breaks down, since the output of a superhet mixer is an i.f. signal which must be "detected" (to extract the original audio modulation) before it can be heard.

The output of *Q3* is fed to *Q5*, which is connected as an "emitter follower." Transistor *Q5*'s main function is to provide a proper impedance match between *Q3* and volume control *R18*. It also acts as another filter, helping *C10* to attenuate unwanted ultrasonic signals.

Audio signals from *R18* feed transistor *Q6*, which is the audio amplifier. And the output of *Q6* is fed to transistors *Q7* and *Q8*, which form an "augmented emitter follower." Their output, available at jack *J2*, will match a set of low-impedance headphones.

Power for the circuit is supplied by 9-volt battery *B1*, and controlled by switch *S1*.

Construction. Building the Ultrasonic Sniffer is a relatively simple job, thanks to the availability of a specially-etched circuit board (see Parts List). Once the holes for the leads and mounting screws have been drilled as instructed by the supplier, construction consists of little more than carefully soldering the components in place.

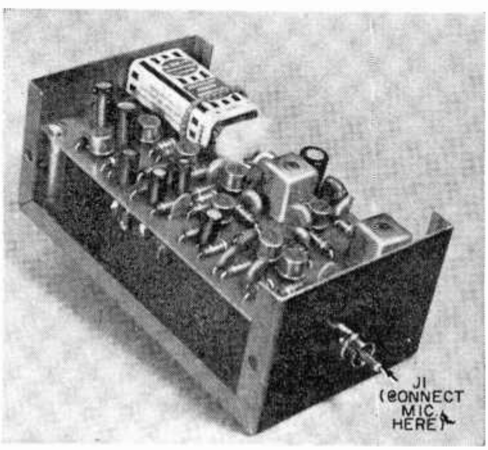
Because of the critical space limitations on the board, the Parts List gives rather complete specifications for all capacitors. Try to pick up the exact units listed—but if you can't, be sure that whatever you do buy will fit. Keep in mind that the voltage ratings for the electrolytics are fairly critical, but anything over ten volts will do for the other capacitors.

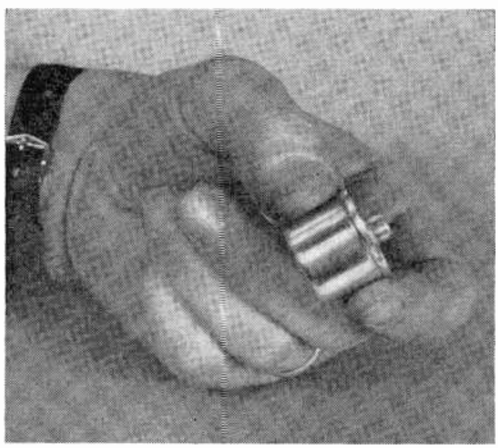
There should be no problems in hooking up the components. The transistors and coils will only fit one way, and, with the exception of the electrolytics, there are no polarities to worry about. Polarities for each electrolytic capacitor must be carefully checked before you solder them in place.

For soldering, use an iron rated at no more than 50 watts—and be careful not to apply it for too long at any one spot. Excessive heat will cause the copper to

(*Continued on page* 116)

After unit is wired (left, below), close up chassis box to protect parts, then connect microphone (right) to jack J1, plug in headset, and advance volume control until a rushing sound is heard.

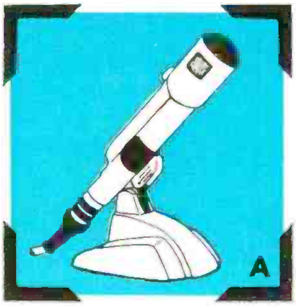




ELECTRONIC PHOTO ALBUM QUIZ

Here's an odd photo album: our electronics-minded artist replaced every photo with a drawing, but each drawing bears some relation to the name of the man whose photo it replaced. Can you match the drawings with the given names below?

By ROBERT P. BALIN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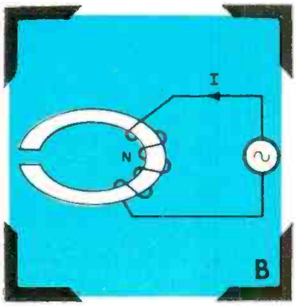

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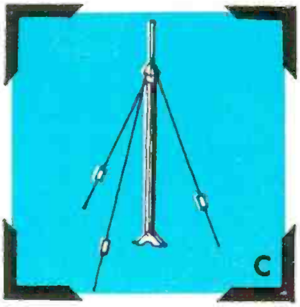
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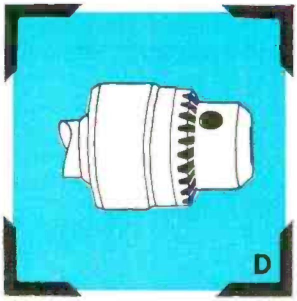
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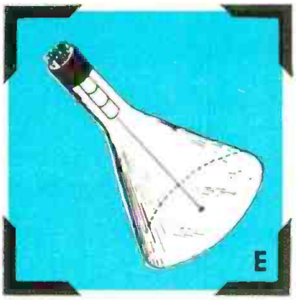
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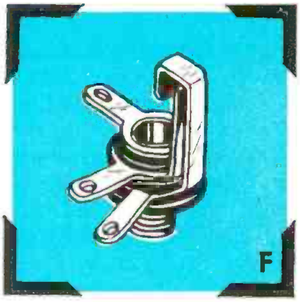
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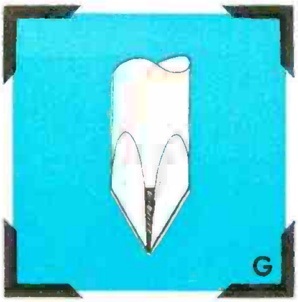
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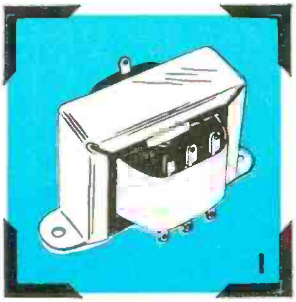
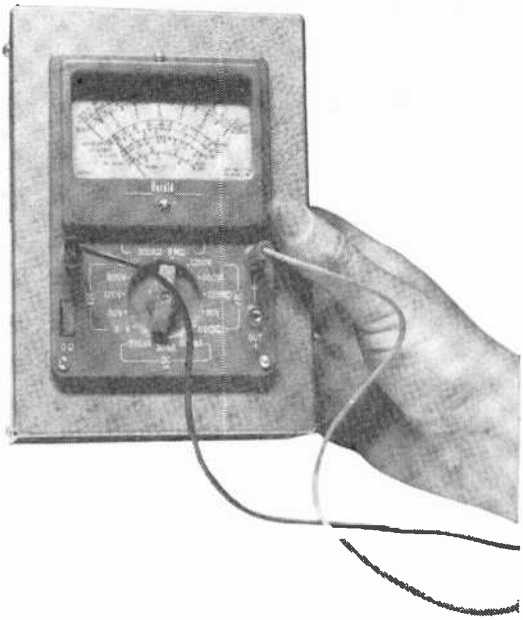

I

(*Answers on page* 102)

1 Jack F 2 Henry I 3 Ray E 4 Gilbert B 5 Chuck D

6 Mike A 7 Phillips G 8 Allen H 9 Guy C

THE CASE OF THE ALUMINUM ALLY



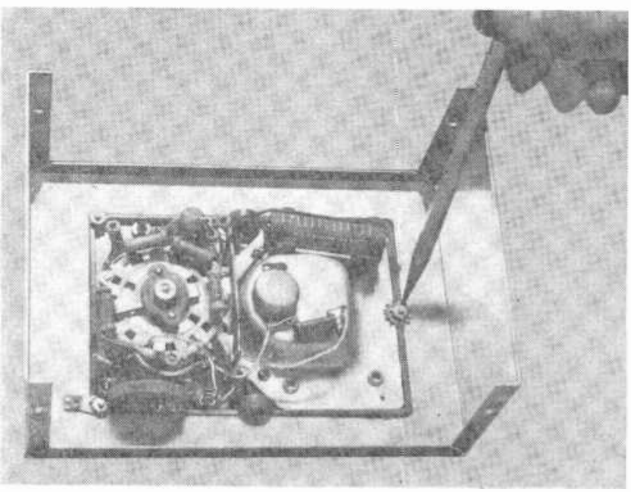
THE PLASTIC CASES used in the construction of low-cost multi-testers such as the VOM have brought into existence a new breed of electronics experimenter—the "cracked-case VOM carrier." Replacement cases simply aren't available. The solution to the situation? Just call on your aluminum ally, the utility chassis box, to house the useful remains of your VOM.

Going about it is quite easy. First, examine the damaged case. In most instances, the plastic box itself is the damaged part; if it is, discard the box. If the front plastic piece which holds the meter, switch, and pin jacks is also damaged, carefully cement this piece with a good-quality epoxy resin.

Now select an aluminum chassis box about ½" larger in each dimension than the original meter case. *Measure* a hole in the cover of the case that will pass the parts mounted on the VOM, leaving a good margin of safety. But remember, if you cut too large a hole, you'll have to start all over again with a new box.

Once the VOM face fits neatly in its new case, secure it in place. The author's VOM had pre-drilled holes which permitted the use of ½"-long screws and nuts to bolt the meter face to the case. Do *not* drill any holes in the delicate plastic VOM face. Instead, resort to epoxy resin cement—you'll have to wait from 4 to 12 hours for the cement to take hold.

Before fitting on the rear cover of the chassis box, weigh the assembly in your hand. If the VOM lacks "heft," you may want to bolt down an old audio or power transformer in the bottom of the case to prevent it from tipping over while in use. —*Homer L. Davidson*



You can cut the VOM mounting hole in the aluminum box face by using the tried-and-true method of drilling many holes edge to edge, knocking out the unwanted center piece, and filing the rough edges smooth. But the job will be much quicker and easier with a square chassis punch or an Adel hand "nibbling" tool. Author took advantage of existing holes in VOM to secure it to the front panel of the "aluminum ally."

LITTLER THAN LILLIPUT

The story of the microminiature in today's electronics

THE SCENE is a radio-TV service shop of the future. The technician wears white coveralls, a tight-fitting headpiece, thin gloves, and special covers for his shoes. He works in an atmosphere that is dust- and lint-free, temperature-controlled, and air-conditioned. His "workbench" is a vacuum-box equipped with tweezer-type micro-manipulators, a binocular microscope, and an electron-beam welder/etcher. Missing are such present-day tools as long-nose pliers, diagonal cutters, and a soldering iron. Missing, too, are stocks of individual components—such as resistors, capacitors, coils, diodes, and transistors. Instead, the technician tests and replaces *complete multi-stage elements* so small that an entire receiver circuit scarcely covers a dime.

Impossible? Not at all. In fact, prototypes of this future "service shop" are already in use in the research and development laboratories of several manufacturers—staffed by engineer/technicians who inspect, test, and modify circuits which are no larger than the head of a pin.

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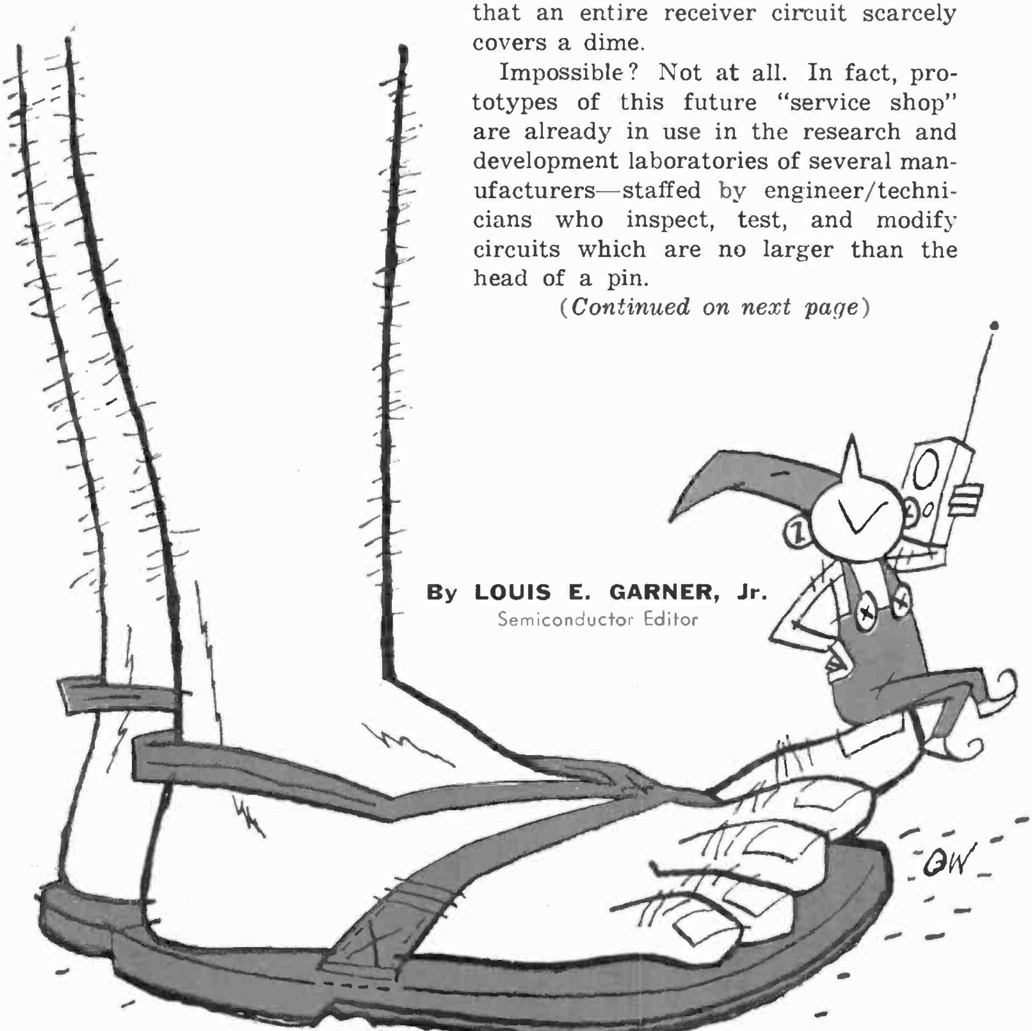
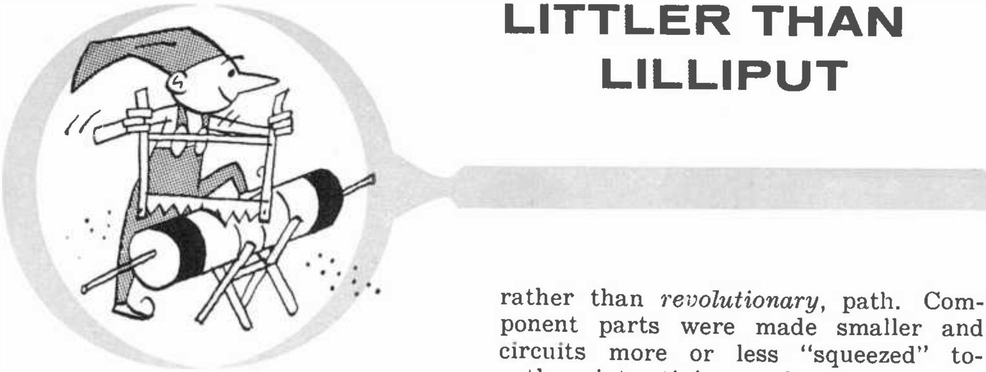


By **LOUIS E. GARNER, Jr.**
Semiconductor Editor



LITTLER THAN LILLIPUT

For decades, science-fiction writers and comic-strip artists have envisioned all sorts of ultra-miniature electronic equipment. Among these items have been rocket navigational systems and computers no bigger than cigar boxes, tiny "spy" television cameras concealed in cigarette cases, and vest-pocket-sized two-way radios.

As is often the case, however, science has a way of overtaking and surpassing its prophets. If current progress in miniaturization is any criteria, even Dick Tracy's two-way wrist radio will turn out to be "oversized." The reason: it may one day be possible to assemble a two-way radio in an ordinary *finger ring*!

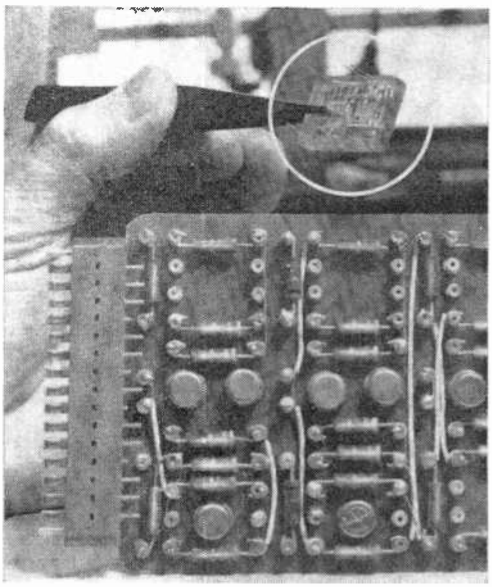
Evolution. Before examining the current situation, let's turn back the pages of history. The trend towards circuit miniaturization began long before World War II. It was evidenced, in part, by the introduction of "miniature" vacuum tubes for conventional applications and "subminiature" tubes for compact equipment, such as hearing aids. Quite understandably, this trend was given tremendous impetus during the war. The result was development of a hand-held transceiver (the *handie-talkie*) and the now-famous *proximity fuse*—a transceiver so small that it could nestle within the nose of a bomb or an artillery shell.

For nearly two decades, progress towards equipment miniaturization followed a gradual, or *evolutionary*, rather than *revolutionary*, path. Component parts were made smaller and circuits more or less "squeezed" together into tinier packages. But the components still resembled their full-sized counterparts, and conventional wiring techniques were employed.

A giant step forward came with the invention of the transistor. This device and its related semiconductor "cousins" —coupled with etched wiring and tiny low-voltage, low-power components— permitted the production of *subminiature* circuits. And the results have been truly fantastic.

A little over a decade ago, for example, the common hearing aid was about the size of a pack of cigarettes and weighed several ounces. But today's transistorized hearing aid weighs only a small fraction of an ounce and occupies about one-fifth of a cubic inch!

Today, two factors have made further miniaturization a prime goal. One is the



Microminiature electronic module (in circle) performs same functions as circuit board below it, also employs 35 components, yet is 1/47th the size!

Minneapolis-Honeywell

Minneapolis-Honeywell

RCA

Space and military applications claim the bulk of current "microminiature" production. New general-purpose digital computer (shown undergoing visual inspection above, left) was designed for inertial guidance systems. "Micropac" (above, right) contains nearly 2000 micromodules, will be used by U.S. Army Signal Corps. At right is a PRSG (pseudo-random sequence generator) which makes 300 million "logic decisions" each second.

Bendix

increasing *complexity* of electronic equipment—a typical computer uses tens of thousands of components and may well fill a small room, even when transistorized and assembled with conventional subminiature components.

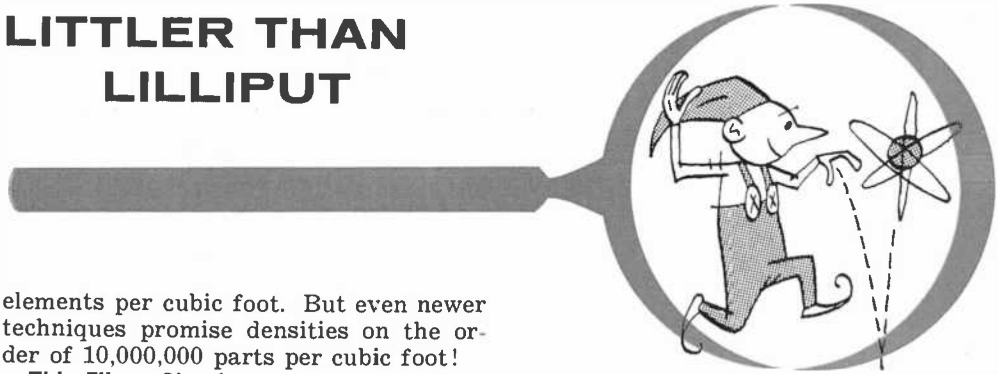
The second factor is the increasing need for a very short signal *response time*, particularly in computers and high-frequency radio circuits. Regardless of the speed at which individual circuits are made to function, a certain amount of time is required for a signal to travel from one part of the equipment to another. As a general rule, if the equipment is made smaller, physically, the signal path is reduced and the operation made speedier.

Revolution. An unprecedented effort at further circuit miniaturization is now being made by a number of manufacturers. The problem is being attacked on three broad fronts: (a) the use of *thin films*; (b) the production of *microcircuits*; and (c) the development of *solid-state* circuits. The final aim is the large-scale commercial production of low-cost, extremely reliable circuits which are microscopic in size (hence, *micro*miniaturization).

To this end, the concept of circuit *integration* has been adopted by most firms. In essence, an integrated circuit is simply one in which the various elements are manufactured and interconnected as a unit—there are no separate resistors, capacitors, coils, and wiring as such. This in itself is a revolutionary concept, since past efforts at miniaturization generally have been based on the use of individual components.

The key phrase in these efforts is *component density*, i.e., the number of individual circuit elements which can be packaged within a cubic foot (or a cubic inch). Not too long ago, in the days of the subminiature tube, a density of 6000 components per cubic foot was considered pretty good. With the invention of the transistor, maximum component density rose to about 100,000

LITTLER THAN LILLIPUT

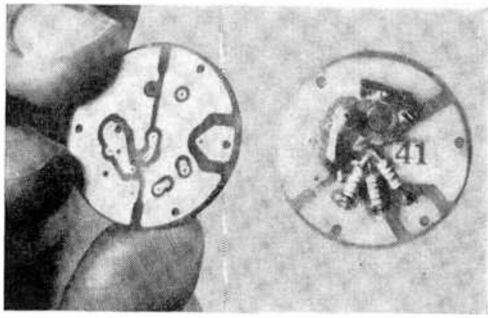


elements per cubic foot. But even newer techniques promise densities on the order of 10,000,000 parts per cubic foot!

Thin-Film Circuits. Many scientists and engineers consider the use of thin films as the first true approach to genuine integrated circuitry, since this technique permits almost all circuit components and wiring to be formed as a direct part of the manufacturing process. As the name implies, a *thin-film* circuit is one made up of ultra-thin metallic films deposited on an insulating base called the *substrate*. These films, which can be comprised of such metals as gold, aluminum, and tantalum, are unbelievably thin—actually one-hundredth as thick as the finest rolled or beaten foil.

Any of several techniques can be used in forming the thin film, but the three most popular are *electroplating*, *evaporation*, and *sputtering*. Of these three, electroplating is quite similar to the methods used in more conventional work except for scale. Currently, the most popular technique is evaporation. Here, the raw material is heated to the boiling point in a crucible placed within a high vacuum chamber. The heated material boils off and condenses on the substrate suspended above the crucible in the same chamber. Unfortunately, some metals are difficult to evaporate, and it is with these materials that the sputtering process is employed. In sputtering, atoms of the metal are splashed onto the substrate by bombarding the raw material with gas ions accelerated by a strong electric field.

Regardless of the basic film forming process used, the circuit elements and interconnections are produced by arranging the film(s) in a precise pattern. Often, several film layers are employed, each in a different pattern, to produce resistors, capacitors, and circuit wiring. The circuit patterns can be developed by a photoengraving and etching proc-

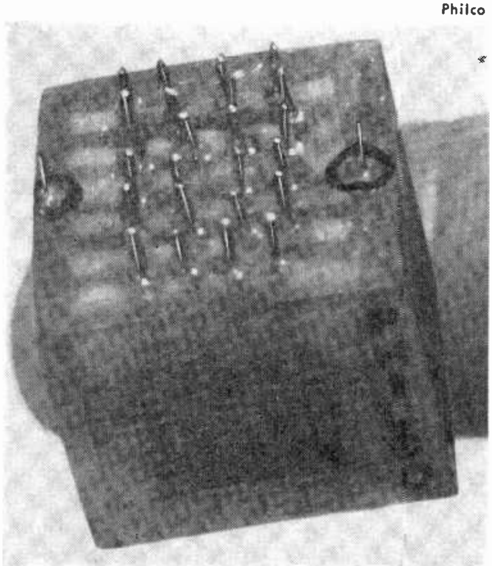


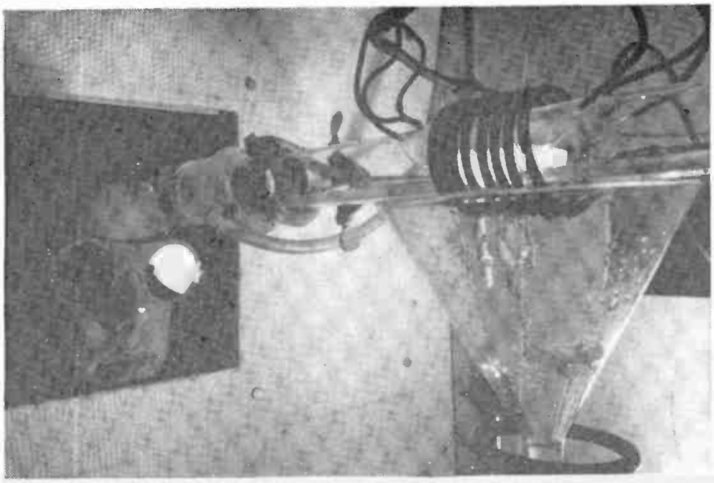
General Electric

Tunnel diode transistor modules for new computer employ subminiature versions of standard parts.

Circuit wafer for diode commutator contains 16 diodes and four resistors, easily rests on finger tip.

Philco





Minneapolis-Honeywell photos

Testing microelectronic circuit materials is a highly exacting science in itself. Above, scientist wearing special glasses monitors preparation of silicon base material for a micro-circuit. At right, researcher subjects thin-film semiconductors to air pressure only one-millionth that at sea level.

ess, applied to a continuous film. Or they can be formed during the original film deposition by interposing a "mask" between the substrate and source of metallic atoms. The latter process is roughly analogous to the use of a stencil for printing.

Production of a typical thin-film circuit begins with thin tantalum and gold films applied to the insulating substrate (glass in this case). Next, the basic circuit pattern is formed by photoengraving and etching techniques, using suitable masks. With the basic circuit pattern established, *passive* components (such as resistors and capacitors) are formed by selective oxidation and anodization of parts of the metallic film. In the last steps, *active* elements (such as diodes and transistors) are inserted and final connections made through the evaporation of aluminum electrodes. As a rule, scores (or even hundreds) of circuits will be processed at the same time.

