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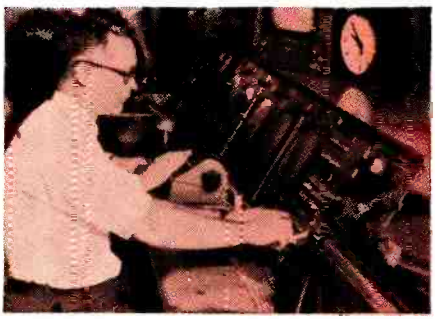

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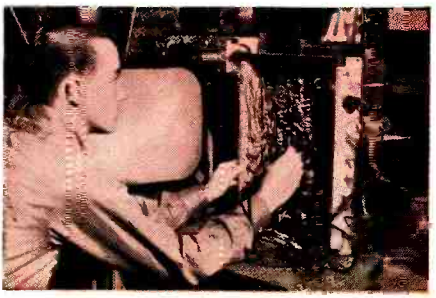

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SUPERVISOR OF TRAINING, J. B. Straughn, is particularly concerned with NRI home-training equipment and its integration into course subject matter.

CHIEF TECHNICAL EDITOR, James P. Tate, Jr., heads a staff whose concern is the careful writing, editing and illustrating of lesson texts, keeping lessons up-to-date.

DIRECTOR OF PUBLICATIONS, Oliver Read, was formerly editor and publisher of Electronics World magazine; publisher Popular Electronics and Hi-Fi Stereo Review magazines.

POPULAR ELECTRONICS

ZIFF-DAVIS PUBLISHING COMPANY

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

This month's cover photo by Bruce Pendleton

VOLUME 17 SEPTEMBER 1962 NUMBER 3

Special Construction Feature

Electronic Construction Projects

Audio and High Fidelity

Amateur and Citizens Band

Short-Wave Listening

Electronic Features and New Developments

Departments

POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company at 434 South Wabash Avenue, Chicago 5, Illinois. **Subscription** Rates: One year United States and possessions, $4.00; Canada and Pan American Union Countries, $4.50; all other foreign countries, $5.00. Second Class postage paid at Chicago, Illinois, and at additional mailing offices. Authorized as second class mail by the Post Office Department, Ottawa, Canada, and for payment of postage in cash. September, 1962, Volume 17, Number 3.

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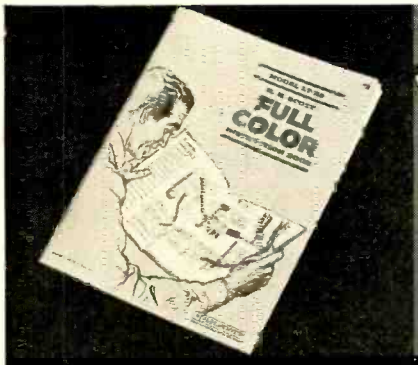
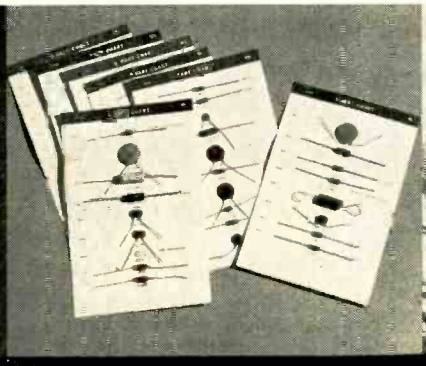
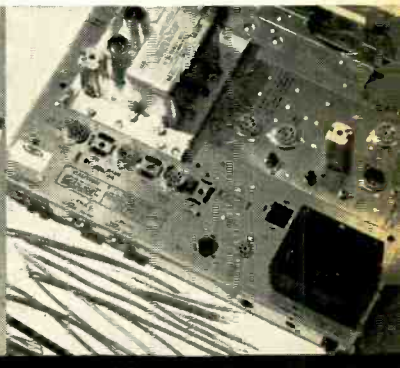
"Simplest to build..." and have "Engineering of the highest calibre"*