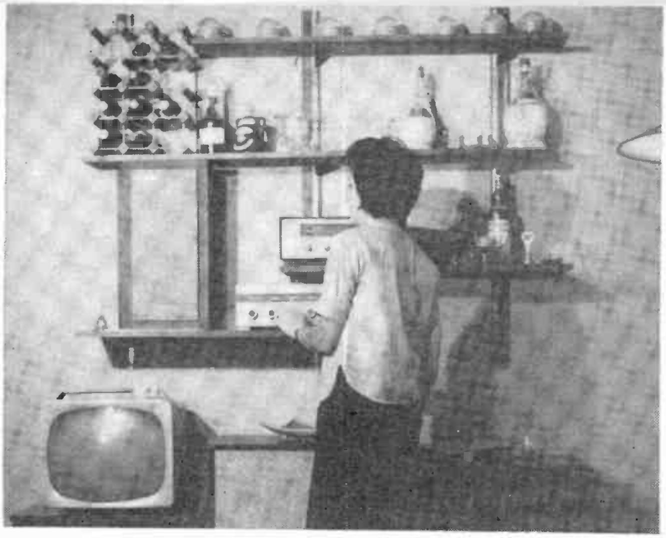
Generally speaking, thin-film techniques have been suitable only for the deposition of circuit wiring and the production of passive components . . . resistors, capacitors, and coils. This means that it's been necessary to produce the active elements (diodes, tunnel diodes, transistors, etc.) separately and then insert these units in the basic assembly during the last production steps. This process is a costly one, of course, and several firms are striving to develop practical methods which will permit the formation of active as well as passive components with thin-film methods.

Micro-Circuits. Another popular technique for manufacturing microminiature circuits is based on the use of conventional transistor assembly methods. The active "heart" of a modern small-signal diode or transistor is a tiny chip of semiconductor material about the size of a pinhead—and thus extremely small compared with the header and case in which it's mounted. This fact first led a number of semiconductor manufacturers to assemble several transistors and/or diodes in a single standard-sized case, providing additional contact leads for the extra units.

Later, several firms started interconnecting the various elements to form such basic circuits as direct-coupled amplifiers, diode matrices, complementary amplifiers, flip-flop's, Darlington stages, and choppers. Externally, the completed circuit assembly is the size and shape of a conventional transistor package,

(*Continued on page* 98)

FOOL-PROOF SPEAKER KIT

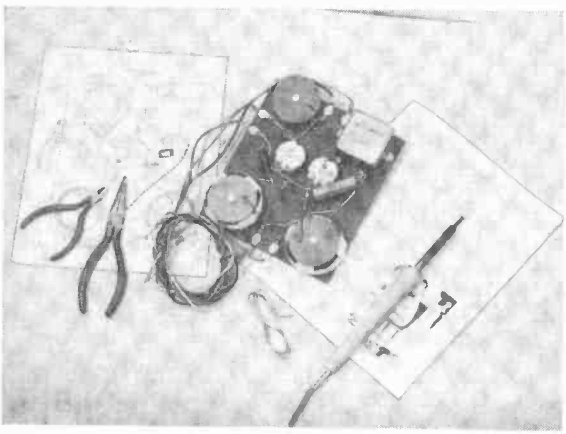


Whether it's standing on end or lying flat, the Model SK-4 both looks and sounds great.

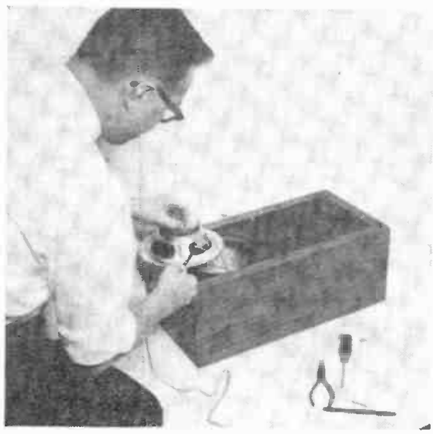
PUTTING the label "foolproof" on a kit is something anyone would hesitate to do, but the H. H. Scott Model SK-4 wide-range speaker system clearly rates one. A minimum of hand tools plus a small soldering iron are all you need to wire up the crossover network, mount it in the factory-finished cabinet, mount and connect the three speakers (woofer, mid-range, and tweeter), and tack on the grille cloth. Then you'll be ready for the "boom-tweet-tweet" of your favorite waltz. (You'll have to build two SK-4's if you own a stereo system, of course.)

In independent listening tests, the SK-4 and a speaker system valued at over $250.00 were connected to the outputs of a stereo amplifier. Single-channel FM programs were fed to one speaker and then the other as qualified listeners rated each speaker. The SK-4 scored par or better except below 100 cycles where the higher priced unit's 10-cu. ft. content made its lows just a bit rounder and mellower. But, considering the cost of the SK-4 (only $79.95), it's an excellent performer. It's available from H. H. Scott, Inc., 111 Powdermill Rd., Maynard, Mass.

Most of the two-hour construction time required is spent in wiring up the two-control multiple-crossover network.



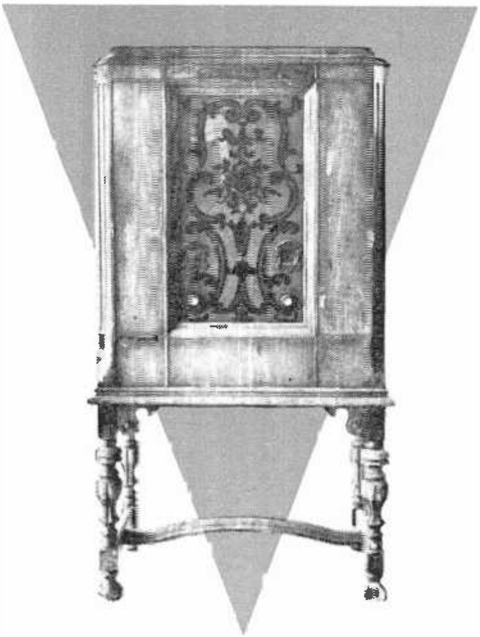
Color-coded wires and terminals eliminate the possibility of improper speaker phasing.



"... and don't forget the Shoe Polish"

Old cabinets make perfectly acceptable baffles—and check out as one of the big bargains in hi-fi!

By DAVID B. WEEMS



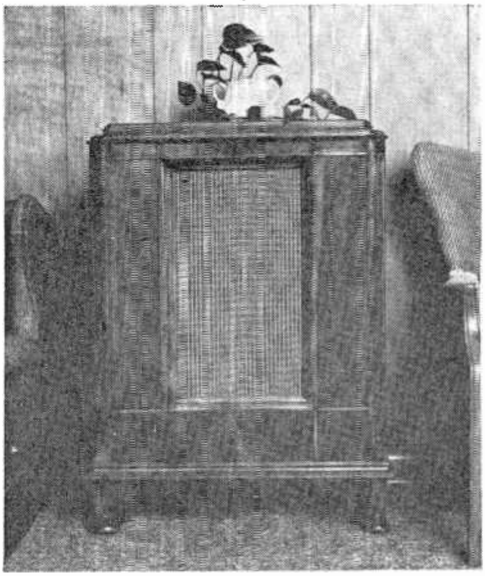
STICK with shoe polish if you want to save money on hi-fi!

Salvaging electronic parts from old radio and TV sets seems to be a fairly common practice with experimenters—but all too often the procedure resembles eating the core and discarding the apple. This was first suggested to me when a lady, whose hobby is interior decorating, drew my attention to the beauty of an empty console of mine that was waiting for the incinerator.

She didn't exactly "convince" me, but I did look more carefully at the wood graining of a side panel. Then I removed the sides and top and put them back together as a contemporary-styled, bass-reflex speaker enclosure (the pieces served the same purpose as prefinished plywood).

After that, I took a new look at old radio cabinets. Many were worthless in every respect, of course; others provided only bits of choice woods. But a good many of those old sets had far more "baffle value" than I had even begun to guess!

One day I generously offered to build an extra speaker enclosure for a relative's hi-fi system. His wife said, "Fine—but remember that I don't like modern furniture." Since contemporary furniture with its simple lines is relatively easy to build with a minimum of equip-



Old radio (above, right) looks pretty unpromising, but see what a little minor surgery and two coats of satin varnish produced (right)! Although this radio was picked up for only $3.50 at a local second-hand store, it was turned into a bass-reflex enclosure worth much more.

First step in revamping an old radio cabinet is to remove the "works." The old field-coil-type speaker and the "ten-ton" chassis have to go, but the shelves can be left to serve as braces.

Structural alterations should be completed before you start refinishing. In most instances, these will entail cutting off legs and adding additional bracing.

ment, I was naturally dismayed. Then I remembered the lady decorator's comment. It had been made several years before, but I think that much time was required for me to overcome my prejudices.

There were no old cabinets on hand, so I visited the local second-hand stores and found a badly treated old radio. It cost me just $3.50, and it didn't look worth a cent more. But with a minimum of carpentry and some refinishing, the immediate problem was solved.

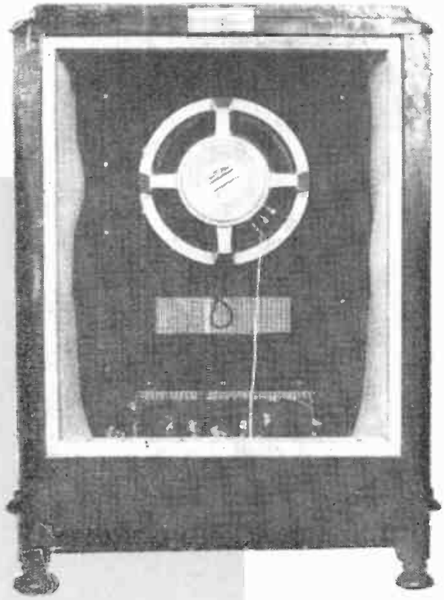
Finally, I realized the great potential lying around us in old radios and (where available) Victrola cabinets. These are made to order for hi-fi or stereo, especially if you don't have much in the way of shop equipment. All it takes is a little looking and a little imagination, both of which I had neglected for far too long.

Cabinets for Sale? In some localities, the biggest problem is finding suitable cabinets. If your town has a store operated by Good Will Industries, that might be a good place to begin. Other sources are church rummage sales, auctions, and open-air "flea markets."

A few hints may help you to know what to look for. Obviously, the design, the kind of wood, and other esthetic considerations can only be determined by your own personal taste. Much will depend on how and where you intend to use the cabinet.

The construction is more important. Check the thickness of the sides and

Last step is to mount your new hi-fi speaker, pad a little, tune a little, and let 'er rip! Foam plastic is damping material here, with cheesecloth-wrapped fiberglass on back panel.



Old finish can be removed, if necessary, although shoe polish may save you the time and trouble. Exact procedure will depend on kind of finish you're after.

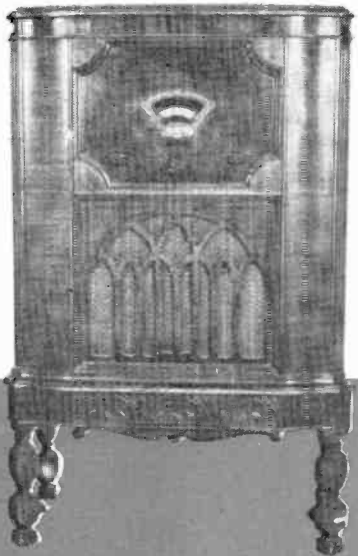
top. Other factors being equal, always choose the heavier woods, especially for speaker cabinets. But this doesn't mean you must necessarily reject a cabinet made of ¼" plywood, since it can be braced by bonding cheap ½" plywood or even Celotex to the inside walls.

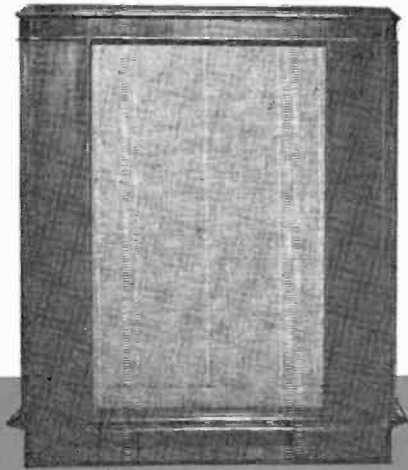
In general, the older the cabinet, the heavier the wood. Many will have walls of ¾" solid core veneer construction. This isn't as good as ¾" plywood, of course, but it's certainly adequate with Celotex glued to the inside walls. The veneers are usually walnut or mahogany and are quite handsome when refinished.

Old Victrolas are obvious candidates for equipment cabinets. However, you may have trouble locating one in some areas. And even if you find one, it may be too expensive. I purchased a really good one for $5.00 when a young friend told me about seeing it stored in a shed. And this, incidentally, is a good way to locate sets. Tell people that you're interested—children are often good agents, since they won't buy it first!

The Unexpected. You sometimes stumble across some weird items at rummage sales and auctions, so it pays to be careful. A couple of examples will serve to prove my point.

Once I paid about $6.00 for a cabinet that, superficially, appeared to be an old Victrola with a record changer in the top. Several people looked somewhat disbelievingly at me, and on close inspection I could see why. The record changer was worn out, and the cabinet





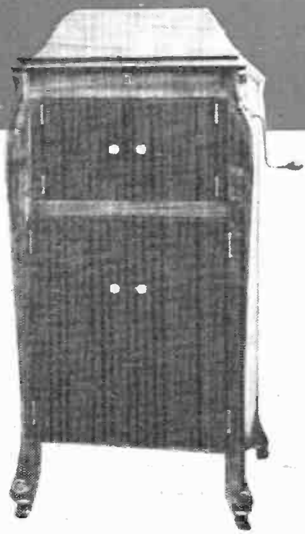
These "before and after" shots are proof enough of what can be done with "ugly ducklings." And here's the clincher: this cabinet received only a coat of shoe polish after the "gingerbread" and legs were removed.

was in really bad condition. But the next day I found a sealed compartment with a shielded cable attached. Inside was a gleaming chrome hi-fi amplifier of a quality brand. It would be interesting to know the odds on that happening again!

Actually, it's much more likely that the opposite will occur. I once paid a premium price for a piece of merchandise because it was described as having a "variable speed 33⅓-rpm transcription turntable with a magnetic pickup." The turntable was 33⅓ all right—complete with spring-loaded governors and built-in flutter! The "magnetic pickup" was of a design so ancient that the magnet was actually made in the shape of a horseshoe and just about as large. The

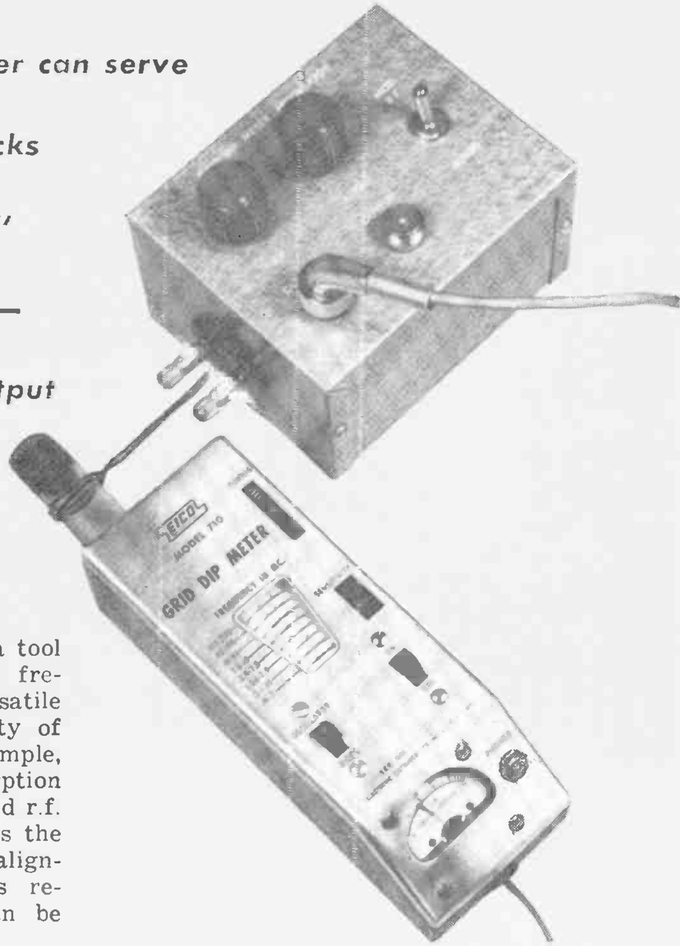
(*Continued on page* 106)

The hand crank on this relic may look inviting, but don't be misled: the motor inside the cabinet is 100% a.c.-operated, and hysteresis-synchronous at that! Amplifiers and tuner are tucked away on shelves below.



GRID DIP MODULATOR

Though any grid dip meter can serve as an r.f. generator, it lacks an important "something" that this gadget supplies—modulation for its r.f. output



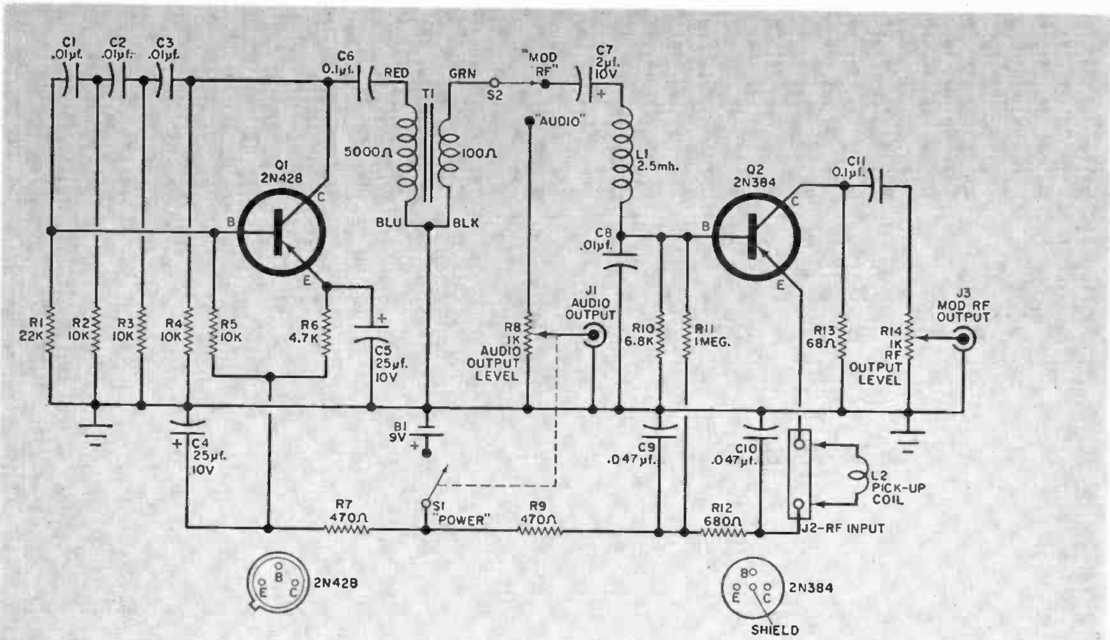
By **CHARLES CARINGELLA**
W6NJV

THOUGH designed primarily as a tool for determining the resonant frequency of tuned circuits, the versatile grid dip meter has a wide variety of other uses. Most models, for example, can also be employed as an absorption wavemeter, modulation monitor, and r.f. generator. This last function makes the GDM an excellent instrument for aligning broadcast or communications receivers—provided that a way can be found to modulate its r.f. output.

In approaching the problem of adding modulation to his GDM, the author decided to avoid making any changes in the unit itself. The result: a neat little battery-powered, transistorized gadget which couples to the output of any grid dip meter. It mixes an audio tone (about 1000 cycles) with the meter's output, and makes the resulting modulated r.f. signal available at a convenient front-panel connector. A flick of a switch converts this handy device into a fixed-frequency audio generator for checking amplifiers and the like.

About the Circuit. The modulating audio signal is generated by transistor *Q1*, which operates as a phase-shift oscillator. Frequency of oscillation is determined by a three-section phase-shift network connected between the collector and base of this transistor.

With the parts values specified, a tone of about 1000 cycles is produced. If a lower frequency is desired, it can be obtained by increasing the capacitances of *C1*, *C2*, and *C3*; for a higher frequency,



PARTS LIST

B1—9-volt battery (Burgess 2U6 or equivalent)
C1, C2, C3, C8—0.01-μf. paper capacitor, voltage not critical
C4, C5—25-μf., 10-w.v.d.c. electrolytic capacitor
C6, C11—0.1-μf. paper capacitor, voltage not critical
C7—2-μf., 10-w.v.d.c. electrolytic capacitor
C9, C10—0.047-μf. paper capacitor, voltage not critical
J1, J3—Chassis-mounting microphone receptacle (Amphenol 75 PC1M or equivalent)
J2—2-terminal binding post assembly (National FWH or equivalent)
L1—2.5-millihenry r.f. choke
L2—Hand-wound pickup coil—see text
Q1—2N428 transistor (G.E.)
Q2—2N384 transistor (R.C.A.)
R1—22,000 ohms
R2, R3, R4, R5—10,000 ohms
R6—4700 ohms all resistors ½ watt
R7, R9—470 ohms
R8, R14—1000-ohm potentiometer
R10—6800 ohms
R11—1 megohm
R12—680 ohms
R13—68 ohms
S1—S.p.s.t. switch (on R8)
S2—S.p.d.t. toggle switch
T1—Transistor output transformer; primary, 5000 ohms; secondary, 100 ohms (Argonne AR-111 or equivalent)
1—5" x 4" x 3" aluminum utility box (Bud CU-2105-A or equivalent)
1—3^11/16" x 4^3/16" section of perforated board (cut from Vectorbord 32AA18, or equivalent)
Misc.—Knobs for R8 and R14, spade lugs, push-in terminals for perforated board, battery connector, battery clamp, wire, solder, etc.

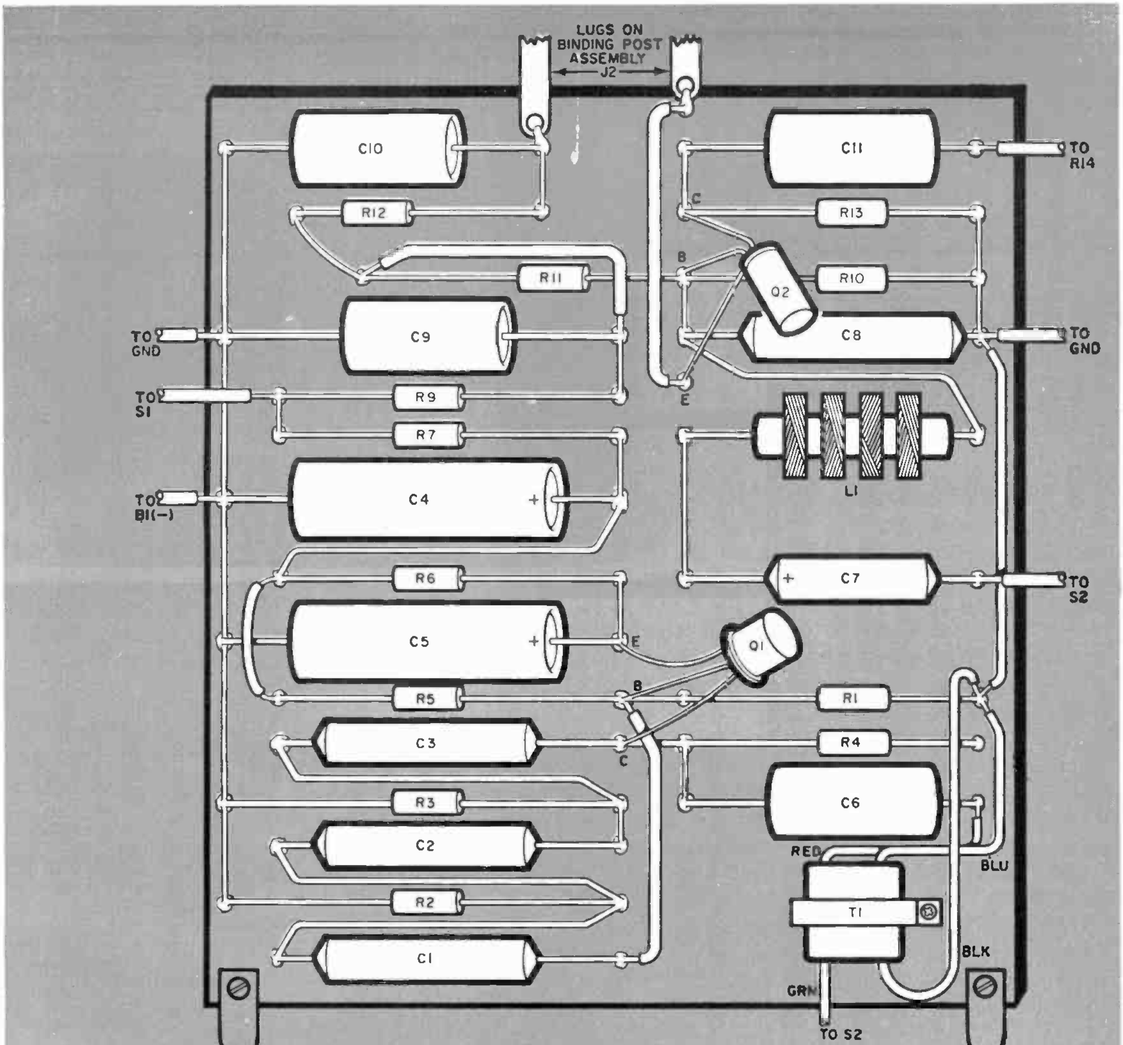
make the same three capacitors smaller.

Approximately 0.3 volt (peak-to-peak) of audio is available across the 100-ohm secondary of transformer *T1*. With switch *S2* in the *Audio* position, this output is fed to *Audio Output* jack *J1*. Potentiometer *R8* then varies the voltage appearing across *J1* from zero to the full 0.3 volt.

When the device is being used as a modulator, *S2* is placed in the *Mod. R.F.* position (as shown). This couples *T1*'s secondary to the base of transistor *Q2*. And, with "pickup coil" *L2* placed near the GDM's output coil and connected to jack *J2*, r.f. from the grid dip meter is coupled to the emitter of the same transistor.

Connected in this way, *Q2* amplifies the r.f. signal picked up by *L2* and mixes it with the audio signal generated by *Q1*. The amplified, modulated r.f. output of *Q2* is made available at jack *J3*. Potentiometer *R14* controls the output level.

The maximum level at *J3* depends, of course, on the GDM used and on the size and placement of *L2*. Employing an EICO Model 710 grid dip meter, the author found that he could obtain a

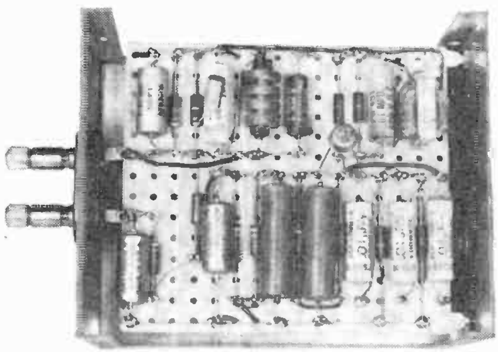


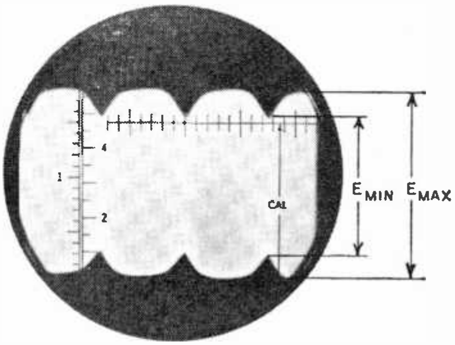
Parts are mounted on a 3 11/16" x 4 3/16" Vectorbord pre-punched terminal board. Wire leads from board should be at least 6" long.

maximum of about half a volt (peak-to-peak) of modulated r.f. from *J3*. For *L2*, he used two turns of hookup wire wound to about the same diameter as the GDM output coil and placed about an inch from it.

Construction. Potentiometers *R14* and *R8/S1*, jacks *J1* and *J3*, and switch *S2* are mounted on the front panel of a 5" x 4" x 3" aluminum utility box. Jack *J2* is placed on one of the ends of the box, and battery *B1* is located at the other end. Install all the remaining components on a 3 11/16" x 4 3/16" section of perforated circuit board.

Completely wired circuit board mounted in unit is carbon copy of details in drawing above.





To determine the percent modulation possible using the Grid Dip Modulator with any grid dip meter, connect the modulated output from jack *J3* to the vertical input of a wideband oscilloscope. Then, with a 4-mc. signal from the GDM being fed to pickup coil *L2*, the scope pattern shown at left can be "sync'd" in. Measure the length of E_{min} and E_{max} on the face of the scope and insert these quantities into the following formula:

$$\% \text{ Modulation} = \frac{E_{max} - E_{min}}{E_{max} + E_{min}} \times 100$$

Using the Grid Dip Modulator and the EICO Model 710 grid dip meter, the author was able to obtain an r.f. signal with 14% modulation—adequate for all practical purposes.

A pictorial diagram and photograph illustrate the parts placement and wiring on the circuit board. The use of terminals (about 50 are required) which push into the perforations facilitates construction. All of the interconnections are made on the component side of the board, and only seven leads leave the board for connection to other parts of the unit.

One end of the board is secured to the box by means of two of its terminals, which are soldered directly to the lugs of *J2*. The other end is fastened by two spade lugs, which are bolted to its corners.

The transistors are soldered directly into the circuit, and care should be taken not to overheat them while soldering to their leads. The battery is held in place by an "L" clamp bent from scrap metal.

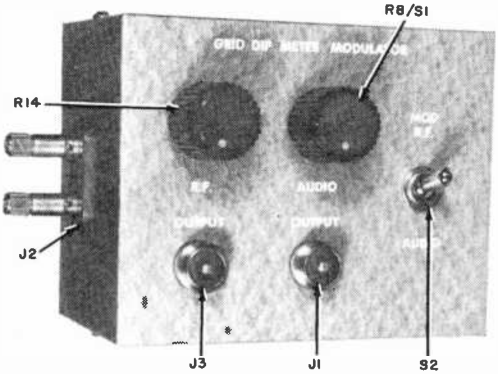
Operation. To use the device as a fixed-frequency audio generator, first turn on *S1*. Then switch *S2* to *Audio,* and pick up the signal from *J1* via a mike connector and shielded cable. Potentiometer *R8* controls the output level.

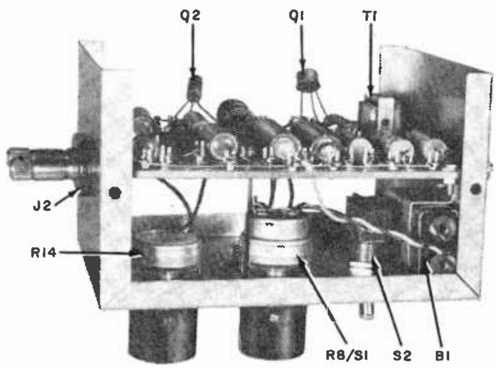
For operation as a GDM modulator, a pickup coil (*L2*) is connected across *J2*. (Details on this coil were given in the "About the Circuit" section.)

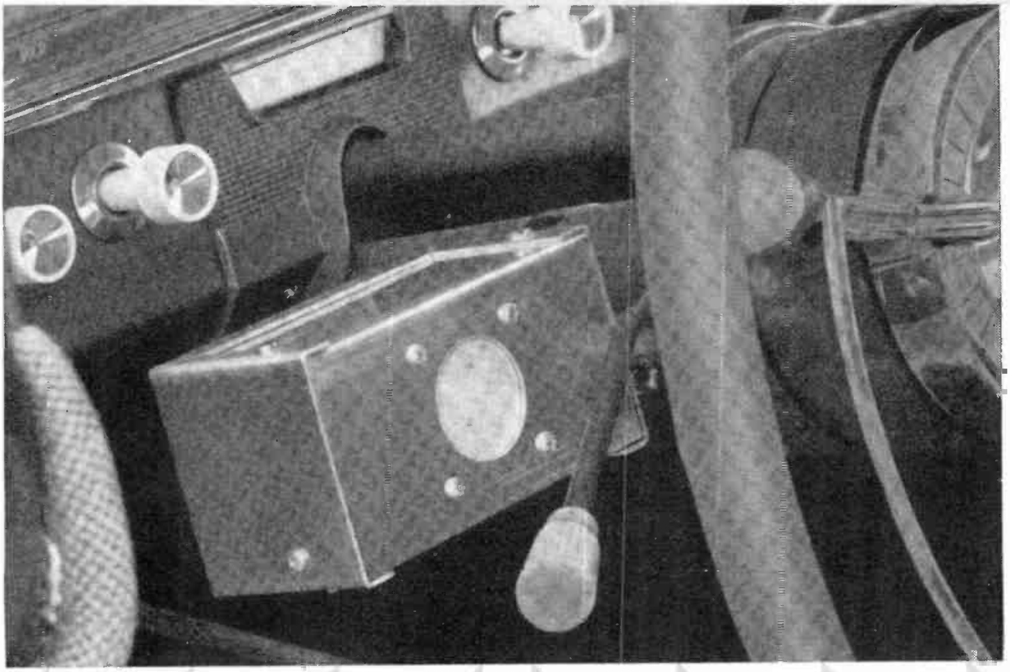
With *L2* in place, turn on *S1*. Then switch *S2* to *Mod. R.F.* and pick up the modulated r.f. signal from *J3*. Since *Q2*'s output impedance is quite low, the shielded lead connected to *J3* can be several feet long with no appreciable signal loss. If you don't get enough output, even with level control *R14* at maximum, try decreasing the distance between *L2* and the GDM output coil.

Though the device was designed for use with a grid dip meter, it will modulate r.f. of similar level from any other source. Its efficiency is quite good up to 50 mc., adequate to about 150 mc. –30–

Mount the parts on the chassis box cover as shown in the photos below. Attach leads from circuit board to mounted parts and then secure board inside cover. Fashion a small battery clamp to tie down B1.







THE BLINKER MINDER

Transistorized gadget emits an audible beep whenever your car's turn-signals are on

By FREDERICK J. HAINES*

HOW MANY TIMES have you observed the driver ahead "poke" along mile after mile, turn-signals blinking away, confusing everyone and making you hesitant to pass him? Now think back and ask yourself, "How many times have I done the same thing?"—inadvertently, of course!

The mechanical turn-signal canceling device in your auto *usually* takes care of the situation. But with the advent of limited-access superhighways and freeways, the 45° turn is now commonplace—on entering or leaving via a ramp, for example. And you've probably noticed that the "canceler" doesn't always cancel under these conditions.

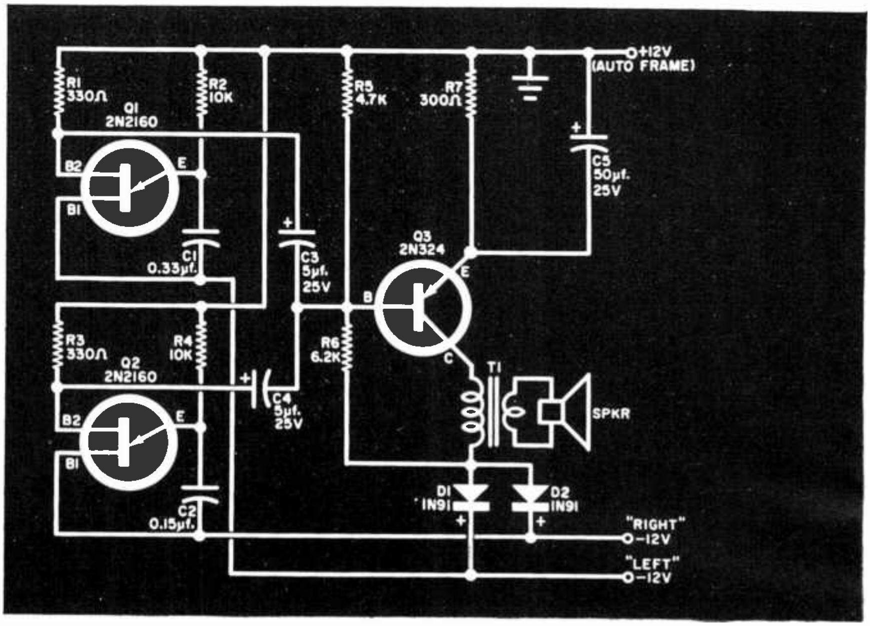
True, the flasher unit in some cars emits an audible click to remind you that the lights are blinking, but other cars have these devices mounted in the engine compartment where they can't be heard. In addition, if the windows are open and your speed is high or traffic noise is great, you can't hear flasher clicks anyway.

"Well," you say, "all I need to do is glance at the green arrows that light up on the dashboard when the signals are on." This is a fine idea, but don't you find it difficult to see them on a bright day? And isn't it a safety hazard to take your eyes from the road? If you agree, then you'll want to build and use the "Blinker Minder."

The idea behind the Blinker Minder is simple enough—have a speaker mounted

*Closed Circuit Television Engineering
Technical Products Operation
General Electric Co., Syracuse, N.Y.

Fig. 1. Schematic diagram of "Blinker Minder" for autos having "positive" grounds. Transistors Q1 and Q2 are new "unijunction" types made by General Electric; "B1" and "B2" indicate "base 1" and "base 2," respectively.



near the driver to provide two different audio tones controlled by the left and right turn-signal circuits. A low-pitched tone for the left flasher and a high-pitched tone for the right let you know which way your signals are set without your even looking up from the road.

It's interesting to note that the device helps develop good driving habits, too—it's such fun to use that you never "forget" to signal. A "bonus" feature of the device is that the flasher usually slows down or stops if a signal bulb burns out, and this fact will be readily apparent to any driver using the Blinker Minder.

In a sense, there are really two Blinker Minders, and two schematic diagrams are provided here; Fig. 1 is for autos having an electrical system with a positive ground and Fig. 2 is for those with a negative ground. Unfortunately, six volts isn't enough to operate either Blinker Minder at full volume. However, this is of no great consequence, since the great majority of vehicles on the road today are equipped with 12-volt batteries.

Construction. A 2¼" x 4" x 2¼" miniature case houses the author's Blinker Minder. The speaker, a miniature type used in pocket radios, is mounted in one section of the case; the speaker opening is covered with a square of cloth, glued in from the rear, of a color to match or blend with the car's interior decor.

The transistor sockets and several tie-strips accommodate the components and are placed in the other "half" of the case. Wiring and layout can be varied to suit your preference or to allow for parts which deviate physically from those shown in the photos.

Take care to wire your Blinker Minder to suit the battery circuit used in your automobile. If the wrong polarity is applied to the Minder, it's likely that the three transistors will be retired from active duty, but permanently! As a precaution, it's a good idea to measure the voltage from the dashboard light circuit with a voltmeter, and note the polarity of the meter leads.

A stainless steel hose clamp is fitted to the side of the case with two *4-40* machine screws, lock washers, and nuts. (*Two* screws are used to prevent rotation of the unit after it's clamped on the left side of the steering column just under the turn-signal lever). As a matter of fact, it's extremely important to use lock washers throughout the unit to prevent "vibration failures."

After installation, check with an ohmmeter on the low-ohms scale to insure that the hose clamp mounting has provided a good contact to the auto frame. If not, scrape a bit of the paint off the

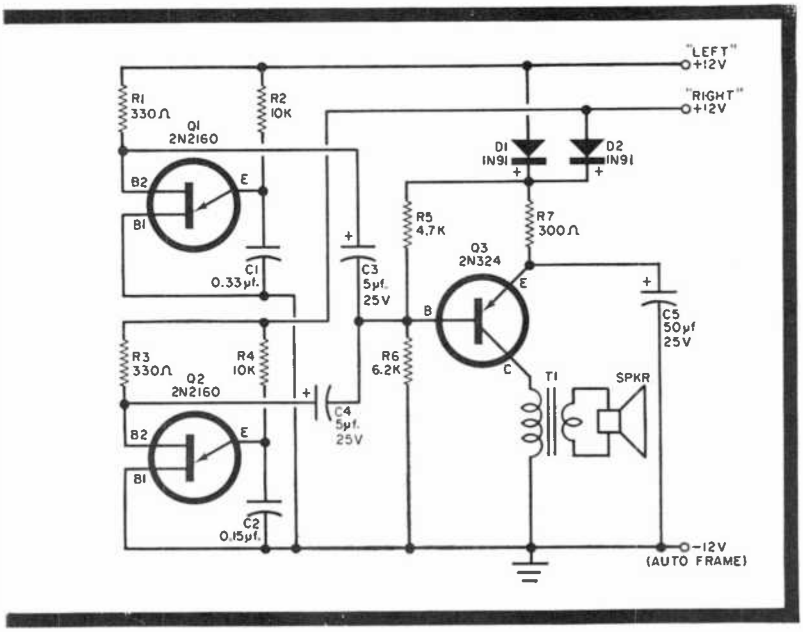


Fig. 2. Automobiles having "negative" grounds will require this version of the "Blinker Minder." Regardless of which version you build, you'll find that the circuit draws almost negligible current—the total power consumption is approximately 0.25 watt.

steering column under the clamp, or provide another wire from the Blinker Minder's case to a good ground point under the dash.

Actually, the most difficult part of the installation is tapping power from the dashboard light circuits. In most cars, the light sockets snap out from behind the dash and drop down to allow easy bulb replacement. In the author's case, the wire to the bulb was cut about 3″ from the socket, both ends stripped back about ½″, then spliced together along with the third wire needed to run to the Blinker Minder. The splice should be soldered and taped, and the "third" wire should be a tough, automotive-type to resist abrasion.

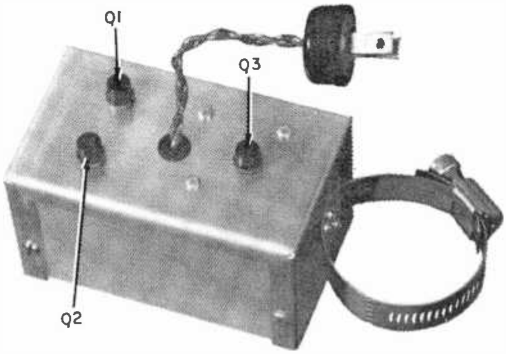
About the Circuit. Both Blinker Minders—the one for positive grounds shown in Fig. 1, and the one for negative grounds which appears in Fig. 2—are essentially the same in operation. Both use two 2N2160 unijunction transistors (*Q1* and *Q2*) as audio oscillators to provide the necessary signaling tones. (The unijunction transistor, incidentally, allows the utmost in circuit simplicity, with only two resistors and a capacitor required in each of the oscillators).

The time constants of *C1/R2* and *C2/R4* determine the frequency of oscillation for *Q1* and *Q2*, respectively. With the values indicated, the "left" oscillator operates at about 400 cycles, and the "right" at about 800 cycles, thus making it a simple matter to differentiate between a left and a right turn-signal being on.

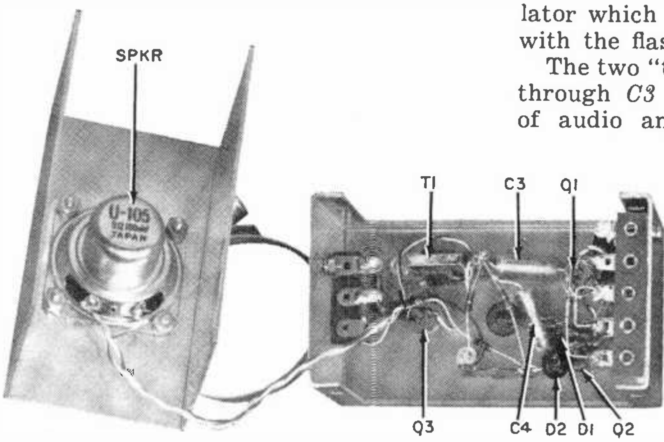
If the voltage between the emitter and base 1 of either transistor is less than the voltage between bases 1 and 2, only a very small leakage current will flow from the emitter to base 1. (In effect, the diode formed by the emitter and base 1 is cut off or reverse-biased). But if the emitter-to-base-1 voltage should be-

PARTS LIST

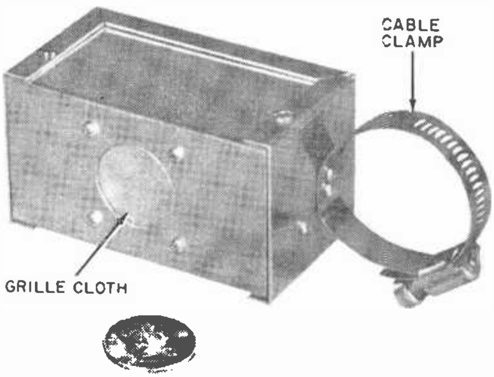
C1—0.33-μf., 200-volt miniature paper capacitor
C2—0.15-μf., 200-volt miniature paper capacitor
C3, C4—5-μf., 25-w.v.d.c. miniature electrolytic capacitor
C5—50-μf., 25-w.v.d.c. miniature electrolytic capacitor
D1, D2—1N91 diode (G.E.)
Q1, Q2—2N2160 transistor (G.E.)
Q3—2N324 transistor (G.E.)
R1, R3—330 ohms
R2, R4—10,000 ohms
R5—4700 ohms } *all resistors ½-watt*
R6—6200 ohms
R7—300 ohms
T1—Transistor output transformer: primary, 500 ohms (CT not used); secondary, 10 ohms (Lafayette TR-109 or equivalent)
SPKR—1½″ PM speaker, 10-ohm voice coil
1—2¼″ x 4″ x 2¼″ aluminum utility box (Premier AMC-1003 or equivalent)
Misc.—Wire, solder, transistor sockets, terminal strips, grille cloth, hardware, hose clamp, etc.



Neat and compact, Blinker Minder can be mounted on steering post or in any other convenient spot.



Hooking up your Blinker Minder should be easy—photo above shows location of all major components. Just be sure to select the correct circuit for your automobile and to observe all indicated polarities.



Grille cloth can be chosen to blend with auto color scheme; metal grille will give more protection.

come equal to or greater than the base-1 to base-2 voltage, current will flow from the emitter to base 1 and the emitter-to-base-1 resistance will suddenly decrease.

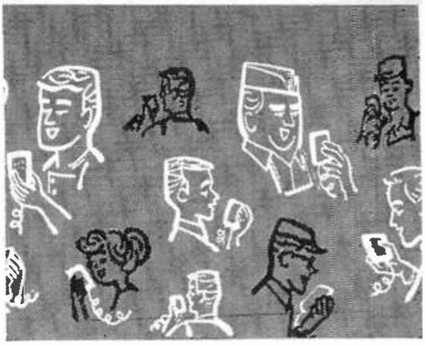
In other words, capacitor *C1* will charge toward +12 volts through *R2* until the voltage across *C1* becomes equal to the voltage between base 1 and base 2. At that instant, the emitter/base-1 diode conducts, shorting out *C1*, and the process begins all over again.

Power for the "left" oscillator is "stolen" from the dashboard "left" turn-signal indicator socket, and power for the "right" oscillator is obtained from the other turn-signal indicator lamp. This results in a tone from either oscillator which is turned on and off in step with the flashing indicator lamps.

The two "tones" are coupled in parallel through *C3* and *C4* to the base circuit of audio amplifier *Q3*. This stage, in turn, drives the speaker through output transformer *T1*. Bias stabilization of *Q3* is assured by the 300-ohm emitter resistor and the relatively low impedance of the base-bias voltage divider, *R5/R6*.

The two 1N91 germanium diodes, *D1* and *D2*, perform a most interesting function. Obviously, the amplifier stage, *Q3*, must be powered regardless of whether the "left" or "right" oscillator is on. However, the "left" and "right" power sources from the dash-indicator lights can't be shorted together. Although one solution would be to power the amplifier directly from the battery and leave it on all the time the ignition is on, a more "elegant" approach was deemed necessary.

In this circuit, *D1* is poled so that it "turns on" when voltage appears at the "left" power supply terminal, thus allowing current to flow to the amplifier stage. No current can reach the "right" +12-volt line at this time because *D2* is "turned off" by the positive potential at its cathode. Similar action takes place when voltage appears at the "right" power supply terminal, except this time *D2* is "turned on" and *D1* is "off." No current is drawn by the unit when the turn-signals are in neutral. —30—



On the Citizens Band

with MATT P. SPINELLO, 18W4689, CB Editor

MANY questions have been raised, along with many eyebrows, regarding the relationship between the Citizens Radio Service of the United States and the General Radio Service of Canada. To date, there has been no actual connection between them, although there are several reasons which may have led some people to believe that the two services overlapped and could be used as one.

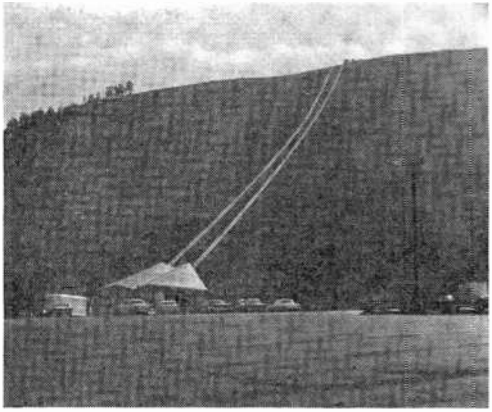
GENERAL RADIO SERVICE OF CANADA

First, the similarity of the two services may have left such an impression on those who failed to investigate further. Secondly, Canada's rules and our Part 19 are very much alike. Next, we in the U.S., as well as our Canadian friends, have referred to the GRS as the Citizens Band, and the operators as CB'ers. And finally, since both services operate on 11 meters, a few wrong-footers have conducted gab-sessions across the border.

While it appears that the Department of Transport (D.O.T.) and the Federal Communications Commission (FCC) *will* make some sort of connective arrangement soon, there is no official authorization for CB'ers and GRS operators to communicate with one another at this time. A summing up of the existing situation can be found in a letter received by a CB member of the 14W Association of Seattle, Wash., from F. G. Nixon, Director of the Telecommunica-

FIVE-WATT POTLUCK

This happy group represents the Glasgow 5 Watt Club of Kentucky. The club was organized in January of 1960, and to date boasts a membership of 80. William Gabbard, Jr., corresponding secretary for the club, informed us that the photograph below was taken at a recent potluck supper, which—incidentally—is an affair that is held regularly by the "5 Watters." Club members are presently engaged in Red Cross First Aid primary and advanced training, and will eventually be issued equipment to meet any emergency. Those CB'ers in the area who are interested in joining this home-spun CB club should contact its president, Paul Jolly, Glasgow, Kentucky.



"The Voice of Dixie," officially known as the Dixie Communications Club of Decatur, Ga., is setting up a monitoring station in a 7-story tower atop Stone Mountain, reached by means of a cable lift ride.

tions and Electronics Branch of Canada's D.O.T.

In his reply to a letter from the CB'er questioning the legality of U.S.-Canadian transmissions, Mr. Nixon stated that radio stations in Canada's General Radio Service, which is similar to the U.S. Citizens Band Service, are not permitted to communicate with stations in any other service. Such stations may be used only for communications concerning the business activities and personal affairs of the licensees. Furthermore, their transmissions may not be directed to any person or station located beyond the ground wave coverage of the station.

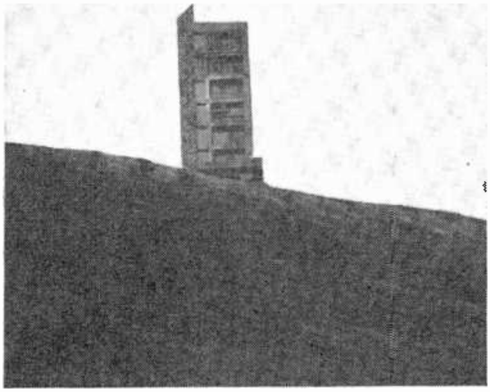
Of course, GRS rules and regulations in this area parallel U.S. Part 19, Sections 19.1, 19.2(a), and 19.61.

Under the provisions of the General Radio Regulations, Part II, those who may apply to the Department of Transport for a license in the General Radio Service include: companies which are incorporated within the British Commonwealth, and British subjects or landed immigrants not less than 18 years of age and having a requirement for direct radio communications with similarly licensed Canadian stations. A GRS license costs the applicant $3.00 per unit and is valid for three years following the first day of April of the fiscal year in which it is issued.

Operational regulations for the Canadian GRS service are much the same as our CB rules and regulations, but operating frequencies are available on only 19 of the 23 channels used for CB in this country, ranging from 27.000 to 27.230 mc. (U.S. CB channels 4 through 22). However, equipment standards for transmitter and receiver gear used by authority of the D.O.T. are much more rigid than those required by the FCC. For example, the transmitter carrier frequency must be measured with a frequency meter having an accuracy of at least 0.0005%, and power across the terminated antenna terminals of the *receiver* must not exceed 20,000 picowatts 0.00000002 watt) at any frequency. In all, there are at least a dozen technical tests the equipment must pass before being considered acceptable by D.O.T. standards.

CB on a Mountain Top. If you were to walk in on a general meeting of the Dixie Communications Club of Decatur, Ga., you'd find yourself well informed on the organization and its activities within a short five minutes—the time it would take to read a sheet headed "Welcome Visitor," which is supplied to all guests who attend DCC meetings.

The Dixie group, known to many as "The Voice of Dixie," is incorporated under the laws of the state of Georgia. It is a CD Communications Unit assigned to the Georgia State Civil Defense Office, and can be counted on to stage drills for rescue training, lost person spotting, stolen vehicle location, etc., on a spur-of-the-moment notice. Organized in July, 1960, the present membership boasts 62 active CB'ers. At the helm



A closer look at top of Stone Mountain. "The Voice of Dixie" will contact CB units 100-150 miles away.

are: President Bud Horton, 6W1458; Vice President Bill Kirkman, 6Q1810; Secretary Taylor P. Whitemire, KDB-2644; Treasurer Tom Witcher, KDB3091.

Although busy as "see-bees" with their regular club projects, voluntary obligations to Civil Defense and area civic groups, the Dixie "communicators" are looking forward to their most recent challenge and long-planned goal. With permission from the Stone Mountain Memorial Association, within 30 to 60 days of this writing the Dixie Communications Club will establish a permanent monitoring station atop Stone Mountain, located 16 miles east of Atlanta. While this project will be a "first" of its type for the DCC members, "firsts" for the Stone Memorial Association will include a huge lake, plantation buildings, beaches, a golf course, full-sized old-time railroad, cottages, camp sites, a cable lift to the top of the mountain, and a large restaurant with a seven-story rock tower. Monitoring facilities of the DCC will be housed in this tower.