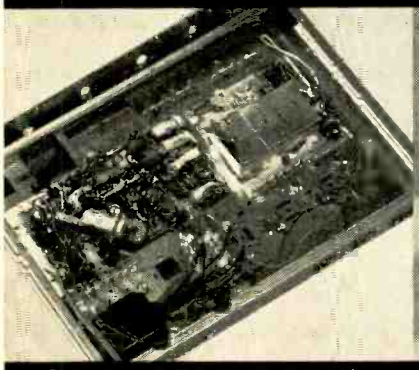
The exclusive Scott full color instruction book shows every part and every wire in natural color and in proper position. To make the instruction book even clearer, each of the full color illustrations shows only a few assembly steps. There are no oversized sheets to confuse you.



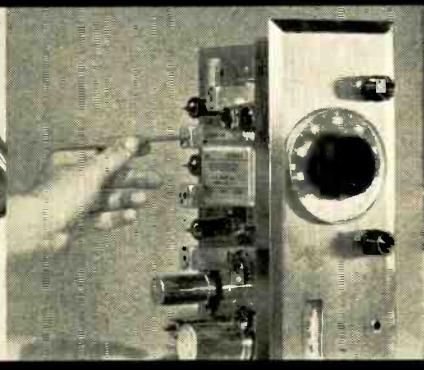
Each full color illustration is accompanied by its own Part Chart . . . another Scott exclusive. The actual parts described in the illustration are placed in the exact sequence in which they are used. You can't possibly make a mistake.



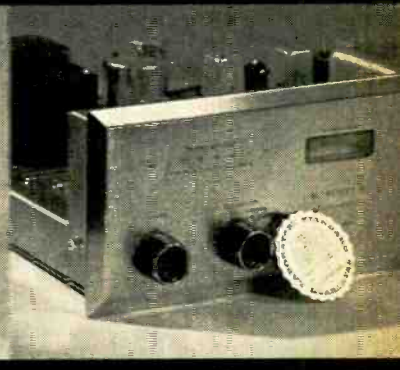
Much of the uninteresting mechanical assembly is completed when you open your Scott Kit. Parts. All the terminal strips and tube sockets are already permanently riveted to the chassis. To insure accuracy all wires are pre-cut and pre-stripped to proper length.



There are certain areas in every professional high fidelity component where wiring is critical and difficult. FM front ends and multiplex sections are an example. In Scott Kits these sections are wired at the factory, and thoroughly tested by Scott experts, assuring you a completed kit meeting stringent factory standards



Tuners are aligned with the unique Scott Ez-A-Line method using the meter on the tuner itself. This assures perfect alignment without expensive signal generators. Amplifier kits require no laboratory instruments for perfect balancing.



The new Scott Warrantee Performance Plan guarantees that your kit will work perfectly when completed. If you have followed all recommended procedures and your kit fails to work Scott guarantees to put your kit in working order at the factory at minimum cost.

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*Audio — February 1961, Pages 54-56

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Editorial and Executive Offices (ORegon 9-7200)
One Park Avenue, New York 16, New York

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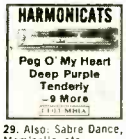
24. "Ideal for stereo." —High Fidelity

11. "He is champion of recordings!"-Newswk.

22. "It soars and it swings."—Playboy

40. Battle Hymn of the Republic, Dixie, etc.



29. Also: Sabre Dance, Mam'selle, etc.

7. Do-Re-Mi, Laendler, Maria, 17 in all

25. 13 top stars in 14 classical and pop hits

15. "No better need be sought"—Atlantic

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21. Also: Don Elliott, Gerry Mulligan, etc.