With a monitoring station located 1686 feet above sea level, and seated on top of 1½ billion tons of exposed granite, the club hopes to handle communications up to the state boundaries on the north, east, and west, and as far south as Macon, Augusta, and Columbus. In all, the coverage will encompass a 100-to-150 mile radius from Stone Mountain. Little wonder that members of the DCC are excited about the part the monitoring station will play as a guide to motorists and as a relay post for emergency communications!

Once a silent guide to explorers of the new world, meeting place for Indian councils and treaty councils with the white man, Stone Mountain suddenly promises to knight the Dixie Communications Club as "The BIG Voice of Dixie!"

"Lot'sa" Lafayette. We took advantage of the opportunity to give the new Lafayette HE-90WX CB rig the once-over the other day. Many advantageous features are included in its $94.50 price tag.

Any one of six channels may be chosen from the front panel control of the unit's transmitter, as well as crystal-controlled receive on all six channels. With a flip of the receiver switch, you can fine-tune all 23 CB channels. A three-stage i.f. circuit promises razor-sharp selectivity.

We also found a sensitive (adjustable) squelch circuit, automatic volume control, electronic push-to-talk switching and an automatic noise limiter, all geared to bring in the weak ones with the least amount of interference. The transmitter's pi-network will match any 30-to-100 ohm antenna and includes a TVI filter. And the whole works is rounded out with a spotting switch for positive channel location and an illuminated S-meter for direct r.f. power and "S" readings.

Lafayette HE-90WX transceiver

The HE-90WX comes equipped with matched crystals for channel 9, and push-to-talk ceramic mike with coiled cord. A 12-volt supply (HE-91W) for mobile operation is available for an additional $11.50. For more information, write to Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, L. I., N. Y.

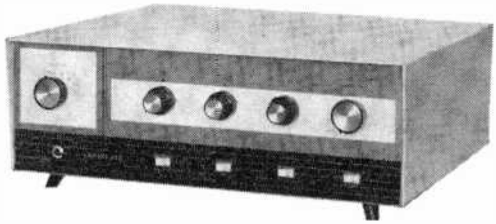
(*Continued on page* 108)

Hi-Fi Lab Check

Lafayette 250A Stereo Amplifier

Manufactured by Lafayette Electronics Manufacturing Corp., 165-08 Liberty Ave., Jamaica 33, N.Y.

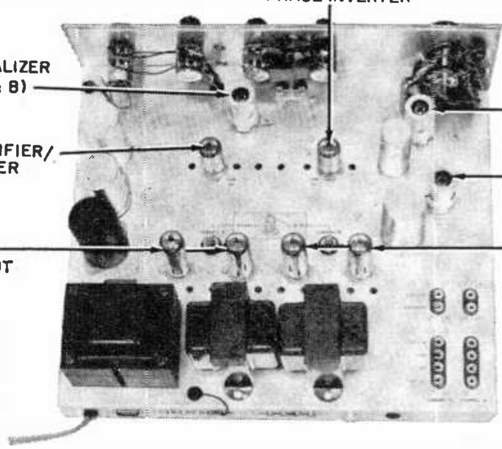
Prices: $74.50 (KT-250A, kit); $99.50 (LA-250A, factory-wired).



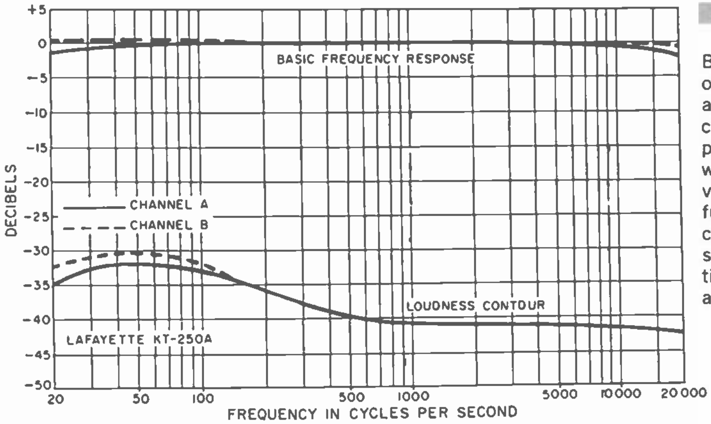
ANY AMPLIFIER that's way down in price and way up in performance is worth crowing about. Since Lafayette's 250A fully meets these qualifications, we have no hesitation in stating that we are most favorably impressed with it. Whether you go for the kit or for the factory-wired version, it's a safe bet that your 250A will stand very high on the performance-delivered for dollar-spent scale.

Actually, Lafayette's stereo 250 amplifier has been around for some time, and it has established an enviable reputation for itself in the field. Recently revised and updated, it's now known as the 250A, and it promises to win even greater acclaim than ever.

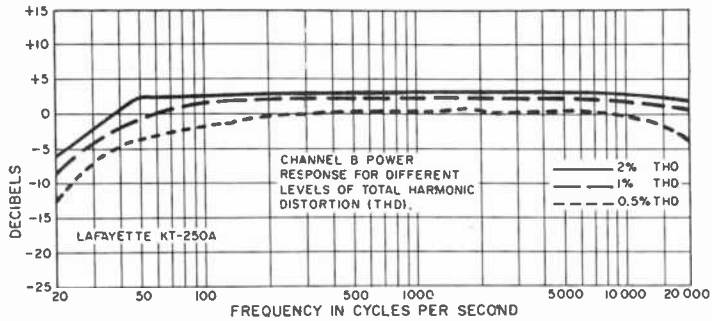
CIRCUIT REPORT: From a design point of view, the 250A is an integrated stereo amplifier that takes care of just about



Chassis layout of the 250A places all controls on front panel, all input jacks at right rear. Slide switches select A and/or B amplifiers, also control loudness on/off and channel A "phase."



Basic frequency response of the 250A is excellent for an amplifier in its price category. Loudness compensation is switch-selected, with the dual-concentric volume/balance control functioning as a loudness control when the loudness switch is in the "on" position. Compensation is mild and free from "tubbiness."



Power response of channel B amplifier with both channels driven. The 0 db level on this graph corresponds to an output of 10 watts, and the maximum power output here is 20 watts.

all conceivable input, output, and acoustic requirements. In other words, it's a self-contained amplifier/preamplifier intended for use with almost any stereo or monophonic program source. Terminations are provided for 4-, 8-, or 16-ohm speakers, and there's also a "third" channel output which delivers a monophonic blend of both stereo channels.

Circuit-wise, the two channels are identical in almost every respect. A 12AX7 dual triode (called "fixed equalizer/preamplifier" on the photo at left, below) furnishes RIAA or NARTB equalization for phono pickup or tape head; tuner and auxiliary inputs are fed directly into ½ of a second 12AX7, which serves as a bass and treble control ("variable equalizer" on the photo). A 7199 pentode/triode serves as a direct-coupled voltage amplifier/phase inverter, and a pair of pentode-connected EL86's delivers up to 25 watts per channel.

The power supply utilizes two diodes in a voltage-doubler circuit, plus a third diode which provides fixed bias for the output tubes and a d.c. heater supply for the fixed and variable equalizers.

HIRSCH-HOUCK LAB CHECK: The basic frequency response of the KT-250A is very flat (±0.5 db from 20 to 20,000 cycles), and power response is also very good for such a low-priced unit. Intermodulation distortion is also satisfactorily low at normal listening levels—a few tenths of a percent.

In the tests made, the tone controls altered the response ±16 db at 50 cycles and ±12 db at 10,000 cycles. The KT-250A performed in excellent fashion and proved itself to be a well-thought-out, clean-sounding unit.

IN CLOSING: The kit we assembled went together in about 13 hours, and we encountered no problems in assembly whatever. The fact that the small parts are very neatly packaged makes checking and sorting extremely easy, and the kit is supplied with generous amounts of wire and cable.

While there are obviously better amplifiers on the market, we feel that few—if any—can match the Lafayette 250A in terms of performance delivered for dollars spent. —30—

POPULAR ELECTRONICS

DX AWARDS

WELL OVER 40,000 short-wave listeners registered with POPULAR ELECTRONICS are now eligible to receive DX Award stickers for their Short-Wave Monitor Certificates. Five different DX Awards are being offered—for 25, 50, 75, 100, and 150 countries logged and *verified.* These awards are the first of a series of awards to be issued to WPE Short-Wave Monitors.

The main objective of the DX Awards is to encourage SWL's to report to all stations heard and logged, and to receive their verifications. This, in turn, will make the average listener dig a little deeper through the ever-present interference to hear and log some of the more elusive stations. The entire concept of the DX Awards is based upon the number of countries the listener has had verified. That is, he must have heard the station, logged it, and reported to the station in detail; in return, the station must have verified his reception report by mailing him a QSL card or letter duly signed and authenticated.

To be eligible for a DX Award, an applicant must carefully read and abide by the rules and regulations that follow:

1 Each applicant must be a registered WPE Short-Wave Monitor, and must enter his call letters on the application form.

2 Each applicant must submit a list of stations for which he has received verifications, one for each country heard. The list should contain 25, 50, 75, 100, or 150 countries, depending on which DX Award is being applied for. And the following information must be furnished in tabular form for each verification:

(a) Country heard
(b) Call-sign or name of station heard
(c) Frequency
(d) Date station was heard
(e) Date of verification

All the above information should be copied from

(*Continued on page* 99)

POPULAR ELECTRONICS' DX AWARD APPLICATION FORM

(please print)

WPE Call Letters ____ Name ____

Address ____ City ____ Zone ____ State ____

Please enter my application for the following POPULAR ELECTRONICS' DX AWARD:

(check one) 25 ☐ 50 ☐ 75 ☐ 100 ☐ 150 ☐

☐ I have enclosed a list of the required number of countries, and I hereby certify that I hold a verification from at least one short-wave broadcasting station in each of the countries listed

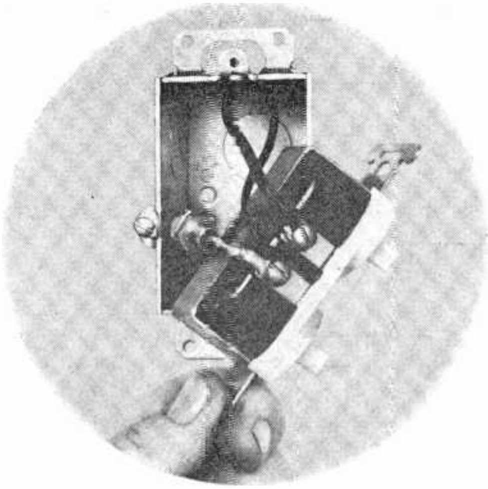
☐ I have enclosed 50 cents to help cover the costs of processing and mailing my DX Award

Signature ____ Date ____ 1963

This form valid only through December 31, 1963

3

Mail to Hank Bennett, POPULAR ELECTRONICS DX AWARDS, P. O. Box 254, Haddonfield, N. J.



ADD an illumination level control to your room lighting—and pinch pennies out of your electric bill at the same time—by building this inexpensive gadget.

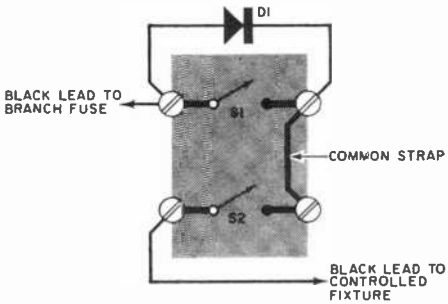
A glance at the schematic diagram will show you that switch *S2* of duplex wall switch *S1/S2* turns the lamp fixture on and off. Switch *S1* has a different function: when it's open, diode *D1* is in series with the lamp. Consequently, the line voltage is rectified, and power is supplied to the lamp only half the time. Result—a dim light. Closing *S1* shorts out diode *D1* and applies the full line voltage to the lamp. Result—normal light intensity.

Diodes rated at 2 amperes with PIV's of 200 are currently sold through surplus outlets for less than a dollar, while new units can be had for about $1.80. Almost any hardware store can supply the duplex switch.

Watch Those Watts

. . . and add atmosphere with dimmed room lights

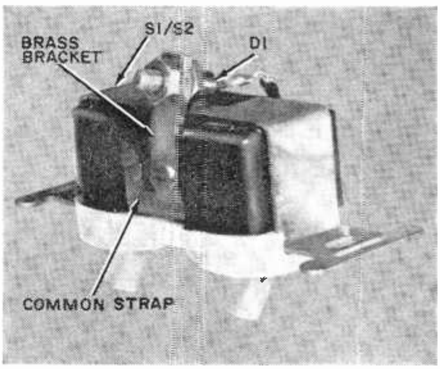
By ROY E. PAFENBERG



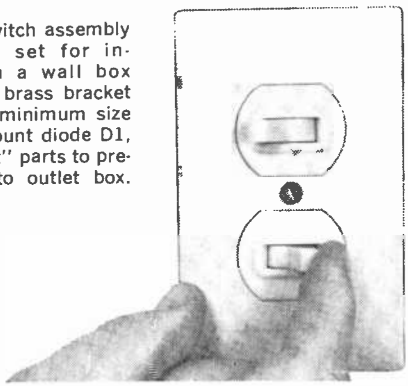
Simple circuit, for use with incandescent lamps only, employs half-wave rectifier to dim lights.

Fashion a brass bracket to connect the stud-mounted diode to a terminal on the switch which connects to the common strap; the other end of the diode connects to the remaining terminal of *S1*. Place electrical tape over the diode and bracket to prevent possible shorts.

To install the control, remove the fuse from the circuit branch supplying the lamp fixture you want dimmed. Then replace the wall switch with the modified duplex switch, screw the fuse back in, and test *S1* and *S2*. The latter should turn the light on and off; the former should dim it. Use the dim light—and start saving! —30—



Completed switch assembly (left) is all set for installation in a wall box (right). Keep brass bracket down to the minimum size needed to mount diode D1, and tape "hot" parts to prevent shorts to outlet box.



Transistor Topics

By **LOU GARNER**, Semiconductor Editor

IT'S CERTAINLY no news that there are literally millions of "d.c." motors in use today throughout the world—in automobiles, appliances, construction equipment, factory machinery, and even toys. But you may be surprised to learn that, except for a few low-power laboratory devices, there's no such thing as a *true* d.c. motor!

Contradictory? Not at all, if you consider the facts. An electric motor, by its very nature, requires a constantly changing magnetic field to produce continuous motion, and d.c. can supply only a steady field. The common d.c. motor is actually a special type of a.c. motor equipped with a built-in automatic mechanical switch to convert the applied d.c. power to pulsating d.c. or a.c. This "switch," of course, is the familiar split-segment commutator and its associated brushes.

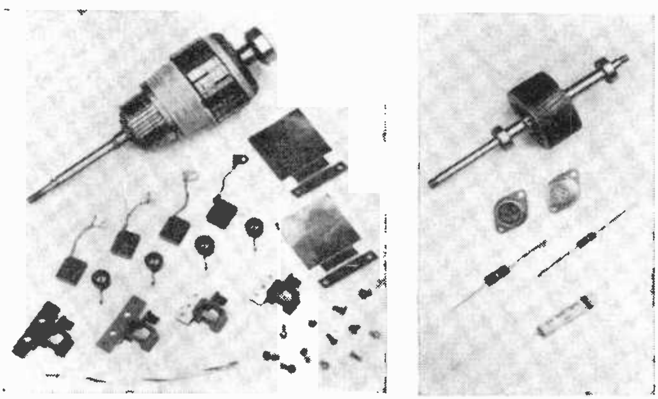
Although used extensively for decades, the commutator-brush arrangement has never been completely satisfactory. Brushes wear out and have to be replaced—sometimes at frequent intervals. Commutators become dirty and inefficient with extended use. Top motor speeds are limited, because excessive centrifugal force will cause a commutator to fly apart. In addition, the constant sparking between brushes and commutator is a prime source of electrical noise and radio interference.

It's no wonder, then, that motor designers have long sought a substitute for the commutator-brush system. One approach has been the use of a d.c.-to-a.c. inverter powering a standard a.c. induction motor. While excellent electrically, this method has a serious disadvantage—reasonable efficiency can be obtained only if the inverter's output transformer is nearly as large as the motor which it powers.

However, a breakthrough has finally been achieved. The transistor and related semiconductor devices have made possible the development and production of brushless d.c. motors no larger than conventional motors and with power ratings ranging from $\frac{1}{50}$th to a full 2 horsepower.

Developed by Leonhard Katz of Astro-Dynamics, Inc., the new brushless motors

New, variable-speed motor is brushless



Compactness, long life, and continuously variable speed are among the advantages of Lamb Electric's "electronic commutator" motor. Parts required for a conventional brush-and-commutator motor appear at right, while the fewer number needed for a motor of the new type are shown at far right next to one of the new motors. Pen points to speed-control potentiometer.

are being made by the Lamb Electric Division of Ametek, Inc., in Kent, Ohio. Dubbed the "Komlectro brushless motor" by its manufacturer to emphasize the fact that it "commutates electronically," the new unit requires fewer components than a conventional d.c. motor (see photos below). In essence, it substitutes transistors (or silicon controlled rectifiers) to perform the switching action normally handled by the commutator and brushes.

In a broad sense, the Komlectro motor is essentially a transistorized d.c.-to-a.c. inverter driving a single-phase a.c. induction motor. The size problem has been overcome by the simple expedient of using *the same circuit element* as both the oscillator-inverter's output transformer and the motor's main field assembly. This was accomplished by employing a center-tapped field winding and adding a small feedback winding to drive the transistors' base circuits.

In addition to eliminating the bothersome commutator and brushes, the Komlectro design offers another advantage over conventional motors. The oscillator frequency can be controlled quite easily by changing the transistors' base bias and drive. This permits motor speed to be adjusted with a relatively small potentiometer instead of the bulky and expensive mechanisms required by standard motors.

According to the manufacturer, the Komlectro brushless motor will be somewhat more expensive than conventional d.c. motors—at least for a while. For this reason, its initial applications will

—and transistorized!

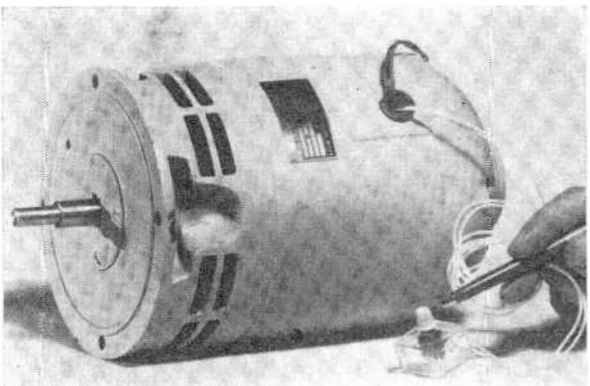
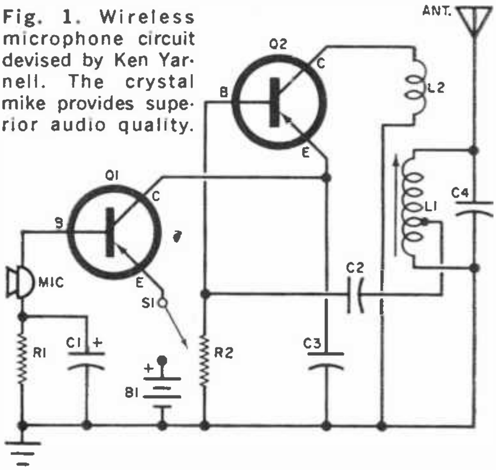


Fig. 1. Wireless microphone circuit devised by Ken Yarnell. The crystal mike provides superior audio quality.



probably be in military and industrial equipment where its advantages will outweigh the cost factor. But the day isn't far distant when similar motors will be used in household appliances and home power tools.

Readers' Circuits. If you're a typical experimenter, chances are you derive as much pleasure from trying experimental changes in published circuits as you do from straightforward assembly. Reader William G. Mitch (R.F.D. 5, Box 365, Cedar Lake, Ind.) is typical in this respect. Writing of his experiences with Malcolm Green's photoelectric relay circuit (P.E., December, 1962, p. 79), he made the following comments:

"When I used a 2N107 transistor in this circuit, as suggested, the relay naturally didn't become energized until the photoelectric cell, *PC1*, was activated. However, replacing the 2N107 with a 2N229 transistor caused the circuit to work in reverse. In other words, when the photocell is activated, the relay is *de*-energized."

Congratulations on your ingenuity, Bill. The results you obtained are exactly what we would expect on the basis of theoretical considerations. The 2N107 is a *pnp* transistor, the 2N229 a *npn* unit. If the latter were substituted directly for the former, reverse bias would be applied and the circuit action *in this particular case* would be just the opposite of that obtained with the *pnp* unit. As a general rule, though, it isn't good practice to substitute *npn* for *pnp* types without reversing power supply polarity.

Of all the reader's circuits we've featured in the past, few are as popular as

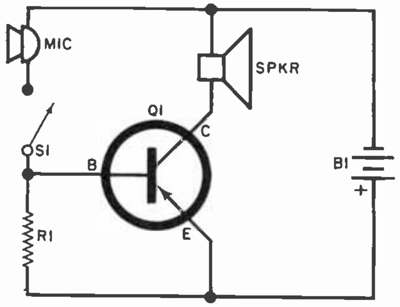


Fig. 2. Patrick Murray, WPE4FUF, is the reader responsible for this low-cost transistor megaphone circuit. The device develops about 0.2 watt.

the AM broadcast-band *wireless microphone*. Perhaps many of us are frustrated announcers. In any case, responding to many requests, we are featuring another such circuit this month.

The wireless microphone circuit in Fig. 1 was submitted by reader Ken Yarnell (734 Bellefonte Ave., Lock Haven, Pa.), a sophomore majoring in electrical engineering at Penn State University. He adapted the circuit from one featured by yours truly in the *Transistor Circuit Handbook* (published by Coyne, 1455 W. Congress Parkway, Chicago 7, Ill.).

Referring to the schematic diagram, *pnp* transistor *Q2* is used as a modified "tickler feedback" r.f. oscillator. Audio modulation is injected into the oscillator's emitter circuit by *Q1* which, in turn, serves to amplify the audio signal picked up by the crystal microphone (*MIC*). The oscillator's basic frequency is determined by tuned circuit *L1/C4*; *R1* and *R2* serve as bias resistors, and *C1* and *C3* as audio and r.f. bypass capacitors, respectively. Operating power is supplied by a 9-volt battery, *B1*, controlled by s.p.s.t. push-button switch *S1*.

Standard components are used throughout. Inductor *L1* is a Lafayette MS-299 antenna coil with 10 turns of #26 enameled wire wound on top as a "tickler" coil (*L2*). Capacitors *C2*, *C3*, and *C4* are small ceramics rated at 0.01 μf., 0.01 μf., and 150 μμf. respectively, while *C1* is a 5-μf., 10-15 w.v.d.c. electrolytic. Both *R1* and *R2* are ½-watt resistors rated at 68,000 and 390,000 ohms, respectively; transistor *Q1* is a 2N109, *Q2* is a CK768. The power supply is a Burgess 2U6 transistor battery or equivalent. Ken used a Lafayette MS-108 crystal microphone cartridge, but similar units should give acceptable results.

Ken assembled his unit in a 3" x 2" x 1" plastic box and suggests that readers duplicating his project do the same. He also recommends that you take a little extra care to achieve a neat, clean layout. A 10" length of hookup wire serves as an external antenna.

Once assembled, the instrument can be checked out with any standard AM broadcast-band receiver. Tune the receiver *slowly* while depressing *S1* and speaking into the microphone. Once a signal is received, shift the unit's frequency by adjusting *L1*'s core until the signal is picked up at a "dead" spot on the dial (where no local stations are received). If difficulty is experienced in obtaining a signal, try reversing the connections to feedback coil *L2*.

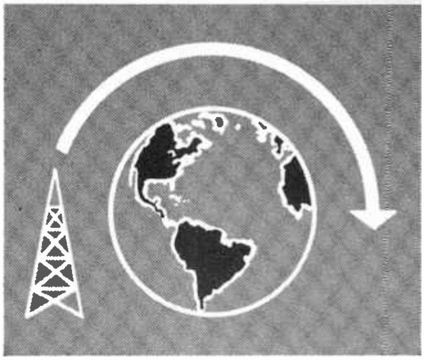
If desired, a crystal phonograph cartridge can be substituted for the microphone. Ken has used this technique to "broadcast" phonograph music from his home to a portable receiver outside, providing music for relaxation while basking the sun . . . or for such tasks as washing the car.

A low-cost, easily duplicated *power megaphone* circuit is illustrated in Fig. 2. Submitted by Patrick Murray, WPE4FUF (2913 Bryan St., Alexandria, Va.), this instrument delivers approximately 200 mw. and can be assembled in a single evening by the average builder.

Referring to the schematic diagram, a *pnp* power transistor, *Q1*, is used in the common-emitter configuration to amplify the signal obtained from a carbon microphone and to provide direct-drive for a small PM speaker. Base bias is supplied through a voltage divider made up of the microphone and fixed resistor *R1*, while operating power is obtained from a 3-volt battery (*B1*). Push-to-talk operation is provided by an s.p.s.t. push-button switch (*S1*).

Neither layout nor lead dress is critical, but Pat suggests assembling the speaker, battery, and amplifier circuit in one case (or baffle) and connecting the microphone assembly to it through a moderately long cable to prevent feed-

(*Continued on page* 100)



Monthly Short-Wave Report

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

THE LONG WAVES

THE long-wave broadcast band (145-350 kc.) receives almost no publicity in the American press. Even the majority of radio clubs fail to recognize the long-wave broadcasters, mainly, perhaps, because the average American listener doesn't have equipment capable of covering the long waves. But even if such equipment were readily available, chances are that very few reports would be received due to the scarcity of stations that could be heard. There is not, to the best of our knowledge, a single long-wave broadcast station in the entire Western Hemisphere! Virtually all, if not entirely all, of the stations are in Europe.

Strange as it may seem, however, the "long waves" carry some of the finest musical programs from a number of the highest powered stations in the world. These stations operate almost exclusively for European listeners and, therefore, many of them broadcast only in the language of a particular country.

During World War II, many American and Canadian servicemen were able to tune in the long waves during their "off" hours. Unfortunately, none of these servicemen returned home with sufficient "long-wave fever" to bring about opening the long-wave band to broadcasting in America.

As mentioned before, the long-wave broadcast band ranges from approximately 145 kc. to 350 kc., and in this span are a number of stations which *can* be heard at times in North America, particularly in the eastern areas. Those who have the equipment to receive them will agree that these stations serve up a widely varied assortment of good music and excellent overall programming.

Here is a partial list of stations most likely to be heard in North America.

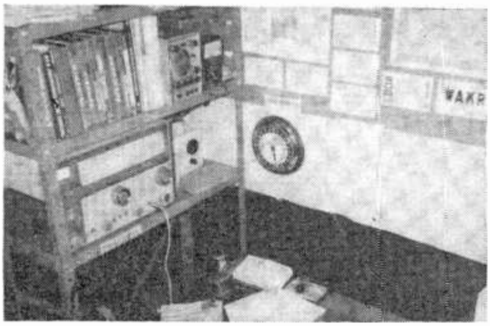
Czechoslovakia—Prague, 272 kc., 200 kw., with music, news, sports.

France—*Radiodiffusion Television Francaise*, Allouis, 165 kc., 250/500 kw., 1220-0013 daily.

East Germany—*Deutschlandsender*, Berlin/Rehmate, 185 kc., 250 kw. (during the day), 100 kw. (at night), all-German, many talks, music; *R. Volga*, Berlin/Koenigswusterhausen, 263 kc., 150 kw., relays *R. Moscow* German program.

West Germany — *RIAS*, Munich/Erching (U. S. Government), 173 kc., 1000 kw., all-German; *Voice of America*, Munich/Erching, 173 kc., 1000 kw., VOA Program (*RIAS* and *VOA* share time); and *Deutschland Funk*, Hamburg/Billwaeder, 151 kc., 50 kw., all-German, 1000-1905 daily.

Terrell D. Craven, WPE4CKD, located near Royston, Ga., has pulled in over 30 states (25 verified) with his Hallicrafters SX-99 receiver. According to Terry, the SX-99 is connected to an 885-foot inverted-L antenna!



The listening post of brothers Robert (WPE2HVV) and Preston (WPE2HXX) Golder, of New York City, is chock full of receivers. The main one is a National NC-188; a Telefunken with Heath Q-Multiplier serves as a standby. Other spares: a Heath "Mohican" and a modified General Electric unit.

Luxembourg—*R. Luxembourg*, Junglinster, 233 kc., 500 kw., all-French, pop music, jazz, news, commercials.

Norway—*Norsk Rikskringkasting*, Oslo, 218 kc., 200 kw., all-Norwegian, classical music, news, talks; Tromsoe, 155 kc., 10 kw., with programming similar to that of Oslo.

Sweden—*Sveriges Radio*, Motala, 191 kc., 600 kw., all-Swedish, music and short talks; Lulea, 182 kc., 10 kw., with same type of programming.

United Kingdom—BBC Light and European Program, 200 kc., 400 kw., music, news, plays, all-English.

U.S.S.R.—Kiev, RV87, 209 kc., 150 kw.; Leningrad, 200, 236, and 263 kc., 100 kw.; Minsk, 281 kc., 100 kw., and 400 kc., 50 kw.; Moscow, RV2 (Tass News Agency), 151 kc., 100 kw., and 172 kc., 500 kw.

SWL-CHC. Want to join the Short-Wave Listeners' Certificate Hunters Club? The SWL-CHC is a newly organized companion club to the well-known CHC (Certificate Hunters Club) for radio amateurs. To join, you must have "earned" at least 25 amateur-radio type awards on a "heard" basis.

Each new member receives a gold 11" x 14" certificate designed to accommodate up to six 2" gold seals with ribbons attesting to still higher achievements. Only the amateur-radio type "awards" count, and the same rules that apply to CHC also apply to SWL-CHC where practical. For further information, send a self-addressed, stamped envelope to the club secretary: Clif Evans, K6BX/WPE6OJ, Box 385, Bonita, Calif.

(*Continued on page* 110)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

All of the stations below specifically beam English-language newscasts to the U.S.A. The times may vary a few minutes from day to day.

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Australia	Melbourne	17,840, 15,315	2030, 2130, 2230
		9580	0745
Bulgaria	Sofia	6070	1900, 2000, 2300
East Congo	Leopoldville	11,755	1630, 2100, 2230
West Congo	Brazzaville	11,725	2015
Czechoslovakia	Prague	11,990, 9795, 9550, 7345, 5930	2000, 2330
Denmark	Copenhagen	9520	2100, 2230
West Germany	Cologne	9735, 5980	1530
		9605, 6145	1920
		9735, 6110	0000
Hungary	Budapest	11,890, 9833, 9770	1900
		9833, 9770, 7220	2230
Italy	Rome	11,905, 9575	1930, 2205
Netherlands	Hilversum	9715, 6085	1625 (exc. Sun.)
		6035, 5985	2030 (exc. Sun.)
Portugal	Lisbon	6185, 6025	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840	0900
		9605	2215
		6065	2045
Switzerland	Berne	11,865, 9535, 6165	2030, 2315
U.S.S.R.	Moscow	9650, 9570, 7330, 7320, 7290, 7280, 7250, 7240, 7200, 7180, 7170, 7150, 7130, 6100, 6070, 5960[1]	1700, 1900, 2000, 2100, 2300, 0000, 0040

1. Not all channels are in use at any one time.

That Vile Interference

By FRED BLECHMAN
K6UGT

Inexpensive filters and a little know-how are all-important allies in the battle for interference-free viewing and listening

LET'S SAY you're relaxing at home, watching an exciting Western on Channel 2. Suddenly the picture goes "crazy," while a strange voice blasts from the speaker of your TV set.

"Eleven-W-Thirteen-Twenty-One, this is Eleven-W-Thirteen Fifty. Copy, Sam?" You hear a click, and everything returns to normal—for a minute, that is.

"Hmmmmm," you think to yourself. "Maybe that new guy who moved next door is a 'ham' operator. I've heard those guys are always causing television interference." And off you go, with chips on your shoulders and daggers in your eyes, to tell that "ham" to get off the air!

As you may already know, such happenings as the one just described have been going on for years. Moreover, with the increasing popularity of hi-fi/stereo systems, intercoms, and the like, and with more Citizens-Band'ers and amateur radio operators on the air every day, the interference problem is worse than ever.

But it doesn't have to be this way. In fact, if you're troubled with CB or ham interference, or if you yourself are *causing* interference, this article will provide you with enough information to eliminate all but the most stubborn cases.

MARSHALLING YOUR FORCES

What causes interference? Who is responsible? How can a campaign be waged to attack and conquer this interference? What can *you* do about *your* interference problem?

Actually, there are innumerable causes of interference to TV sets, radio receivers, hi-fi/stereo systems, and other such equipment. However, let's confine ourselves to a very common type of interference—that involving CB and ham transmissions. This kind of interference makes itself evident in two forms: picture interference and sound interference.

Picture Interference. For the most part, picture interference is caused when a signal, not intended to be received, "mixes" with the desired signal, causing a "beat frequency" to appear on the television screen in a "herringbone" pattern. If the interference is strong enough, or if it occurs on certain critical frequencies, the picture may be completely destroyed.

Figure 1 shows the location of picture and sound carriers in a television channel (this happens to be Channel 2), and illustrates the 4.5-mc. separation between the carriers. However, many heterodyne and image relationships exist between the picture carrier, sound carrier, and the i.f. of the receiver.

If the bandpass of the receiver is not sufficiently sharp, these various signals may mix together, generating sum and difference frequencies whose origins are difficult to analyze, and whose effects pop up in unexpected places—sometimes not even on the TV screen! An example is shown in Fig. 2, which indicates how a 6-meter ham transmission can "knock out" the sound on Channel 2, because the television receiver's bandpass is broad enough to allow the sound image frequency to get into the circuitry.

Sound Interference. When you hear a CB'er or ham operator over your hi-fi/stereo system, intercom, or phonograph (none of which have r.f. tuned circuits), the cause is quite different from interference to a television picture. This is strictly the fault of the equipment picking up the interference, and is known as "audio rectification."

The clue to this type of interference is that it *cannot be tuned out,* and that it is often not affected by the volume control setting! On a TV set, all channels pick up the voice interference; on an AM or FM receiver, the voice appears all across the dial.

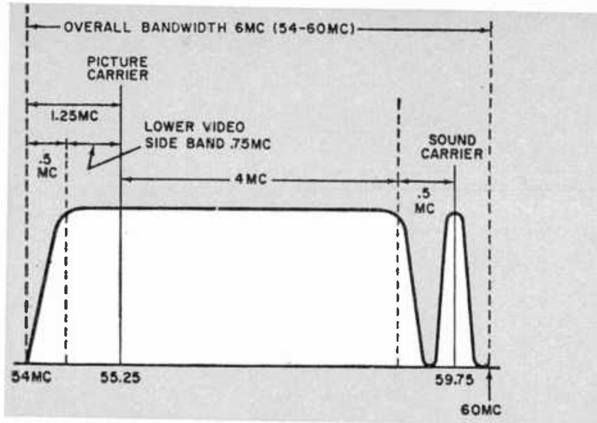


Fig. 1. Channel 2 picture and sound carriers are 4.5 mc. apart, occupy overall bandwidth of 6 mc.

What is happening is that the strong, locally generated r.f. signal is being picked up on the grid of an audio amplifier tube. It is detected and then amplified by the following stages, finally issuing from the speaker with the desired audio signals.

Who's To Blame? Most receivers and sound equipment for the home are engineered without much attempt to block possible interference that may be nearby. The reason is simple: since the bulk of this equipment is not subject to such interference, designers can omit the additional shielding and bandpass filtering which would price their product over that of a competitor. The result, of

Finding the "culprit" in your particular interference problem should be comparatively easy with the aid of these tables. Match the probable source of interference with its symptom (Table 1) and you get a "key" number. Locate this same number in Table 2, and you learn both the probable reason for the interference and what might eliminate it.

TABLE 1

WHERE INTERFERENCE OCCURS		PROBABLE SOURCE OF INTERFERING SIGNAL						
		CB Xmtr	CB Xmtr (Harmonics)	Ham Xmtr 6 Meters	Ham Xmtr 10 and 15 Meters	Ham Xmtr 15 Meters	Ham Xmtr 20, 40, 80 and 160 Meters	Ham Xmtr (Harmonics)
TELEVISION SETS	Picture (Channel 2)	3	2	4	3			2
	Sound (Channel 2)	3	2	5	3			2
	Picture & Sound (more than one channel)	3	2	3	3	3	3	2
	Picture & Sound (all channels)					6		
AM & FM RECEIVERS	Some Frequencies (tunable)		2				7	2
	All Frequencies (not tunable)	1	1	1	1	1		1

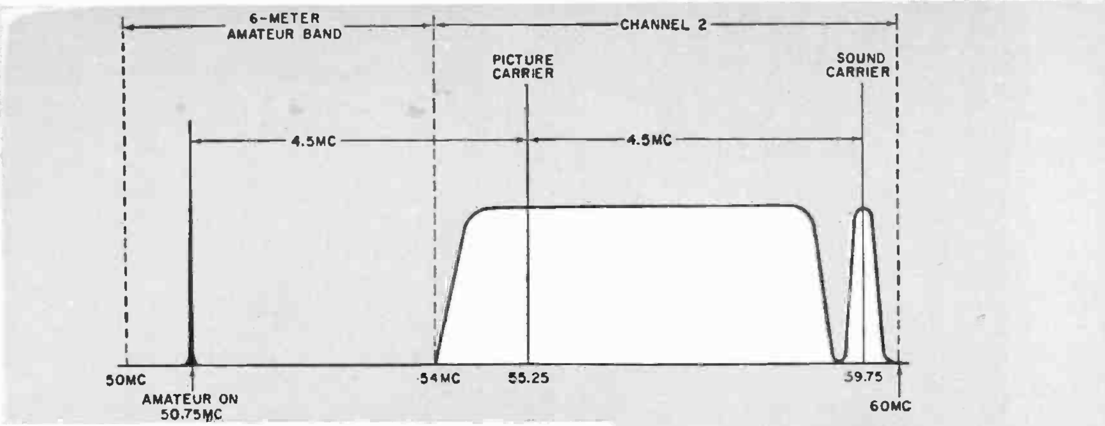


Fig. 2. Due to 4.5-mc. spacing between Channel 2 carriers, a ham on 50.75 mc. can block TV sound.

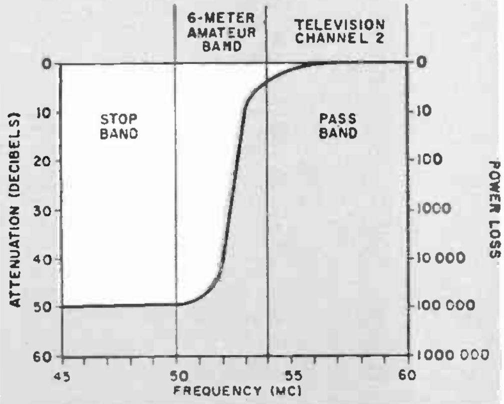


Fig. 3. Good high-pass filter will attenuate signals below Channel 2, pass signals above 54 mc.

course, is that a local CB or ham transmitter, *even though operating properly,* may be "seen" on the screen of a neighbor's TV set or heard over his hi-fi/stereo system, intercom, etc.

In all cases, the responsibility for eliminating the interference rests with the *owner of the equipment at fault.* And, interestingly enough, in an overwhelming percentage of complaints investigated by the Federal Communications Commission, the faulty equipment was found to be that in the home where the interference occurred, and *not* the transmitter involved!

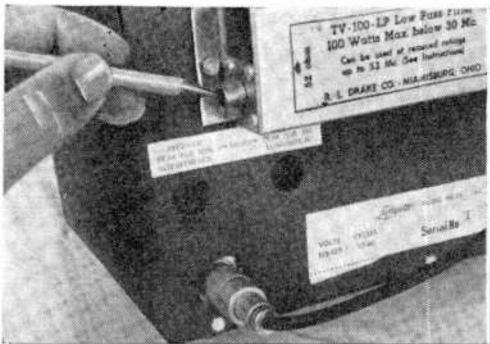
METHODS OF ATTACK

As in any military campaign, it's wasteful to attack the enemy without exercising some strategy or formulating a tactical plan. The "strategy" here is to define the cause of the interference (the "enemy") through its symptom, using Table 1. The "plan" is to arm yourself with the "weapons" indicated in Table 2, gather your forces (you and the CB'er or ham in question), and unhesitatingly descend on the "enemy" of Table 1. To give you "basic training" in the use of your "weapons," here's a brief explanation of exactly what each one is intended to do.

High-Pass Filter. Figure 3 shows the attenuation characteristics of one very effective high-pass filter. Note that it takes a signal 100,000 times more powerful at 50 mc. than at 56 mc. to produce

TABLE 2 — WHAT TO TRY TO ELIMINATE INTERFERENCE

PROBABLE REASON FOR INTERFERENCE	High-Pass Filter	Low-Pass Filter	Audio Filter	Line Filter	Shield for Receiver	Tuning Stub	Wave Trap
1 Audio Rectification			✓	✓			
2 Transmitter Broadcasting Improperly		✓					
3 Receiver Overloading	✓			✓			
4 Receiver Bandpass Too Broad	✓					✓	
5 Receiver Bandpass Allows Sound I.F. Image	✓					✓	
6 Receiver I.F. Tuned to Ham Frequency	✓			✓	✓		
7 Broadcast-Band Receiver Passes Image Signal				✓			✓



Low-pass filter by R. L. Drake, the TV-100-LP, accepts up to 100 watts at 30 mc. and below.

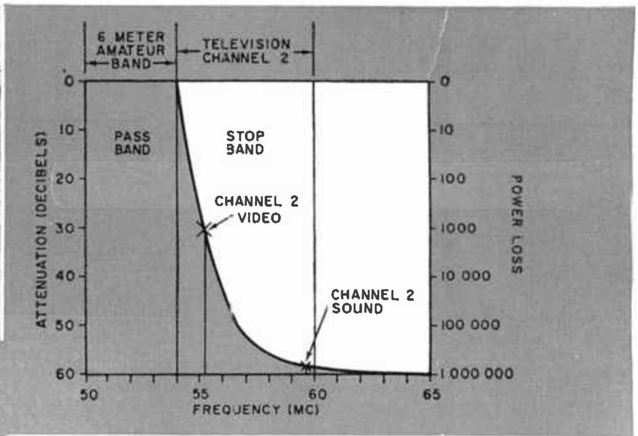


Fig. 4. Attenuation characteristics of typical low-pass filter show cut of 58 db at Channel 2 sound.

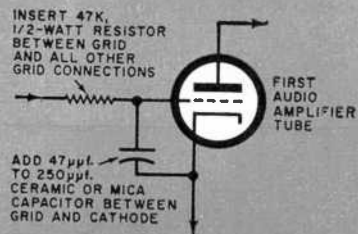


Fig. 5. If an audio filter is the remedy listed in Table 2, a resistor and a small capacitor are all that you'll require. An adapter can be inserted between the first audio tube and its socket to avoid the usual underchassis "surgery."

the same output from this filter. As a result, this device virtually eliminates interference from all CB signals and also from ham signals on frequencies *below* 54 mc.; but it allows an unrestricted path for television signals, all of which are *above* 54 mc.

Most high-pass filters can be installed with a screwdriver, and should be placed as close to the tuner as possible. This will enable you to make the interconnecting lead very short and thus subdue another "foe" that might pick up offending signals.

Incidentally, most television manufacturers realize that their receivers aren't equipped to reject such interference and will cooperate with the set's owner by supplying an effective TVI (television interference) filter without charge, if properly requested. A personal letter should be sent to the manufacturer's service manager requesting a TVI filter, stating the model and serial numbers of the TV set, as well as the "call" letters and frequency of the interfering station or stations (if known).

Low-Pass Filter. The low-pass filter works in a manner opposite to that of the high-pass filter, inasmuch as it attenuates all signals *above* the normal transmitting frequencies. As you might guess, it's intended for use at the output of the transmitter suspected of generating harmonic or spurious frequencies. A very significant thing about these filters is that they produce negligible loss on the desired transmitting frequency—if they are installed in a reasonably efficient antenna system.

The attenuation characteristics for a good low-pass filter appear in Fig. 4. Note, in contrast to the high-pass filter, that it takes a signal 100,000 times more powerful at 57 mc. than at 54 mc. to produce the same output. As a result, there is an attenuation factor of 1000 at the Channel 2 video carrier frequency of 55.25 mc.

Audio Filter. If Table 2 indicates the need for an audio filter, you will have to exercise a certain amount of initiative, since there are no commercially available units to perform this function. Assuming that the volume control has no effect on the interference, you can be sure that the offending signal is being detected after the volume control, and

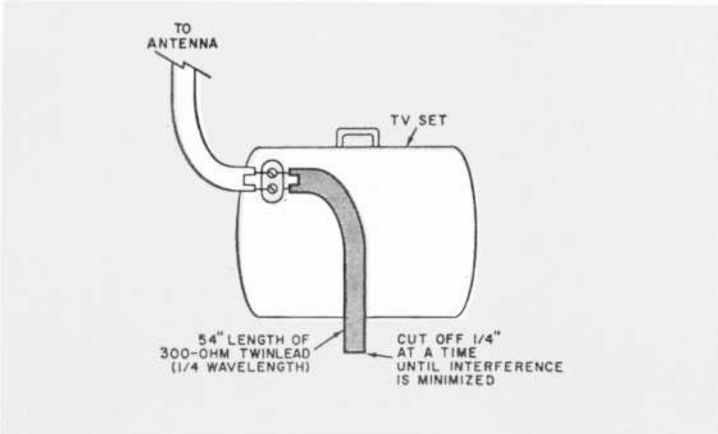
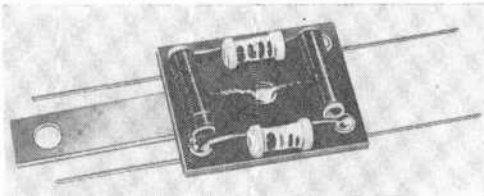


Fig. 6. Quarter-wave tuning stub made from 300-ohm twin-lead should negate 6-meter ham interference.



High-pass filters, such as the Bud HF600 (above, right) and the Regency HP-45 (right) are inexpensive and easy to install. The Bud device rejects signals between 0 and 42 mc., passes frequencies above 42 mc. with negligible loss.

not somewhere in the circuit ahead of it.

The traditional solution to this problem is to perform some underchassis "surgery"—see Fig. 5. However, there *is* a way to avoid "pulling" the chassis. You can make an adapter that fits between the tube socket and the tube suspected of causing the problem (usually the first audio amplifier tube).

First, select the proper base and socket combination needed to adapt the suspected tube, and refer to the schematic diagram for the unit or to a tube manual to find out which are the grid and cathode pins. Next, wire the adapter so that connections are "straight through" for all pins but the grid pin, and insert a 47,000-ohm, ½-watt resistor in the grid circuit.

Then solder a small ceramic or mica capacitor, using the shortest leads you can, from the cathode pin to the grid side of the resistor. This forms a bypass for r.f. signals at the grid of the tube, without affecting the normal audio signal present at this point.

Line Filter. Some forms of interference result from a signal on the power lines being coupled into the receiver through the line cord. A line filter may or may not be completely effective, but it is certainly worth a try in eliminating some forms of interference. If it doesn't do the job, another method of attack will be called for.

Installation merely involves plugging the affected unit into the filter, and plugging the filter into a 117-volt outlet. This prevents any r.f. signals from entering the equipment through the power lines, but does not affect the normal 60-cycle power to the equipment.

Shielding. If the wiring within the receiver picks up the interfering signal, you can shield the set by lining the entire cabinet with aluminum foil or copper screening and grounding the shield to the chassis. As an extra precaution, be sure that all tube shields are in place and properly seated.

Tuning Stub for Six Meters. In the case of interference from a nearby 6-meter amateur station, a ¼-wave stub is often effective in shorting out the offending signal (see Fig. 6). Starting with a 54" length of 300-ohm twin-lead (the same type that runs from your TV set to the

(*Continued on page* 102)

INTERVIEW With

KN3NOB

By DAVE HARBAUGH

Short-Wave Broadcast Predictions

By **STANLEY LEINWOLL**
Radio Propagation Editor

MARCH 1963

THE RANGE of useful short-wave frequencies that the ionosphere will reflect depends in part on the amount of ultraviolet radiation from the sun. Prime sources of solar ultraviolet radiation are "sunspots," which are enormous gaseous "storms" on the sun's surface. The number and intensity of sunspots vary over an 11-year period, going from maximum to minimum and back to maximum again. Currently, the sunspot cycle is approaching a period of minimum activity, with the downward trend expected to continue into late 1964. *Best bet for March*: the 6-, 7-, and 9-mc. bands at night, and the 11- and 15-mc. bands during the day.

TIME (EST)

Between Eastern USA and:	00	02	04	06	08	10	12	14	16	18	20	22 24
Western Europe	6	6	6	9	15	17	15	11	9	7	7	7
Eastern Europe	6	6	7	9	15	15	15	11	9	7	7	7
South & Central America	11	11	11	11	15	17	17	15	15	15	11	11
Near East	7	7	7	9	15	15	15	11	9	9	7	7
North Africa	6	6	6	9	15	15	15	15	11	9	7	7
South & Central Africa	9	9	9	11	17	21	21	17	15	11	9	9
Australia & New Zealand	9	9	9	9	9	9	*	15	17	15	11	11

TIME (CST)

Between Central USA and:	00	02	04	06	08	10	12	14	16	18	20	22 24
Western Europe	7	7	7	9	15	17	17	11	9	6	6	6
Eastern Europe	7	7	7	9	11	15	11	9	7	7	7	7
South & Central America	9	9	9	11	15	15	17	17	17	15	11	9
North Africa	7	7	7	11	15	15	15	11	9	9	9	7
South & Central Africa	7	7	7	11	17	21	21	17	15	11	11	9
Far East	7	7	7	7	7	7	7	9	15	15	9	9
Australia & New Zealand	11	11	9	9	9	9	17	17	17	17	15	11

TIME (PST)

Between Western USA and:	00	02	04	06	08	10	12	14	16	18	20	22 24
Western Europe	7	7	7	11	15	15	11	9	7	7	6	6
Eastern Europe	7	9	9	11	11	9	9	7	7	7	7	7
South & Central America	9	11	11	15	15	15	15	15	15	11	9	9
Africa	7	7	7	11	15	17	15	11	11	9	7	7
Far East	7	7	7	7	7	7	7	15	17	15	11	9
South Asia	6	6	6	7	9	11	11	9	15	15	11	9
Australia & New Zealand	11	9	9	9	11	17	21	21	21	17	15	11

To determine the frequencies and times for best short-wave reception in the United States, select the table for the area you are located in, read down the left-hand column to the region you want to hear, then follow the line to the right until you are under the figures indicating your approximate local time. The boxed numbers will tell you the frequency band (in megacycles) to listen to during any 2-hour interval. Asterisk (*) indicates that signals will probably not be heard.

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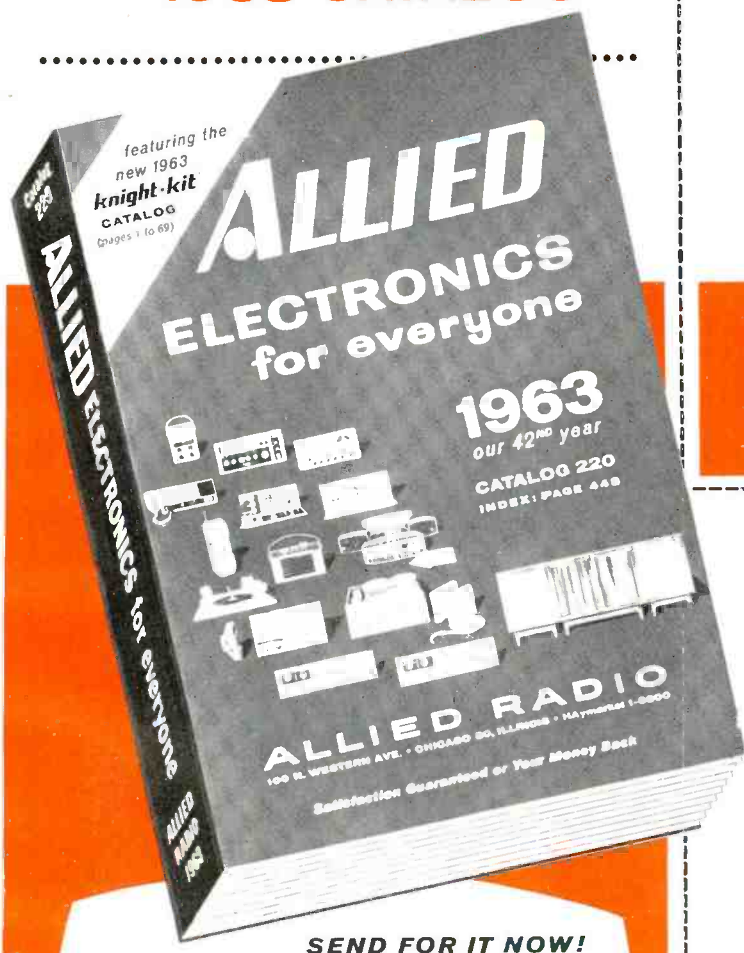

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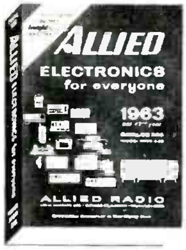

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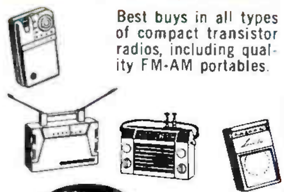

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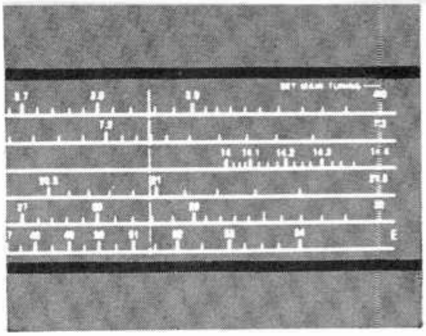


Across the Ham Bands

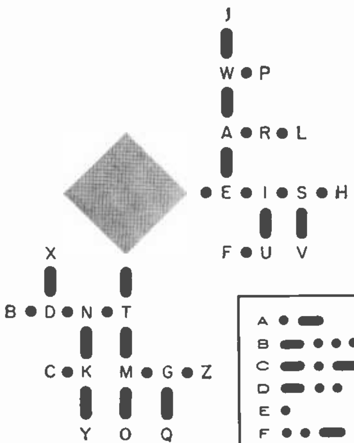
By **HERB S. BRIER,** W9EGQ
Amateur Radio Editor

AN UNUSUAL METHOD OF MEMORIZING THE CODE

MOST code experts believe that the ideal way to learn the code is with the aid of a skilled teacher who will tap out the code characters one by one while the student immediately writes down the corresponding letter. A modern recorded code course is almost as good, because it supplies essentially the same type of instruction. But not every would-be ham has either of these code learning methods available to him. Also, the method that works for the majority of students doesn't necessarily work for everyone.

Code Learning Chart. If you must learn the code without experienced help, or if you have had trouble memorizing it, you might try the "Code Learning Chart" at left. It was submitted by Bud, K9WQS, who used it to learn the code. Bud, in turn, was introduced to it by Al, W9TFS, who first saw it in a radio magazine published in the early 1930's. Bud reports that the students *he* has introduced to the chart have been able to memorize the entire code alphabet in an hour or so.

To use the Code Learning Chart, start at the diamond and follow the dots and dashes to the desired letter, moving



Learning the code is just a matter of "dit's" and "dah's," and knowing what to do with them. All you need to learn for the Novice exam is the alphabet (below). But numbers and punctuation marks are important, too, if you want to talk to other hams on the air. The "Code Learning Chart" at left is designed to help a beginner learn the alphabet quickly. Start at the diamond and take the path over dots and dashes to the letter you want. Read the dots and dashes as "dit's" and "dah's" (see text) as you go.

A	• —	N	— •	1	• — — — —
B	— • • •	O	— — —	2	• • — — —
C	— • — •	P	• — — •	3	• • • — —
D	— • •	Q	— — • —	4	• • • • —
E	•	R	• — •	5	• • • • •
F	• • — •	S	• • •	6	— • • • •
G	— — •	T	—	7	— — • • •
H	• • • •	U	• • —	8	— — — • •
I	• •	V	• • • —	9	— — — — •
J	• — — —	W	• — —	Ø	— — — — —
K	— • —	X	— • • —		
L	• — • •	Y	— • — —		
M	— —	Z	— — • •		

WAIT (AS)	• — • • •	QUESTION MARK	• • — — • •
PERIOD	• — • — • —	DOUBLE DASH (BREAK)	— • • • —
COMMA	— — • • — —	END OF MESSAGE (AR)	• — • — •
FRACTION BAR (/)	— • • — •	INVITATION TO TRANSMIT	— • —
ERROR	• • • • • • • •	END OF TRANSMISSION (SK)	• • • — • —

horizontally for the dots and vertically for the dashes. Examples: E = dot; P = dot-dash-dash-dot.

As soon as you have memorized the code, discard the Code Learning Chart and start actual copying practice. If you have a friend who has also learned the code by means of the chart, you can send the code to each other on your code-practice sets. When you do, be sure to watch the spacing between letters and words carefully.

Your short-wave receiver will also bring in hundreds of code stations in the ham bands for you to copy. At first, all of them will probably be sending the code faster than you can copy it, but keep at it, writing down every letter you do recognize. Sooner than you expect, you will be copying words and sentences.

Vocal Practice. You can also practice the code vocally. Just remember that the dot in the code is never pronounced as a *dot,* but as a *dit.* Hence, the letter E is a *dit.* However, the *t* of the *dit* is not pronounced except when it is the final *dit* in a code character. For example, the letter H, which consists of four dots, is pronounced *didididit.*

The dash in a code letter is pronounced *dah.* Using the *dit*'s and *dah*'s, you will be able to approximate the actual sounds of code characters heard on the air. For example: the letter F is pronounced *dididahdit.*

Note that the *dit*'s and *dah*'s are printed without any space between them. When "speaking" in code, as when keying it, you do not pause between *dit*'s and *dah*'s except after a complete character, or letter, has been recited.

Numerals and Punctuation. Neither numerals nor punctuation marks are included in the Novice and Technician code receiving test, nor are they included in the Code Learning Chart. However, it's pretty difficult to avoid learning them if you get your copying practice over the air, or use any standard code course. It's a good idea to learn them, anyway—you can't copy call letters and signal reports without knowing the numbers, and the period, comma, question mark, and fraction bar (/) are commonly used. Besides, they are part of the Conditional and General Class amateur code test—if you're aiming for a higher grade of license.

17-VOLT BOOSTER POWER SUPPLY

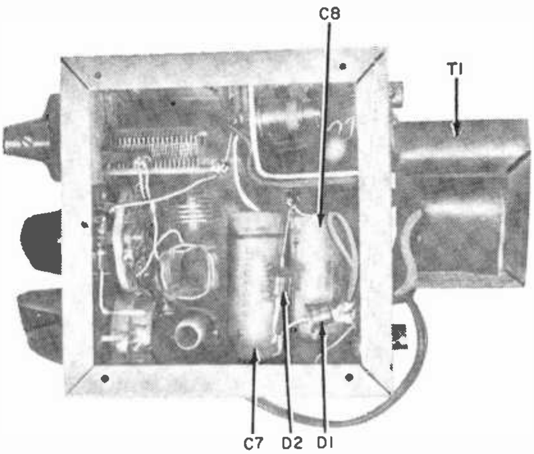
In our February column, we promised to give construction details for a supply to power the outboarded six-band Nuvistor booster presented last month. Although this booster can be powered from your receiver's power supply, many hams prefer self-powered units. So, here goes!

Originally, the booster circuit required 125 volts d.c. for the plate and 50 volts d.c. for the screen. However, it was discovered that only 17 volts was adequate for both plate and screen with this circuit. The schematic diagram at right shows how the 17 volts is obtained, and the Parts List is a continuation of the

Novice Station of the Month

The winning photo in the "Novice Station of the Month" contest for March shows the neat station of Jim O'Hara, WL7EMO. Located on the "Dew Line" at the RCA Distant Early Warning Station in Clear, Alaska, Jim is a prize catch on 15 and 40 meters! The various equipment that can be seen on his specially designed desk includes a Heathkit DX-60 transmitter, which runs the maximum legal Novice power of 75 watts, and a Heathkit HR-10 receiver. A 40-meter dipole antenna 30′ high does the outside work.

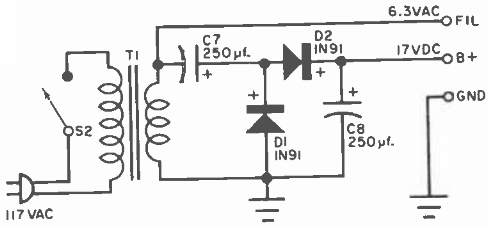
Jim will receive a one-year free subscription to P.E. for his photo. If you would like to try for a similar award, send us a picture of your station—preferably showing you at the controls, and include with your entry some information about yourself, your equipment, and your activities. You may be one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

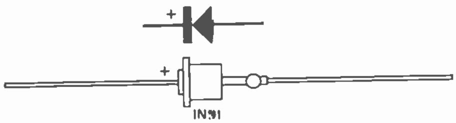


It's no problem at all to fit the parts for the 17-volt power supply into the 6-band Nuvistor booster. Schematic at right shows how voltage-doubler rectifier circuit converts 6.3 volts a.c. to 17 volts d.c.

PARTS LIST

C7, C8—250-µf., 25-w.v.d.c. electrolytic capacitor
D1, D2—1N91 diode (or equivalent)
S2—S.p.s.t. toggle switch
T1—Filament transformer; primary, 117 volts; secondary, 6.3 volts @ 0.6 amp (Stancor P6465 or equivalent)
Misc.—Line cord and plug, 2-lug terminal strip, wire, solder, etc.





Booster Parts List printed last month.

Two diodes, *D1* and *D2*, and two husky electrolytic capacitors, *C7* and *C8*, serve as a voltage doubler/rectifier to convert the 6.3-volt a.c. output of filament transformer *T1* to the required 17 volts d.c. Double duty is obtained from *T1* in this circuit, since its output also powers the heater of the Nuvistor. Power switch *S2* needn't necessarily be mounted on the booster's chassis; your shack setup will determine if this is advisable.

All the power supply parts fit nicely into the booster's aluminum box with the exception of transformer *T1*, which is mounted out of sight on the rear surface. Exactly how you wire the power supply in the booster is up to you, but the accompanying photo shows you how it was done in the original unit.

With the wiring completed, you're all set to tie into the receiver's antenna terminal and start pulling in that DX. The operating instructions given last month still hold true.

FCC AMATEUR NEWS

An input of 1000 watts is now legal on the 420-450 mc. amateur band. Effective January 2, 1963, the Federal Communications Commission raised the maximum authorized transmitter power on the ¾-meter band from 50 to 1000 watts, except in a few specified areas. In announcing the change, the FCC said that the new power limit would "contribute to wider and more flexible use of radio in the Amateur Radio Service."

The restricted regions (in which the 420-mc. band power limit remains at 50 watts) are the areas within a 200-mile radius of the Elgin and Patrick Air Force Bases in Florida; those portions of Texas and New Mexico bounded by latitude 31° 53′ N., longitude 105° 40′ W., lat. 33° 24′ N., and long. 106° 10′ N.; those portions of California and Nevada south of lat. 37° 10′ N.; and any point within a 200-mile radius of the U. S. Navy Missile Base at Point Mugu, Calif.

Less pleasant news is that the FCC recently suspended the license of a young "K5" for deliberate interference to other hams and other violations of the ham regulations—"in a spirit of fun," *he* said. Well, the young K5 has a year to laugh at his own cleverness—while he just looks at his transmitter.

Also, a certain "K8" is under notice to show cause why his station license should not be revoked. *His* troubles stem from failure to respond to official notices of a relatively minor violation of the FCC amateur regulations. Chances are

(*Continued on page* 105)

12-foot Transformer for CB

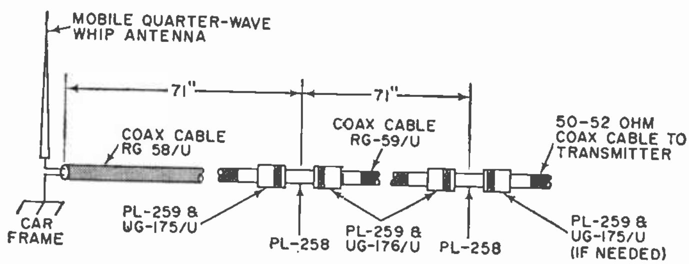
By **DAVID T. GEISER,** 20W2456*

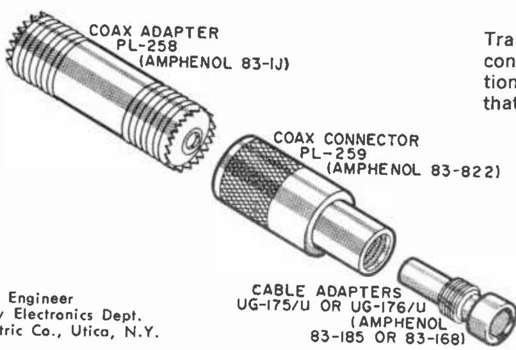
THE Class D Citizens Bander faces many of the same problems that confront every other mobile operator. For one thing, the antenna on his automobile or truck represents a compromise as to both height and location. Furthermore, the theoretical impedances of the ideal antenna simply don't agree with the actual installation. But hang on: although we can't do much about height and location, we *can* make the ordinary CB mobile antenna feed like the ideal base-station "sky wire."

Here's the story. The common CB rig is designed to feed a 50-ohm coaxial transmission line. Yet most mobile antennas have an impedance of 20 to 30 ohms *at the point where the coaxial cable is attached.* And in this mismatch lies the rub.

We can step up the impedance to a more useful value with quarter-wave lengths of RG-58/U and RG-59/U coax—which, at 27 mc., are approximately 71″ long. Such a 71″ piece of RG-58/U connected to a 25-ohm antenna will step the impedance up to 100 ohms, and a 71″ piece of RG-59/U will bring it back to 52 ohms. Any length of 50- to 52-ohm cable can now be used to connect the free end of the RG-59/U cable to the CB transmitter.

What's the explanation? Just this: the total length of the two sections of cable (12′) makes a true 2:1 impedance-matching transformer for the Citizens Band. And, assuming that the antenna impedance is somewhere between 20 and 30 ohms resistive, the standing-wave ratio presented to the transmitter will be 1.2:1 or less. For the record, the equations for each section of cable are $Ri \times Ro = Z^2$, where Ri is the input resistance of a ¼-wave cable section, Ro its terminating resistance, and Z is the characteristic impedance of that section. -30-



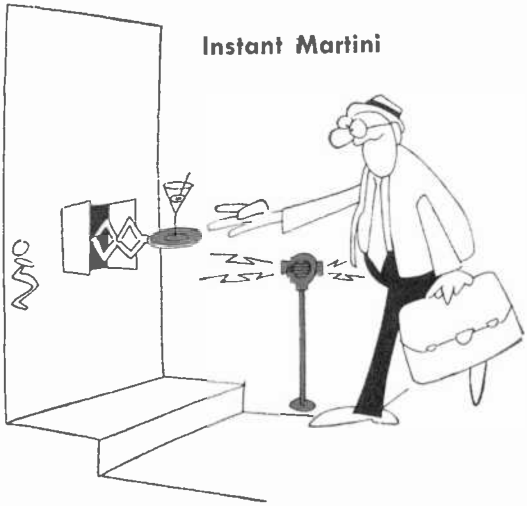


Transformer uses conventional coaxial connectors, but its two principal sections must be shortened slightly so that each has a 71″ overall length.

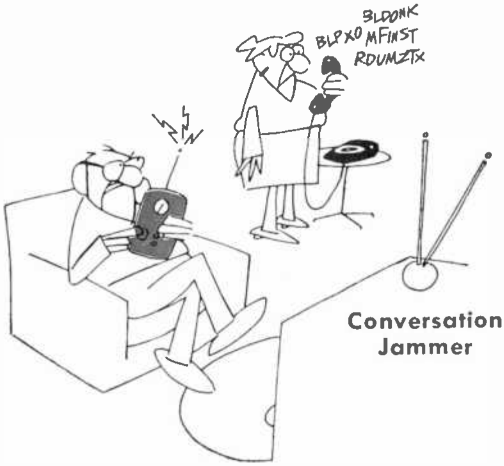
*Components Engineer
Light Military Electronics Dept.
General Electric Co., Utica, N.Y.

Hobnobbing with Harbaugh

The 5 Most Wanted Household Inventions



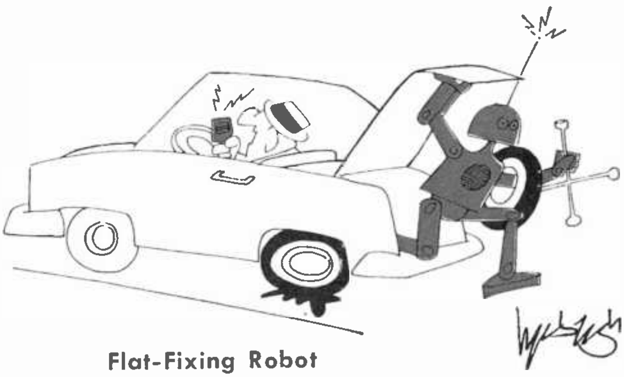
Instant Martini



Conversation Jammer

Income Tax Computer

Alarm Clock Vaporizer



Flat-Fixing Robot

a Carl and Jerry Adventure

Succoring a Soroban

By **JOHN T. FRYE** W9EGV

CARL AND JERRY had uninvited guests in their residence hall room at Parvoo University. Bruce, a fat boy from across the hall, and a couple of his cronies had barged in a half hour earlier and showed no signs of leaving. Sprawled on his back on Jerry's bed, Bruce was holding forth:

"Sometimes I wonder if Parvoo is good enough for me. My cousin at the Case Institute of Technology is one of two hundred students who have been issued personal portable analog computers by the school for use in solving differential equations and other problems in their linear systems course. The school is going to check the work of these students against that of students using only the slide rule or making occasional visits to the computer laboratory, to see how much of an advantage it is to have ready access to an analog computer at all times."

"Do they issue burros to carry them?" Carl asked sarcastically.

"No need for burros. The entire computer consists of six units, each a little larger than a package of king-sized cigarettes, that can be connected in various combinations with plug-in wires. There's an adder unit, two coefficients, two integrators, and one meter control unit. The units are self-powered so that the student can use the computer while he's parked in his car or sitting out under a tree if he wishes."

"How much do they cost?" Jerry asked.

"First cost of the six units was $300, but it's expected that manufacturing improvements will lower this to $120. The computers were designed by Dr. James B. Reswick, Head of the Case Engineering Design Center, and James Pastoriza and George A. Philbrick. Pastoriza Electronics of Boston makes them.

"To use the computer, you first have to understand the physics of a system being studied. Next, you construct a theoretical model of the behavior of the system as expressed by an equation. The computer is then assembled so that it behaves in a manner identical to the system. The meter control unit displays the answer on a numbered scale and provides signals which freeze a solution at fixed time intervals, making it possible to plot numerical units accurately on graph paper. Boy, that's for me! The newest and consequently the best!"

"Oh, I don't know about something new *always* being better," Jerry remarked as he took an object from a drawer and set it on the desk before him.

It was a rectangular frame of black-painted wood about a foot long, two and a half inches high, and three-quarters of an inch thick. A narrow partition, or "beam," ran lengthwise about a half-inch down from the top. Twenty-one evenly spaced little bamboo rods passed vertically through top, beam, and bottom. On each rod four white plastic beads were strung between the beam and the bottom and one bead between the beam and the top. Each rod had enough empty spaces so that any one bead could be moved about a quarter of an inch.

"This *soroban*, or modern Japanese abacus, has an ancestry reaching back more than 2000 years," Jerry said; "yet when a contest was held in Tokyo a few years back between a skillful soroban operator and the most expert electric calculating machine operator to be found in Japan—he was from the disbursing department of the U. S. Army troops there—the abacus operator was an easy victor in problems involving addition, subtraction, division, or a combination of these operations. Only in multiplication problems did the electric machine win, and even then the decision was close. When you consider that this great-great-granddaddy of all computers costs only about $3.50 and that it operates anywhere with only a tiny amount of muscular energy, it doesn't stack up too badly against modern competition."

Bruce heaved himself up on his elbows and looked disparagingly at the soroban. "Aw, knock it off, will you! That thing's a child's toy. The contest must have been rigged. . . . Do you know how to work the gadget?" he finished, his small blue eyes taking on a sly, calculating look.

Jerry felt an angry red spreading over his face. Bruce had that effect on people. "I'm no expert," he retorted, "but I've noodled around enough to learn how to add and subtract on it."

"Fine! Let's have our own contest.

I'm no whiz at ciphering, but I'll bet I can add up a long column of four-digit numbers with a pencil and paper faster than you can on that rack of allegedly educated wampum. You game?"

Jerry hesitated a moment and then asked: "Can we have someone read the numbers off to us? I have to watch what I'm doing with my fingers yet."

"Sure. Tomorrow we can have someone add up several strings of numbers on an adding machine. Tomorrow night a judge can pick three columns of numbers at random for each of us. He can read the numbers off as fast as the person doing the adding wants. A stopwatch will determine the total time used in adding all three columns. Okay?"

"I reckon so," Jerry said slowly.

"Good," Bruce exclaimed as he struggled to his feet. "Come on, fellows. Let's go, and let Jerry get some practice on his counter. He'll need it."

AFTER THEY HAD GONE, Jerry and Carl stared at each other. "That was a stupid thing to do," Carl observed. "You know you're a long way from being proficient on that abacus. You're lucky if you get the same answer twice when you add up a column of figures."

"I know," Jerry admitted, "but something about that guy and his know-it-all attitude goads me into accepting any challenge he throws down. It takes years of practice to master the soroban; manipulating those beads rapidly and accurately is a highly developed skill. The Japanese government gives examinations and issues three grades of licenses for operating the instrument. No one starting to study the soroban after he was out of his teens has ever been able to obtain a first-grade license. And an average student has to practice faithfully for an hour each day for half a year to obtain a third-grade license. I've probably played with the thing for a total of five hours! Oh, well, maybe Bruce isn't so hot figuring with a pencil and paper."

Before Carl could reply, Fred, a friend of theirs from down the hall, stuck his head in the door.

"Say, Jerry," Fred said hurriedly, "I just heard about the contest tomorrow night and I thought I'd better tell you something. Bruce is a real whiz at adding figures. He won a lot of ciphering contests back in high school. I've seen him add long columns of four-digit figures almost as fast as he can write them down many a time. I've got to go now, to study for an exam, but I didn't want you walking into that session cold turkey!"

"Well, that tears it," Carl declared, after Fred had gone. "You and your soroban are going to look pretty silly tomorrow night. Bruce suckered you when he said he wasn't good at ciphering."

"Yeah," Jerry said thoughtfully, "and that lie relieves me of any responsibility to play this thing straight. I wonder if we could dream up some way to give the soroban a little boost to compensate for an inept operator."

"I can't, but you look as though you could."

"Does that friend of yours in the room below us, the one whose dad is an adding machine salesman, still have that little electric machine?"

"Yeah; I saw it in his room yesterday. Don really makes that thing go."

"Good, good! We'll conceal a mike and amplifier here and run a couple of small wires out our window and into his window to a speaker. Both you and he, down there in his room, will be able to hear everything said up here. When the guy reads the numbers off to me, Don can add them up on his machine."

"What good will that do you?"

"Remember back in high school how we used to send code to each other in study hall?"

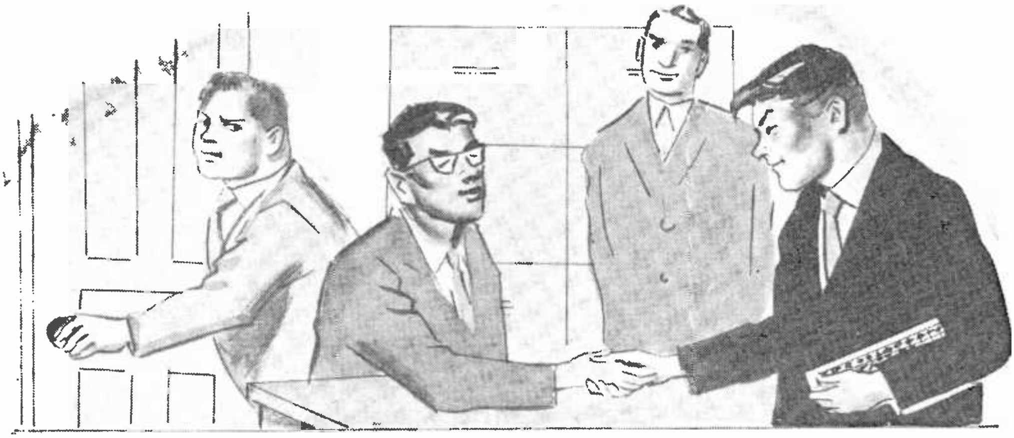
"Sure. We used transistorized transmitters modulated with a low-frequency tone, and the receivers fed earphones buzzing against our skin."

"We'll do the same thing tomorrow night. You will have a phono oscillator modulated with a keyed low-frequency tone. I'll be wearing a concealed broadcast transistorized receiver tuned to the phono oscillator and feeding a low-impedance earphone with the cap removed and the diaphragm taped directly against the inside of my leg. I'll be able to feel the vibration of the diaphragm and read the coded numbers you send."

Don did not like Bruce any better than did Carl and Jerry; so he happily agreed to take part in the plan. All arrangements were made the next day and checked out. Jerry found that he was able to read the sample numbers Carl sent with no trouble at all.

BUT when Bruce and his friends arrived that evening, Jerry's heart sank. They had a stranger with them, a Japanese student Bruce introduced as Takeo Kojima. Takeo had obviously been brought along to make sure there was no faking in the operation of the soroban! But there was no time to change plans. The two boys agreed upon as judges arrived almost immediately and announced that they were ready to start.

Bruce lost the toss of a coin and had to go first. He explained to the boy who was to read off the numbers that he



would move his left hand when he wanted another number read. The judge started reading, the stopwatch was started, and Bruce's pencil began darting over the paper.

There was a little space of time between the reading of each number and Bruce's signal to continue with the next. Obviously he was adding as he went along. This was confirmed after the reading of the fifteenth number, for he came up with the total almost immediately. In the room below, Don, who had been writing down the numbers for practice, nodded that the total was correct.

And it was also correct for the next two columns of numbers Bruce added up with amazing speed. "Six minutes and five seconds total time for adding all three columns," announced the boy holding the stopwatch.

"Okay, Jerry," Bruce gloated. "There's something for you and your ancient computer to shoot at. But just to make sure you don't have your desk wired for some sort of electronic hanky-panky, suppose you move over here and use Carl's. I still think it's funny he isn't here. Must be a mighty important engagement he has."

Jerry agreeably moved over to the other desk, and he noticed that Takeo also changed seats, so he could watch the operation of the soroban closely. Jerry tilted the instrument toward him to slide the bottom beads down, then laid the instrument flat and ran a finger along the beam to raise the top row of beads. He nodded to the judge that he was ready.

As soon as the judge finished reading one number, Jerry slapped his left hand on the table to indicate he was ready for the next. At the same time, he kept flipping the beads of the abacus aimlessly with the thumb and forefinger of his right hand. Without looking, he could sense that Takeo was watching every move.

Suddenly the fifteenth number was given, and the judge said, "Add!" Quickly Jerry cleared the abacus and began setting up the numbers he felt vibrating in dots and dashes against the flesh of his leg.

"Fifty two thousand five hundred and three!" he read aloud.

"Correct," the judge answered; "go ahead with the next column."

The addition of the next two columns was a repetition of the first. Jerry left much less time between the reading of the numbers than had Bruce, and he came up with the total almost as quickly.

"Three minutes and forty seconds total time," the judge with the stopwatch announced. "I guess there's no doubt about the winner."

"Now comes the exposure!" Jerry thought as he braced himself and looked up at Takeo; but the Japanese was smiling at him in admiration.

"Let me congratulate you," he said, holding out his hand. "I studied the soroban in school, and at first you puzzled me with your unorthodox manipulation of the beads; but then I realized what you were doing: you were using mental calculation, the method of the experts!

"You see," he explained to the others, "this is a method in which the operator simply visualizes a soroban and mentally manipulates the beads as each number is added. It is extremely fast because the whole operation takes place in the brain cells. I realized that Jerry was using this method when I noticed he was actually not recording the numbers read off on the physical soroban in front of him; yet, when it was time for the total, he racked it up correctly on the instrument."

"WHY didn't you tell us you were an expert?" Bruce demanded as he headed angrily for the door.

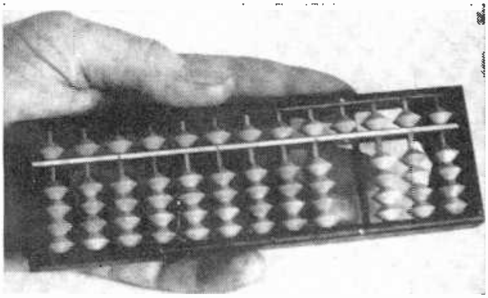
"You did a little holding out yourself, didn't you?" Jerry retorted.

Shortly after the others left, Carl and Don, grinning from ear to ear, came into the room.

"Boy, that was close!" Carl exclaimed. "I thought we'd had it when they introduced that Japanese fellow."

"I know," Jerry agreed, and then went on to admit, "I still don't feel quite right, though, about resorting to trickery to win."

"Neither do I," Carl confessed; "but I console myself by thinking it could not have happened to a more deserving guy than Bruce!" —30—



If you're interested in getting a soroban (often called a "Japanese abacus") like the small 13-reed one shown above, Charles E. Tuttle Co., Inc., Rutland, Vt., will sell you one for $1.25. A medium-size, 15-reed unit costs $2.75, and a large 23-reed soroban $3.25. Also available (for another $1.25) is a paperback book titled "The Japanese Abacus—Its Use and Theory." When you order, enclose 25 cents extra for postage for each soroban and book. And when you order, say "Carl and Jerry sent me."

Littler Than Lilliput

(*Continued from page* 51)

except for the additional leads involved.

While integrated and ultraminiature by definition, micro-circuits assembled on standard headers from individual diodes and transistors are not as representative of a new manufacturing process as they are of a refinement in assembly techniques. The circuit designs employed generally depend on direct coupling between semiconductor devices, with a minimum of external components (such as resistors and capacitors). The use of micro-circuit assemblies has made possible a considerable increase in component density, however, with a corresponding decrease in overall equipment size.

Price-wise, micro-circuits provide an excellent example of what we can expect as production techniques are refined and as the economies of mass production come into full play. When first introduced, these units sold for over one hundred dollars *each*, even in modest quantities. Today, some firms offer complete circuit assemblies in several standard configurations at prices approximating those of some transistors!

Solid-State Circuits. Thin-film techniques and micro-circuit assembly methods have accomplished miracles in miniaturization and offer tremendous promise for the future. But perhaps the ultimate approach to micromiaturization is the production of a complete circuit as a single semiconductor device—in essence, a solid crystal which performs the same function as a conventional circuit through a rearrangement of its internal molecular structure, and without the need for individual active and passive electrical elements.

When perfected, this technique may permit the manufacture of a pinhead-sized crystal capable of performing all the functions of an amplifier or oscillator stage. Interconnected, a few such "pinheads" could serve as a complete receiver or amplifier. One manufacturer, for example, is now developing a computer using solid-state circuits. The completed instrument will weigh less than 15 pounds and occupy less than one-third of a cubic foot, compared with the 175-pound weight and three-cubic-foot space requirements of an equivalent "miniature" transistorized computer.

The basic steps in the fabrication of at least one type of solid-state circuit are essentially similar to the methods used for the production of individual diodes and transistors (see "Transistors—Types and Techniques," POPULAR ELECTRONICS, November, 1962, p. 64). The base material on which the circuit is formed is a wafer of semiconductor material (such as silicon) rather than an insulating substrate.

Area masking, photoengraving, etching, and impurity diffusion techniques are used to form appropriate *p*- and *n*-type semiconductor regions in the wafer to produce various circuit elements. Evaporation methods are then employed to apply metallic conductors. And, finally, the wafer is mounted in a suitable case (such as a ceramic wafer), the crystal is diced to isolate individual elements, and circuit interconnections are made.

Summing Up. At present, the majority of commercially available thin-film, "micro-circuit," and solid-state microminiature circuits are used in computer designs . . . flip-flop's, gates, buffer amplifiers, shift registers, adders, and memory arrays. There is a good reason for this—of all electronic systems, computers require the greatest number of repetitive circuits, and it is here that the advantages of the multiple production of identical circuits can be utilized to the fullest extent.

As far as consumer products are concerned, microminiaturization of circuitry will offer few advantages until "accessory" components (microphones, speakers, etc.) can be subjected to a similar "shrinking" process. Research is being conducted along these lines, however, and there is a definite possibility that microminiaturization will be applied to such units as hearing aids, walkie-talkies, personal receivers, amplifiers, and similar products in the not-too-distant future.

As for industrial applications, one firm has confidently estimated that the market for microminiature circuits will approach twenty billion dollars a year by 1980! -30-

DX Awards

(Continued from page 70)

the station's verification. Do not list any verification you cannot supply for authentication on demand.

3 All pertinent verifications, whether QSL cards or letters, should be carefully packaged and stored by the applicant until such time as instructions are received to send in some or all of them for checking purposes. Instructions on how and to whom to send the verifications will be given at that time. Failure to comply with these instructions will disqualify the application.

4 A fee of 50 cents (in U.S. coin) must accompany the list of verifications to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible for an Award.

5 Apply for the highest DX Award for which you are eligible. If, at a later date, you become eligible for a higher award, then apply for that Award, following these rules and regulations exactly as before.

6 Awards will be issued to all duly qualified applicants whose applications are received during the year 1963. Any applications postmarked after midnight, December 31, 1963, will be invaiid.

7 Mail your verification list, 50¢ fee, and application form to:

Hank Bennett, Short-Wave Editor
POPULAR ELECTRONICS DX AWARDS
P. O. Box 254
Haddonfield, N. J.

Include in the envelope only those items which are directly related to your entry for the Award. Do not include an application for a Short-Wave Monitor Certificate (you are not eligible for any of the Awards until you have a Short-Wave Monitor Certificate in your possession). If you want to ask other questions or supply news items, reports, etc., use another envelope.

The DX Award is a gold seal with embossed blue lettering, and is designed to adhere to the bottom of a WPE Monitor Certificate. When you win your first award, paste it on the Certificate over the inscription "1st Award," in the lower left-hand corner. If you are only eligible for a "25 country" Award at this time, and at a later date want to apply for a "50 country" Award, paste the second award—when you get it—on top of the first one. The other Award positions provided on the Certificate are intended for different awards—which will be announced at a later date. —30—

Transistor Topics

(Continued from page 74)

back. The *MIC* is a standard carbon microphone cartridge; *R1* a 10-ohm, 1-watt resistor; *S1* a spring-return normally open switch; and *Q1* a 2N301 power transistor mounted on a small metal chassis which serves as a heat sink. Almost any standard PM speaker with a 3-4 ohm voice coil should give satisfactory results; as a general rule, though, the larger the speaker and the heavier its magnet, the greater the unit's overall efficiency. The power supply (*B1*) can be made up by connecting two flashlight cells in series.

Technical Data. Two new publications have been announced which should be of real interest to most experimenters and hobbyists. Either can be obtained by writing directly to their respective publishers.

A 24-page *Zener Diode Locator* has been issued by the International Rectifier Corp. (233 Kansas St., El Segundo, Calif.). This comprehensive guidebook lists all known zener devices by both JEDEC (EIA) and manufacturers' part numbers. The listings are in numerical sequence and include case type, power rating, nominal voltage range, and specified test current for each type. Also included are detailed specifications for all of International Rectifier's standard zener devices, including 250-mw., 400-mw., 750-mw., 1-watt, 3½- and 10-watt units. A table in the back of the booklet gives case outlines and dimensions.

General Electric (Semiconductor Products Dept., Electronics Park, Syracuse 1, N.Y.) has published a 16-page *Transistor Interchangeability Listing.* Starting with the 2N22, this booklet lists 1167 JEDEC transistor types in numerical order, along with the closest GE equivalents, maximum ratings, and basic electrical parameters. Outline drawings, case sizes, and lead connections are included for standard small-signal and power units.

Product News. A transient voltage protector substitution selector has been introduced by the International Rectifier Corp. (233 Kansas St., El Segundo, Calif.). Dubbed the "Klipselector," this instrument permits selection of the optimum-size clamping device to protect semiconductor rectifiers, controlled rectifiers, and transistors. Selector switches permit the operator to choose any number of non-polarized "Klip-Sels" having from 1 to 20 series elements in 26-volt step-ups from 26 to 520 volts. Measuring approximately 8¼" x 5¾" x 6" overall, the Klipselector is described in detail in Bulletin SR-156.

New instrument by International Rectifier helps select proper "voltage protection" device. The unit is called a "Klipselector."

Motorola Semiconductor Products, Inc. (5005 E. McDowell Rd., Phoenix 8, Ariz.) has introduced a number of new transistor types, including a series of silicon epitaxial "Star" planar units—featuring a low storage time along with high-current, high-speed switching capabilities—and a series of alloy-diffused *pnip* power transistors with breakdown voltage ratings up to 160 volts. The latter units are germanium devices intended for such applications as transistorized ignition systems, wide-range audio amplifiers, TV sweep circuits, high-voltage power switching circuits, servo amplifiers, ultrasonic oscillators, etc.—designs which, in the past, would have required silicon transistors to obtain the necessary high-voltage characteristics. The new "Star" transistors (Types 2N2537 to 2N2540) sell for $6.65 to $7.40 each in small quantities, while the new high-voltage power units (Types 2N2526 to 2N2528), sell for $7.13 to $14.85 each. Detailed electrical specifications on either series can be obtained by writing directly to Motorola.

Four new low-cost audio transistors have been announced by RCA (Semiconductor and Materials Div., Somerville, N. J.). All four are germanium units, with Types 2N2613 and 2N2614 designed for input stages of audio-frequency equipment and featuring low noise, high gain, excellent frequency response, and low leakage; the other two units, Types 2N2147 and 2N2148, are power types featuring high gain and excellent linearity for audio output applications. A pair of 2N2147's in Class B push-pull can deliver 25 watts (sine-wave) to a 4-ohm speaker with less than 5% distortion, and provide 32 db power gain. The 2N2148 can deliver up to 5 watts (sine-wave) and provide 36 db power gain in Class A service.

That takes us to the end of another column . . . and almost to the end of winter. All of which brings up a very timely question: have you started planning your spring projects yet? If you haven't, be sure to go heavy on transistors when you do!

—*Lou*

That Vile Interference

(*Continued from page* 81)

antenna), attach one end to the terminals on the back of the TV set along with the regular antenna lead.

Then, when the interference is "on," start cutting off about ¼" of the free end at a time until the interference is minimized. Be sure to let go of the twin-lead after each cut, since your body capacity will affect the resonant frequency of the stub. In fact, it's a good idea to have the television set in its normal position, if possible, to compensate for the effects of any nearby objects. If you cut off ½" too much, try sticking straight pins into the ends of the twin-lead.

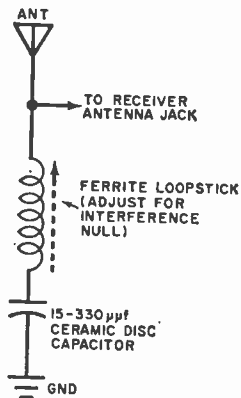


Fig. 7. Troublesome interference on AM broadcast-band receivers can often be eliminated with a simple wave trap. Optimum value for series capacitor can be determined by trial and error, or you can use a variable capacitor instead.

Broadcast-Band Trap. Sometimes, signals above the broadcast band cause interference on AM receivers. The remedy in this case is to put a ferrite loopstick and capacitor in series across the antenna terminals of the receiver, as shown in Fig. 7. Since this combination is a short circuit at its resonant frequency, it must be tuned to the frequency of the interfering signal.

The value of the capacitor will have to be determined by trial and error, unless the frequency of the offending signal is known. Using values of 330, 220, 100, 68, 33, and 15 μμf., one at a time, try adjusting the loopstick slug for an interference null. If desired, a variable capacitor can be used in place of the fixed capacitor.

WINNING THE BATTLE

As mentioned earlier, remember that the "enemy" is usually the equipment in the home where the interference occurs and not the transmitting equipment itself. Therefore, this article has been directed mostly toward the "responsible party," and not the CB'er or ham—often the recipient of much misdirected criticism.

In any case, a good supply of courtesy and understanding will go a long way in getting the cooperation you'll need in your fight against interference. Armed with an understanding of the problem, plus the necessary "combat gear," you'll be all set to do battle with the often misunderstood and usually surreptitious interference problem.

Good luck . . . . . and CHARGE! –30–

Photo Album Quiz Answers

(*Quiz on page* 45)

1—F A JACK is an electrical connecting device designed for the insertion of a mating electrical plug.

2—I A HENRY is the electromagnetic unit of inductance or mutual inductance. Its magnitude is a measure of a coil's ability to produce a back e.m.f.

3—E The RAY in a television picture tube is the beam of electrons which originate at the cathode and strike the fluorescent screen.

4—B A GILBERT is a unit of magnemotive force whose magnitude is proportional to the current I and turns N in a coil.

5—D A CHUCK is a mechanical device which holds the bit on the shaft of an electric or hand drill.

6—A A MIKE is, of course, a short common name for microphone.

7—G A PHILLIPS screwdriver has fluted cruciform tip which fit slots in a screw head designed to receive it.

8—H An ALLEN wrench has a hexagonal cross-section designed to fit inside a similarly slotted screw head.

9—C GUY wires are used to hold an antenna mast in place and/or reduce mast swaying.

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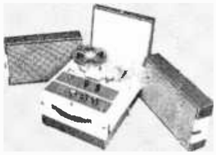

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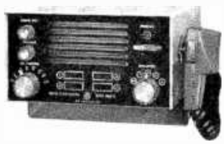

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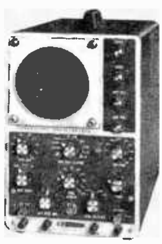

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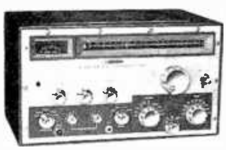

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Across the Ham Bands

(*Continued from page* 89)

that this ham moved and neglected to notify the FCC of his new address—a violation in itself—and consequently, he probably never received the FCC notices. Whatever the reason, he seems to be in real trouble. If any of our "K8" readers fits into this category, we suggest that he report in to the FCC immediately—before it's too late.

News and Views

Robert Zimmer, WN2AXH, 94 Brittle Lane, Hicksville, N. Y., attacks the 40-meter Novice band interference with an EICO 723 transmitter and a 20-year-old RME-69 receiver. He has 13 states worked. . . . **Andy Heyward, WA6YWR,** 608 N. Crescent Drive, Beverly Hills, Calif., closed out his Novice career (when his General ticket arrived) with 200 contacts in 30 states. Andy has a tri-bander rotary beam, a Gotham vertical in the back yard, a Johnson "Viking II" transmitter cranked down to 75 watts, and a Lafayette HE-30 receiver. There's a Rag Chewers' Club certificate on his shack wall. . . . **Les Biglands, WN2DWR,** 186 Grove St., Angola, N. Y., almost needs a telescope to see the other end of his antenna—it's 260' long! A Heathkit DX-35 transmitter feeds the antenna, and the antenna feeds a Lafayette HE-30 receiver. Operating on 40 and 15 meters, Les has 35 states worked, plus Switzerland, Canada, Puerto Rico, Canal Zone, and Venezuela. When he's not hamming, he does some SWL'ing as WPE2CTS.

Ken Crandall, WNØDKA, P.O. Box 224, 5107 Woodhill Dr., Glen Lake, Minn., spends most of his time on 40 meters, where his Heathkit DX-40—running a "Novice gallon"—feeds a Hy-Gain 14-AVS vertical antenna. He receives on a Knight-Kit "Span Master," and his 31-states-worked-plus-Puerto Rico record leaves him little to complain about. But he does wish the General theory was as easy as the code! . . . Speaking of the code, we've received a couple of comments from Novices (and from one General, too) to the effect that the code speed used in some of the so-called "slow-speed" Novice nets is pretty fast. Do you agree?

Jack Ekstrom, K9BQL, 169 S. River Rd., N. Aurora, Ill., has three antennas: 80- and 40-meter dipoles, and a 1-element rotary dipole for 15 meters. Using a Johnson Ranger transmitter and a Drake 2B receiver, Jack needs only North Dakota for WAS. He has also worked 13 countries. Jack feels that the secret of working DX is to listen, listen, and listen, and most Novices waste their time with long, long "CQ DX" calls. . . . **Bob Wind, WN8CQA,** 19371 Forrer, Detroit 35, Mich., operates on the three low-frequency Novice bands with his EICO 720 transmitter, Knight-Kit R-100 receiver, and Hy-Gain 14-AVS vertical antenna. So far his record is 50 contacts in 12 states.

Kenneth W. Kaplan, WN2QRT, 11 Babylon Rd., Merrick, L. I., N. Y., feeds a 6-element, 2-meter beam with a Heathkit "Twoer." The beam must like the diet, because Ken has made over 300 contacts on 2 meters with this combination. But he is building a high-power amplifier to use when his Technician license arrives. . . . **Reid Shipp, WN5ARI,** 511 East Elm St., Prescott, Ark., works 40 and 80 meters with a home-brew 75-watt transmitter to feed a 40-meter dipole antenna, and he receives with a venerable Hallicrafters S-20R receiver. Twenty-three states worked, 17 of them confirmed, is the result. Reid is also experimenting with a single-transistor transmitter on 40 and 15 meters—it works fine, but 12 milliwatts of power doesn't cut through much interference.

Paul Folmsbee, WA4BRS, Route 1, Hasty Rd., Laurinburg, N. C., divides most of his operating time between the 80-meter Novice band, using a Heathkit DX-40 transmitter running 75 watts, and 75-meter phone using a "war-surplus" ART-13 transmitter running 200 watts. Being the "most active" ham station in Scotland County, he is very popular with stations trying to work all counties in North Carolina. . . . **Bob Bender, WN2CZS,** Buffalo, N. Y., transmits on a Knight-Kit T-150 and receives on a Heathkit HR-10. A 40-meter dipole 45' high couples the receiver and transmitter to the ionosphere, mostly on 40 meters, but Bob gets on 15 meters at times. He has 31 states worked, with cards from 27 of them. Bob wants to thank POPULAR ELECTRONICS for the Short-Wave Monitoring program that first got him interested in SWL'ing (he is WPE2HXV). He then started listening to hams, and studying for a Novice license. A General Class license and a WB2 call are next on the program.

Tom O'Brien, WV6UZG, Venice, Calif., who may be a General by now, likes to work strong locals with his EICO 723 transmitter and Gonset 63 receiver.

Before we sign off for the month, we'd like to remind you that *Across the Ham Bands* is *your* column; so let us hear your "News and Views" and see your photos. Mail them to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Ind. Until next month, 73,

Herb, W9EGQ

Don't Forget the Shoe Polish

(Continued from page 56)

player had been used by the Army or Navy for the old standard-groove, 33⅓ transcriptions and was probably "war surplus" before World War II.

The moral: always consider the electronic or mechanical gear as worthless when you figure the value of any old cabinet. In addition, always gauge the price against the cost of new materials of comparable quality.

Make Way for a Speaker. When you have found a suitable cabinet, do the major surgery first. For a typical speaker enclosure, you'll need to brace the walls; perhaps add a new speaker board cut for your speaker size; and, very likely, put in some new grille cloth.

You can derive the port area from a bass reflex design chart if you have one available. If not, make the port area equal to the effective piston area of your speaker (about 85 sq. in. for a 12" speaker, 30" sq. in. for an 8" speaker), and tune. If you have trouble tuning the enclosure, try tacking several layers of cloth over the port to broaden the *Q*. Also, don't forget to pad heavily.

You'll probably have to add cleats to the sides, top, and bottom to accept screws for the back. And this, in many cases, is the only part you'll need to buy.

Bringing Out the Beauty. Your next step is to decide how the wood will be refinished. If it has been badly scratched or if it's darker than you desire, the decision is simple. You'll have to use varnish remover and go all the way down to the bare wood.

Follow directions with the varnish remover—brush it on, and let it work for the specified time before you start scraping. A putty knife will serve at first, but "gingerbread" or other kinds of tooled surfaces will require the use of a wire brush or steel wool. If you use steel wool, be careful to remove the small shreds or the magnet may attract them into the speaker voice coil gap. (A rag dampened with paint thinner will often pick them up very nicely.)

Most of the really old cabinets seem to have had a darkening agent applied.

This must be removed from the pores of the wood if you want to apply a lighter, more natural finish. Dark woods can be bleached, but bleaching is a tricky process unless you're experienced at refinishing work.

When you have removed the old varnish and filler, you're ready to put on a new coating. New filler isn't necessary, but in some cases it will make a smoother surface without the slightly dimpled effect of unfilled wood.

If you try to match another piece of furniture, you'll probably find it impossible to purchase the proper stain. Actually, minor deviations usually go unnoticed, anyway. I prefer to use the "old-fashioned" oil stains, which seem to give a cleaner appearance than the "painty" stains. The latter are useful mainly to cover up undesirable grain or make cheap wood look like something better. Since these cabinets are usually made of high-grade veneers, the problem is to find a clear stain that adds the color you want without clouding the beauty of the wood.

The Shoe Polish! There are various kinds of "final coat" materials. Varnish is probably most common, lacquer almost as much so. Each has advantages. Varnish is easy to brush, lacquer more difficult. But lacquer dries dust-free almost immediately. Both will give a durable finish if you buy a good product and use it properly. (I've learned by experience that it *never* pays to economize on either of these items).

If you choose varnish, let it dry thoroughly (this is usually a matter of days) between coats for best results. Lacquer jobs can be rushed more. With either type of material, make sure the wood is cleaned with a cloth dampened with solvent and allowed to dry before you begin. Work only in good light and with as little dust as possible.

Some may question the sense of applying expensive finishes to a cheap cabinet, especially if it's only to serve as a remote speaker enclosure. And this is where shoe polish comes in. A can of paste shoe polish in the color desired can do an admirable job of staining and waxing the cabinet. In fact, some people like the waxed wood effect better than conventional treatments.

Apply the polish after you've removed the old varnish. With some cabinets, the whole refinishing job will amount to nothing more than dabbing on shoe polish to fill minor scratches and add new luster. The camouflage possibilities of shoe polish are almost unbelievable if the old finish is even remotely good.

White Elephants. Although the majority of the cabinets I've reworked have been from old radios, the possibilities are endless. Just recently I came across some old walnut buffets which were for sale. They were of a dated style, which brought the asking price down to the $5.00 level. All were about six feet long with an identical compartment in either end. It shouldn't take too much imagination for someone to convert such white elephants into very acceptably styled stereo enclosures with equipment in the central portion and speakers at either end.

One thing you can be sure of—if you do decide to rework any of these old pieces, your hi-fi or stereo rig will be unique, to say the least! -30-

On the Citizens Band

(*Continued from page* 67)

The "Track" Team. We've often made reference to the "unlimited applications" of the Citizens Band. While the saying may become a little trite after a while, new and valuable "applications" continue to materialize at a rapid rate. Morris G. Ellis of Boulder, Colo., has just contributed another one. He informed us of the very effective operation of the Cherryvale Tracking Team of Colorado, which consists of 11 men whose main function is locating and guiding lost persons to safety and administering first aid.

The group will work any part of the state, under any conditions. The members have all been trained by another member of the team who was himself raised and trained by Indian trackers. Besides their 21 pieces of CB gear, including mobile, base, and hand-held units, the team makes use of a proven bloodhound and two pack mules. Other modes of transportation include vehicles for rugged terrain, and an airplane.

The Cherryvale trackers' response time to any call is 15 minutes, with transport facilities available on less than 90 minutes notice. The team is completely self-sustaining on missions lasting up to five days. In less than a year-and-a-half they have participated in over two dozen rescues from mountains, plains, and cities. To their knowledge, and to ours, they are the only such tracking team in the country.

Club Chatter. Kudos to Verne Reimers, 11W7585, for his excellent job of editing the Citizens Radio Associates newspaper! The CRA is located in Los Angeles, and while the latest issue of the paper we received made no direct indication of total membership, we're convinced that they're a hefty group (in number). Besides three officers and an editor for the paper, the CRA has a three-man advisory board, sergeant-at-arms, a parliamentarian, and eight committees made up of 31 members, covering everything from refreshments to public relations. . . . Three more cases of stolen mobile radio equipment were reported recently by Walt Payne, 3W3672, editor of the South Jersey Citizens Band News. Walt informed club members that in one case "the car containing the equipment was stolen along with it." Just goes to show which is the more important in the minds of CB'ers! But the story has a moral: keep your vehicle locked, or—better still—install one of the many burglar alarms that are available. Some can be connected so as to keep your horn honking as long as anyone attempts to tamper, while others have built-in attention-getting devices.

We have two recently organized CB clubs to add to the growing cross-country list this month. President Louis J. Berkovitz, 18W7877, informed us of the Manitowoc County Communicators of Wisconsin (how about a mailing address, Lou?), while Robert J. Simmons announced the recent bonding of the Central Connecticut Citizens Band Association. Anyone interested in joining the latter group should write to the CCCBA, P. O. Box 286, New Britain, Conn.

Our thanks to the Mid-State Minutemen of Stillwater, Okla., for honoring your CB Editor with a membership—*sans* an expiration date! . . . Many thanks also for all the friendly comments received regarding the new hand on the mike button at the *On the Citizens Band* desk. They're much appreciated and we enjoy hearing from you. . . . We'd especially like to add one last bit of thanks to 13-year-old Russ Hawkins of Springfield, Ohio, and ask that he forward us his street address. We were honored to have Russ become our first fan! —30—

Heathkit AA-21 Report

We regret that circumstances beyond our control have prevented us from presenting a detailed test report on the Heathkit AA-21 transistorized stereo amplifier in this issue. Preliminary tests indicate that the AA-21 meets or far exceeds many of Heath's specifications for this unit. Distortion is very low at most power levels, and output is flat from 20 to above 20,000 cycles. The AA-21 is perfectly stable under capacitive loads, with hum and noise levels down 70 db from a 0 db level at 10 watts. Full details, with graphs and photos, are now scheduled for our April issue.

Operation "Assist"

(Continued from page 32)

Radio Corp. of America (Model MI-13174) coin-operated receiver. (Richard Kruse, RFD 2, Box 42, Galva, Kans.)

aerOking (Model A-725) wire recorder. (Robert Leslie, WPE4DEY, 6628 Washington Dr., Falls Church, Va.)

Western Electric (Model 39A) transmitter and (Model 38AA) receiver. Also technical data. (Lt. Col. Carl H. White, USAF-Ret., 7924 Kipling Parkway, Washington 28, D. C.)

Electrohome (Model PMF82-429) 8-tube, a.c. only, AM/FM receiver. (Barry S. Toppeman, 548 Palmerston Blvd., Toronto 4, Ont., Canada.)

National Co. (Model NC-33) receiver, or military equivalent (BM-282). (Duffy E. Hoyt, WPE2JCZ, 3127 Lake St., Horseheads, N.Y.)

Sonar (Model MR3, Serial #1137) mobile receiver for 75, 20, and 15 meters. (John W. Ayres, II, Box 228, Virginia Military Institute, Lexington, Va.)

Silver Vomax (Model 900) vacuum-tube voltmeter, manufactured by McMurdo Silver Co. of Hartford, Conn. Also operating instructions. (Paul E. Klein, 116 Surry Lane, River Edge, N.J.)

TECHNICAL DATA

Military (PP-748/U) rectifier. Modifications or application notes for use with 24- to 28-volt gear. (Ralph H. Franklin, 298 Park St., West Springfield, Mass.)

Hallicrafters (Model H 140105) Sky Buddy receiver. Modifications for substituting newer tube types for the ones presently used. (C. L. Miller, RFD 2, Box 585, Alvin, Texas.)

Andrea Radio (Model COVK125) TV set. TV picture tube type number. (Sheldon Kolansky, Box 336, Woodbourne, N.Y.)

Military (Model R.D.R.) receiver, built for the U.S. Navy by RCA. Modifications for operation on amateur frequencies and a schematic. (Clifford Eldert, 1417 Illinois St., Pekin, Ill.)

Military (R-77/ARC-3 or R-77A/ARC-3) VHF receiver, manufactured by Colonial Radio Corp. Any and all available information and data. (Ken W. Sandvoss, El Retiro Lane, Irvington-on-Hudson, N.Y.)

Bendix (Model MRT-6-JB, Serial #1-405 B) "mobile unit," about 1950 vintage. Alignment instructions and schematic. (W.L. Albertson, 413 Third St., San Bernardino, Calif.) -30-

Short-Wave Report

(*Continued from page 76*)

Current Station Reports

The following is a resume 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. Reports should be sent to P.O. Box 254, Haddonfield, N.J., in time to reach your Short-Wave Editor by the eighth of each month; be sure to include your WPE call letters and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Andorra—*R. Des Vallees D'Andorre,* 6305 kc., is presently being heard at 0300-0330 in French.

Argentina—The latest schedule from Buenos Aires shows the Central Europe xmsn as being from 1400 to 2000 with one hour each in Spanish, German, Italian, French, English, and Portuguese, in that order; all on 11,730 kc. except the Portuguese xmsn which is on 9690 kc. Broadcasts go to Eastern N.A. at 2000-2200 in Spanish and at 2200-2300 in Eng. on 9690 kc., and to Western N.A. at 2300-0100 in Spanish and at 0100-0200 in Eng., also on 9690 kc. Other listed xmsns include: 1400-1700 on 11,780 and 6090 kc.; 2000-0200 on 11,780 kc.; and 2100-0200 on 6090 kc. Specific programming for the latter xmsns was not given.

Bulgaria—Sofia has moved from 9700 to 6070 kc. for its daily broadcasts to N.A. at 1900-1930, 2000-2030, and 2300-2330. The daily concert to N.A. and Canada at 1835-1900 is also heard on the same frequency.

Cameroons—*R. Yaounde,* 4972.5 kc., has been noted at 0000-0030 with native music and Eng. anmts followed by an Eng. newscast. From 0030 it is in French.

Cape Verde Islands—CR4AA, *R. Clube de Cabo Verde,* Praia, was heard on 3952 kc. at 1643 in Portuguese with frequent mention of other Portuguese colonies. A brief musical period was given at 1650, and closing—after a full ID—was at 1702.

Ceylon—The Commercial Service of *R. Ceylon,* Colombo, has been heard on 9560 kc. at 0848-0959 with commercials, records, and Eng. anmts.

Chile—CE1185, *R. La Cruz Del Sur.* Santiago, has been heard on 11,850 kc. at 2000-2100 with a religious program and a request for reports. This is a rarely reported station and may actually have been off the air for some time.

Colombia—Recent loggings include: HJFQ, *La Voz Del Pueblo,* 5997 kc., Pereira, at 2200 with news, a talk at 2225, ID at 2232; HJCA, *R. Nacional,* Bogota (?), 5012 kc., with L.A. music around 2025 and all-Spanish anmts; and HJCQ, *R. Nacional*, Bogota, 4955 kc., at 1805 with L.A. music and an excellent signal. Spanish news is given at 1800.

Costa Rica—TIFC, San Jose, operates in Eng. at 2300-0000 daily and at 1500-1600 on Sundays on 6037 and 9645 kc., with classical music and/or religious programs. *R. Reloj,* San Jose, 6006 kc., is noted at 2230-0100 with L.A. music, frequent ID's, commercials, and time checks.

Cuba—Havana has replaced 6010 kc. with 6135 kc., and 5990 kc. with 5975 kc. for the 2200-2300 and 0000-0100 xmsns to North, Central and South America. English to Europe is now aired on 11,800 kc. at 1555, and a Spanish xmsn was noted on 15,270 kc. from 1130.

Czechoslovakia—Prague's new schedule to N.A. now reads: 2000-2055 and 2330-0030 on 5930, 7345, 9550, 9795, and 11,990 kc. Letter acknowledgments are read on Tuesdays and Thursdays and the "Stamp Club" and "Ham Show" are broadcast on alternate Thursdays. The schedule to New Zealand, Australia, Japan, and the Far East now reads: 0300-0355 on 11,725, 15,245, 15,285, and 21,450 kc.

Dominican Republic—A rarely reported station is HI2JP, Santo Domingo, 4970 kc., noted recently at 2000 with an ID and music.

Egypt—Cairo's S.E. Asia xmsn in Eng. at 0830-0930 on 17,915 kc. is being heard well. A newscast is given at 0845.

Ethiopia—Addis Ababa has moved from 11,955 to 11,760 kc. for the daily Eng. xmsn

Special Medium-Wave Report

Medium-wave aircraft beacon RAB, Rabinal, Guatemala, can be heard at times on 1613 kc. with a constant ID in Morse code. Power is 50 watts.

Standard broadcast-band stations outside of the United States which are currently being heard include: ZFCL, *R. St. George*, St. George, Bermuda, 960 kc., 1 kw., 0000-0330 (this may be a 24-hour station); *R. Nacional, la Republica de Panama,* 646 kc. (which may be the medium-wave outlet of HOQQ, Panama City, 6140 kc.) noted at 2300; YND, Managua, Nicaragua, 675 kc., Havana, 690 kc., and *R. Americas*. Swan Island, all good after 1930; TGUX, Guatemala, heard regularly on Mondays with Eng. at 0115-0145 on 1020 kc.; and PJA6, *R. Victoria,* Aruba, 905 kc., 10 kw., heard most evenings for a solid month in your Short-Wave Editor's listening post (they plan to present a new "DX Program" on the first of each month at 0000).

Bordeaux I, France, 1205 kc., has an excellent signal on Mondays from 0100 to 0200 while WCAU is off the air; at times it blocks TGED, 1208 kc., in Guatemala. Another French station noted is Lille I Camphin, Lille, France, on 1376 kc.; this one was logged near New York City at 1658.

at 1510-1530. From 1530 they broadcast in French. The International Service has been noted on 15,292 kc. at 1337 with African music and a French ID, a French newscast at 1345, ID at 1350, then s/off.

Fiji—A report from Australia lists Suva as currently using 4785 kc. (VRH5) and 3935 kc. (VRH7) for local programming. and 3286 kc. (VRH8), 3980 kc. (VRH4), and 4756 kc. (VRH5) for the Eng. xmsns, with s/off at 0530.

France—Paris broadcasts to the Far East at 0800-0845 in Eng., at 0845-0945 in French, and to 1000 in Vietnamese on 15,245, 17,775,

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	N.A.—North America
B/C—Broadcasting	QRM—Station interference
Eng.—English	R.—Radio
ID—Identification	s/off—Sign-off
kc.—Kilocycles	s/on—Sign-on
kw.—Kilowatts	VOA—Voice of America
L.A.—Latin America	xmsn—Transmission

and 21,620 kc. The Eng. is heard well at times. Another Far East xmsn is given at 1800-1830 in French on 9680 and 9560 kc. The French xmsn to Canada on 15,160 kc. is also heard well at 1315-1345.

Germany (West)—The Eng. xmsn to N.A. at 1530-1610 is now broadcast on 5980 kc. (replacing 11,795 kc.) and 9735 kc. The other periods remain the same, i.e., 1920-2000 on 6145 and 9605 kc., and 0000-0040 on 6110 and 9735 kc. A xmsn in French may be heard at 2000-2045 on 6145 and 9605 kc.

Hungary—Budapest has Eng. to N.A. at 1900-2000 on 11,890, 9833, and 9770 kc., and at 2230-2330 on 9833, 9770, and 7220 kc. The European xmsns are carried at 1500-1530 in Eng. on 9833 and 7220 kc.; at 1600-1655 in Spanish and at 1700-1730 in Eng. on 9833, 7220, and 6230 kc. They may also be testing in native language on 17,875 kc. at 0900-1000.

India—Delhi has been noted at 1500-1515 with a speech and "Press Review" in Eng. on 7235 kc.

Iraq—Baghdad's Eng. at 1630-1700 is listed for 6135 kc. but has been found on 6094 and 6030 kc. ZYB7 in Brazil often QRM's the higher channel.

Italy—Rome no longer carries the 0930-1005 xmsn on 15,400 kc., possibly because KCBR, Delano, Calif., has Eng. here to 1000. The 1505 xmsn in Bengali goes on as usual on 15,400 kc. A rarely reported broadcast is Rome's Rumanian xmsn which opens at 1535 on 7290 kc.

Ivory Coast—Abidjan is heard well on 11,820 kc. in Eng. at 1345-1415 with news and music. Transmissions in French are made before and after the Eng. period. The 4940-kc. outlet can also be heard at 1700-1732 with Eng. religious music, French anmts, a short newscast, and s/off.

Lebanon—Beirut has moved its Eng. from 1600-1615 on 15,295 kc. to 1630-1645 on 11,890 kc. They open with a fanfare from the march from "Tannhauser." At 1645 they go into Arabic and French.

Liberia—The *Voice of America* has opened operations in Monrovia on 7195 kc. with a 1700-1730 Eng. segment to Africa.

Monaco—Trans-World Radio, Monte Carlo, has been tuned on 7260 kc. at 0150 with "Back to the Bible," and on 7202 kc. at 1430 testing in Eng. and French and asking for reports.

Peru—Here are four rare and difficult stations to log: OAX10, *R. Chiclayo*, Chiclayo, 5680 kc., noted at 2115-2200, all-Spanish, with L.A. tunes and many commercials; OAX5X, *R. Nasca*, Nasca, 4790 kc., heard at 2235-2335 with ID, time checks, but no commercials while they are still in the testing stage; OAX70, *R. Madre de Dios,* Puerto Maldonado, 3960 kc., tuned with an ID at 2024, then dance music to 2044 s/off (many ID's and all-Spanish); OAX7T, *R. Sicuani*, Sicuani, 4835 kc., often heard around 2200-2215 with ID's, commercials, and L.A. tunes (this station runs only 350 watts). An easier station to tune in N.A. is OAX8K, Iquitos, on 9625 kc. with L.A. music, time signals, and Spanish ID's; try for it around 2230-2300.

Philippine Islands—The newest schedule from the Far East B/C Co., Manila, lists these Eng. xmsns: DZI9, on 7230 kc. at 1830-1930 and 0545-0830 to Hong Kong and Formosa; DZH7, on 9730 kc., at 2100-2200 (to 2300 on Saturdays) and 0130-0330 to Japan; DZH8, on 11,855 kc., at 1830-1930 to S.E. Asia, at 0130-0500 to Australia, and at 0730-0830 and 1000-1130 to S.E. Asia; DZF2, on 11,920 kc., at 2100-2200 (to 2300 on Saturdays) to S.E. Asia; DZH9, on 15,300 kc., at 1655-1800 and 0030-0130 to Australia, at 2100-2200 (to 2300 on Saturdays) to S.E. Asia, at 0130-0330 to S. & S.E. Asia, and at 0730-0830 to S. Asia; DZF3. on 15,385 kc., at 2000-2045 and 2100-2130 to S.E. Asia; DZI6, on 17,805 kc., at 1655-1930 and 0030-0130 to Australia, at 2100-2200 (to 2300 on Saturdays), 0130-0330 and 0730-0830 to S.E. Asia. They have dropped DZ18. 21,515 kc., for the time being, reportedly due to financial difficulties.

Portuguese Timor—A new station is located in Dili and operates on 3268 kc. It was noted in Australia around 0600, with s/off believed to be around 1000.

Ruanda—*R. Ruandi*, Kigali, is running a mixed program on 6050 kc. It was noted at 2347 with African and European songs, and at 0030 with a positive ID.

South Africa—Paradys has been noted on 7295 kc. at 2200 s/on to 2300 s/off with commercials in Eng. (but everything else in German) and with pop music. A newscast is given in German at 2245. The 9523-kc. xmsn is heard from 1542 to 1615 s/off with Eng. pop and jazz music and an Eng. newscast at 1600. The 15,084-kc. channel has been heard at 1430-1530 and later with pop tunes.

Sudan—*R. Omdurman* broadcasts in Eng. daily at 0700-0730 on 11,860 kc., and in Arabic from 0730 to past 0900.

Syria—Here is the latest available schedule from *R. Damascus*: 1815-2015 on 17,865 kc.

SHORT-WAVE CONTRIBUTORS

Anson Boice *(WPE1BD)*, New Britain, Conn.
Bob Michaels *(WPE1CVI)*, Bridgeport, Conn.
Andrew Kasparson *(WPE1DFW)*, Auburn, Mass.
Dave Siddall *(WPE1EBX)*, Hyannis, Mass.
John MacMillan *(WPE1EKE)*, Needham, Mass.
Bernard Langley *(WPE1FV)*, Auburn, Maine
Riley Sundstrom *(WPE2AJ)*, Stockton, N. J.
Peter Collings *(WPE2CON)*,Ossining, N. Y.
Ruth Kalish *(WPE2DMN)*, Bellmore, N. Y.
Craig Kleinfield *(WPE2FCV)*, Maywood, N. J.
Gary Davis *(WPE2GOY)*, Collingswood, N. J.
George Fank *(WPE2GQD)*, N. Valley Stream, N. Y.
Grant Nicholls *(WPE2GXU)*, Medford Lakes, N. J.
George Derringer *(WPE2GYZ)*, Newburgh, N. Y.
David Berger *(WPE2HJD)*, N. Woodmere, N. Y.
Paul Bassiri *(WPE2HKS)*, Morristown, N. J.
Richard Mills *(WPE2HOZ)*, New York, N. Y.
Leslie Shattuck *(WPE2HZU)*, Locke, N. Y.
Marvin Brown *(HS/WPE2IJB)*, Bangkok, Thailand
Avi Freund *(WPE2IKU)*, New York, N. Y.
Daniel Grumet *(WPE2IMF)*, Toms River, N. J.
Paul Kulkosky *(WPE2IMJ)*, Kearny, N. J.
Joe Pawlick *(WPE2IPM)*, Fanwood, N. J.
Barry Shiffrin *(WPE2ISY)*, Glens Falls, N. Y.
Bruce De Vlieger *(WPE2IVS)*, Vestal, N. Y.
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Larry Rector *(WPE3DIG)*, Pittsburgh, Pa.
Jack Cunningham *(WPE3DOV)*, Silver Spring, Md.
Albert Sincavage *(WPE3DYL)*, Bear Creek, Pa.
Charles Black *(WPE3EED)*, York, Pa.
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Paul Asplin *(WPE5BZD)*, Oklahoma City, Okla.
Chris Maher *(WPE5CEV)*, Jackson, Miss.
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Saidul Choudhry *(WPE6GE)*, Los Angeles, Calif.
Warren Studebaker *(WPE8ACA)*, Cincinnati, Ohio
Robert Kipp *(WPE8BBL)*, Detroit, Mich.
Tim Shaw *(WPE8BUV)*, Bay Village, Ohio
Norman Elser *(WPE8CSI)*, Evansport, Ohio
Ronnie Boerst *(WPE8DIG)*, Toledo, Ohio
Mark Ellstrom *(WPE8DZP)*, Aurora, Ohio
Robert Eddy *(WPE8EQW)*, Newport, Ohio
Rusty West *(WPE8ERJ)*, Painesville, Ohio
Don Stovicek *(WPE8EWI)*, Cleveland, Ohio
John Toikkanen *(WPE8FFD)*, Conneaut, Ohio
Ken Riley *(WPE8FKR)*, Berkley, Mich.
Robin Fisher *(WPE8OG)*, Beach City, Ohio
Billy Wambach *(WPE9AT)*, Evansville, Ind.
Ray Fronczak *(WPE9CMG)*, St. Louis, Mo.
J. P. Arendt *(WPE9DN)*, Aurora, Ill.
Glen Wright *(WPE9EOP)*, Findlay, Ill.
Danny Goodman *(WPE9EVH)*, Skokie, Ill.
Martin Cummings *(WPEØATR)*, St. Louis, Mo.
James Whitworth *(WPEØBZQ)*, Colorado Springs, Colo.
Jim Phelps *(WPEØCGE)*, Davenport, Iowa
Jack Perolo *(PY2PE1C)*, Sao Paulo, Brazil
John Yokoff *(TA3PE1J)*, Diyarbakir, Turkey
Gregg Calkin *(VE1PE3L)*, St. John, N. B.
Robert Viau *(VE2PE6O)*, Sept-Iles, Quebec
Bradley McCarter *(VE3PE1SB)*, Islington, Ontario
Tim Kerfoot *(VE3PE1TH)*, Rexdale, Ontario
Steve Thurlow *(VK1PE1K)*, Cabramatta, Australia
Patricio McGrath *(VP5PE1A)*, Kingston, Jamaica
W. E. Biege, Okmulgee, Okla.
Bernard Brown, Derby, England
Warren Fisher, Miami, Fla.
John McKillop, Washington, D. C.
Bernd Schutze, Krefeld/Oppum, West Germany
Blase Thorz, Linden, N. J.

(20 kw.), 15,165 kc. (50 kw.), and 11,915 kc. (20 kw.) beamed to Central and South America in Arabic, Spanish, and Portuguese; 1430-1530 on 15,165 kc. beamed to Europe in French and English; 1600-1700 on 15,165 kc., in Arabic; 2300-1800 on 11,750 kc. (300 watts), 6165 kc. (50 kw.), and 5287 kc. (300 watts) in Arabic; 0300-0630 and 0900-1800 on 7398 kc. (7500 watts) in Arabic. The latter two xmsns are undirectional. The Eng. newscast on 15,165 kc. at 1500 is generally heard well.

Togo—Lime is heard with a poor signal on 5047 kc.; it has anmts and an ID at 1730. Morse QRM makes good reception next to impossible.

USA—Many readers report hearing the *Voice of America* on the medium waves on 1040 and 1180 kc. The latter causes severe QRM to WHAM, Rochester. These stations are located at Marathon, Florida, and beamed to Cuba.

The *VOA* continues to test on many frequencies, among them 15,370 kc. at 1345, 15,200 kc. around 2230, and several channels in the 49-meter band during afternoons and early evenings. These xmsns are from the new installation in Greenville, N.C.

WINB, Red Lion, Pa., is definitely not a *VOA* station, as some readers believe, but a private station (see item in our November, 1962, column). The current schedule is: 1300-1600 on 17,735 kc. (news at 1500); and 1600-1800 on 11,785 kc. All programs to date have been in Eng., and the power rating is said to be 50 kw. Reports go to WINB, P.O. Box 88, Red Lion, Pa.

USSR—A letter received from *R. Kiev* listed the N.A. Service as being in Ukrainian daily on 7315, 7125, 7280, 7305, and 7175 kc. at 2030-0330. It also listed an Eng. program as being broadcast on Mondays and Thursdays at 0250 and again at 0330-0530 on the same channels.

Moscow's Pacific Coast Service to N.A. is broadcast daily at 2200-0230 on 7250, 9630, 9730, and 9540 kc., and on Sundays at 1230-1430 on 6150, 7100, and 7270 kc.

Vatican City—The latest schedule from the Vatican City lists Eng. at 1000-1015 on 9645, 11,740, and 15,120 kc., and at 1315-1330 on 7250, 9645, and 11,740 kc., both to Great Britain; at 0500-0535 to Africa on 17,840 and 21,490 kc. (except Sundays); at 1100-1115 to India on 11,740 and 15,120 kc. (Mondays, Wednesdays, and Saturdays only); and at 1730-1800 to the Philippines on 9540 and 11,740 kc. (Mondays, Wednesdays, and Fridays only).

Venezuela—YVLK, *R. Rumbos*, Caracas, 4970 kc., is still one of the most widely reported stations in this country. Recent loggings: from 2000 to 2230 with music and news, all-Spanish. Reports go to Apt. 2618, Caracas.

West Congo—*Radiodifusion Nationale De La Republique Congolaise* has been found on 7175 kc. at 1715-1730 with music and to 1745 with French news. English xmsns from Brazzaville include one to Africa at 1400-1430 on 15,190 kc. with news, music, and letters, and one at 2015-2100 to N.A. on 11,725 kc. with news at 2015. —30—

Satellites On The Air

The following satellites, launched by the United States, were reported to have beacon and telemetry transmissions as of January 15, 1963. The satellites are listed by their code names, according to frequency; because some transmit on more than one frequency, they appear more than once.

Transit IVA	54.000 mc.
Courier IB	107.970 mc.
TIROS I	107.997 mc.
TIROS III	108.000 mc.
Vanguard I*	108.024 mc.
TIROS III	108.030 mc.
Telstar	136.050 mc.
Explorer XV	136.101 mc.
Relay I	136.140 mc.
Transit IVA	136.200 mc.
Explorer XVI	136.200 mc.
TIROS IV	136.230 mc.
TIROS V and TIROS VI	136.235 mc.
Ariel	136.408 mc.
Explorer XIV	136.440 mc.
Injun SR-3	136.500 mc.
Alouette	136.590 mc.
Relay I	136.620 mc.
Traac*	136.650 mc.
OSO I	136.744 mc.
Transit IVB	136.800 mc.
Anna	136.815 mc.
Explorer XVI	136.860 mc.
TIROS IV	136.920 mc.
TIROS V and TIROS VI	136.922 mc.
Alouette	136.979 mc.
Transit IVA	150.000 mc.
Transit VA	150.000 mc.
Transit IIA	161.990 mc.
Transit IIA	215.990 mc.
Midas IV	228.200 mc.
Midas IV	232.400 mc.
Transit VA	400.000 mc.

*Signal may be very weak

There are several more satellites in orbit and may be transmitting. However, these are so-called "secret" satellites launched by the U.S. Air Force.

If you're interested in eavesdropping on satellites, and missed our June 1962 article on the NASA-136 converter, we recommend that you look it up. Easy to construct, this sensitive converter can intercept the satellites operating in the 136-137 mc. band.

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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 ....

Ultrasonic Sniffer

(*Continued from page* 44)

unbond from the board and also ruin transistors, capacitors, and even resistors. The danger of heat damage to these last items is particularly great because all will have very short leads.

Battery *B1* is fastened in place by means of a piece of hookup wire. Pass the wire around *B1* and through a couple of holes drilled in the board; then tie the ends of the wire together. The battery leads are wired to the board at points *F* and *G* (see schematic diagram).

The remainder of the construction is relatively easy. Potentiometer *R18* and jacks *J1* and *J2* are mounted on a 5¼" x 3" x 2⅛" aluminum utility box. The board is held in place in the box by means of four 1¼" spacers. These are installed at the corners of the box top and placed to mate with the mounting holes in the board.

Run the "hot" leads from *J1* and *J2* to points *A* and *C* on the board, respectively. Potentiometer *R18*'s arm is wired to *D*; the "high" end of *R18* goes to *B*; and switch *S1*'s terminals run to *E* and *F*. Finally, solder the ground lead (from the "frame" terminal of *J2* and the "low" end of *R18*) to the ground bus which circles the board at its edges.

Complete the construction by running a bead of solder around one of the 1¼" spacers where it touches the ground bus. This will insure good contact between the board and the box.

Adjustment. Before closing up the utility box, you must adjust coils *L1* and *L2*. For this task, you'll need a signal generator that can be tuned up to 38 kc.

Begin by plugging the headset into jack *J2*, turning on *S1*, and adjusting *R18* to the half-way point. Then set the signal generator for a 37.5-kc. output, turn its "gain" control to minimum, and connect the output terminals to *J1*. The signal generator's output should now be increased until you hear a tone in the headset.

Adjust the slug on coil *L2* until the tone "zero beats." This done, reset the signal generator for 38 kc. A tone will again be heard in the headset, and the slug of *L1* should be adjusted for maximum volume.

Install the chassis cover, plug the transducer into *J1* in place of the signal generator, and your Ultrasonic Sniffer is ready for use.

Operation and Applications. Don't expect to be overwhelmed with sound as soon as you turn the unit on. Though there are many ultrasonic sounds to be heard, these high frequencies are easily blocked and absorbed. Furthermore, the transducer element is quite directional.

A good test for proper operation is to rub your fingers together (lightly) at arm's length from the transducer. With *R18* set at maximum, you should be able to hear the sound clearly. Now have someone jingle a bunch of keys from 10 to 15 feet away; this sound, too, should be clearly heard.

Insect and animal life provides a fascinating source of ultrasonic sound. Take the unit out to a wooded area some evening and probe around the trees and bushes. You should be rewarded with ultrasonic "signals" from tree locusts, tree frogs, and other wild life.

If you happen to live in an area where bats are common, you'll be able to hear the pulses these animals send out to find their way or locate food. They begin at about 100 kc., then shift downward to about 20 kc., and can be detected as they pass through the sensitive range of the transducer.

On a more practical level, gases escaping under pressure generate high intensities of ultrasonic sound. For this reason, the Sniffer makes an excellent "leak detector." It can be used, for example, to check auto exhaust systems for tightness.

The author has even employed the unit to set valve tappets on his car. Since the microphone is very directional, it can be aimed to hear sounds from one valve only. The tappet-adjusting nut is turned (while the engine is running) until no clicks are heard.

One last tip: the instrument is an excellent tool for testing ultrasonic remote-control transmitters for TV sets. Each control button should produce a tone, and all tones should be of about the same magnitude. With a little experience, you'll be able to spot malfunctions quickly. –30–

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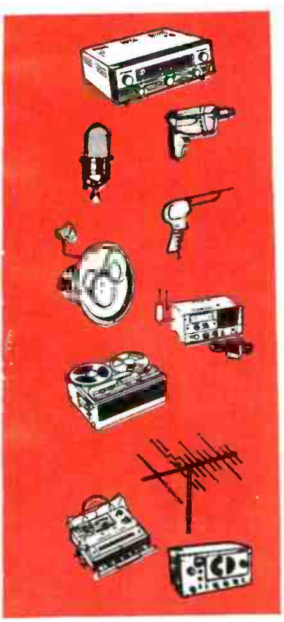

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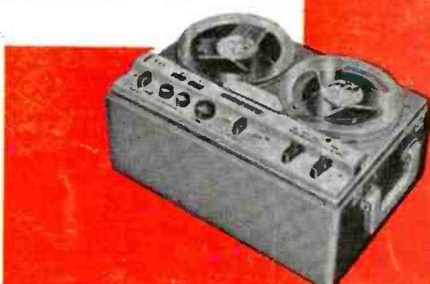

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