16. "Superb...best recording."—Wash. Post

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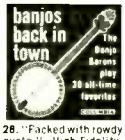
19. "Gorgeous colors." —Hi Fi Review



28. "Packed with rowdy gusto."—High Fidelity

5. The Rain in Spain, Show Me, 16 in all

2. I'm Always Chasing Rainbows, 12 in all

34. Also: The Boy Next Door, Bewitched, etc.

3. Also: How High the Moon, etc.

47. Isle of Capri, Sibonay, Say Si Si, etc.

31. A Wonderful Guy, I Love Paris, 12 in all

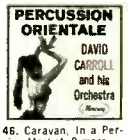
4. Moonlight Bay, Avalon, 16 hits in all

13. "Fabulous sound." —Washington Post

30. Also includes: April in Paris, etc.

27. "Exquisite glitters throughout."—Playboy

18. "A super soprano." —The New Yorker



46. Caravan, In a Persian Market, 9 more

8. "A glittering performance..."-Billboard

48. Rib Joint, With a Song in My Heart, etc.

20. "...perfect in stereo."—High Fidelity

45. Too Darn Hot, Bewitched, 43 hits in all

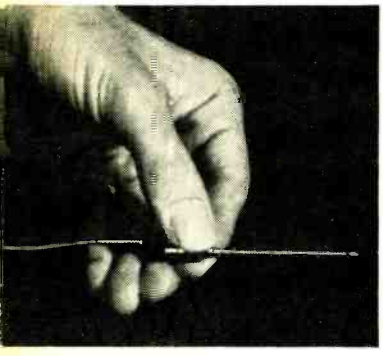
35. "Rich, billowing sound."—Hi Fi Review

POP'tronics

NEWS SCOPE

ELECTRONIC PIANOS, completely portable and operated on batteries, may soon become the rage of picnickers, beach-goers, and just about any type of sun lover. Made by the Wurlitzer Company, DeKalb, Ill., the new 64-note transistorized version of the piano weighs only 81 pounds and is built into its own suitcase—about the size of a two-suiter. The instrument's musical scale has a bass made richer by amplification and a slight bell-like overtone in the upper register. A vibrato control permits other musical tonalities that range from the Hawaiian guitar to vibraphone effects. Apartment pianists can keep their neighbors happy by using earphones while practicing for surfside jam sessions.

PEEKING INSIDE of transistors, diodes, micro-modules or just about any miniature encapsulated assembly is an important quality control step in the construction of complex electronic equipment. Previously, when delicate parts were X-rayed to detect faults, the processing of the film was a costly process that ate up hours as well as dollars. Now, a new "Gammacon" X-ray TV system introduced by American Microwave & Television Corp., San Carlos, Calif., displays the X-ray image instantaneously, magnified up to 30 times, and thus eliminates the need for film processing. The TV camera system uses 945-line scan, permitting easy and accurate inspection of $\frac{3}{8}$″ by $\frac{1}{2}$″ rectangular areas.



MICROMINIATURE GEIGER COUNTERS, ranging in size from 0.040″ (in diameter) x .250″ to .125″ x 1.000″, are being used to monitor tumor cell growth during treatment in experimental studies at the Columbia-Presbyterian Medical Center in New York City. Probably the smallest **beta** or **gamma** radiation detectors in existence, the counters are made by the EON Corporation of Brooklyn and are the newest of the many electronic weapons being used in the attack on cancer. Since they are small enough to be passed through the bore of a hypodermic needle, they can be implanted directly in blood vessels, body cavities, or solid tissues without appreciable tissue damage. Hence, researchers can study the effects of new radioisotope-labeled compounds on tumor cells in animals.

CHECKING ON CHOW by totaling the costs of meals and keeping track of food sold are functions of a new inventory control system designed for cafeterias. The system, developed by American Machine and Foundry Company, is a combination cash register and inventory machine which greatly simplifies accounting procedures for the billion-dollar cafeteria industry. There are 16 variations of the "Amficon-Inventrol" (the system's given name), which can be tailored to compute a city or state sales tax, indicate cash received, make change, and even make it possible for the cashier to total a second tray while the first customer is getting his money ready. The cashier need not remember prices at all, but simply punch buttons corresponding to the foods seen on the tray.

men 17-55

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FCC Report

By ROBERT E. TALL
Washington Correspondent

FACED with a rash of applications and correspondence from Citizens Band radio licensees and applicants contemplating the use of CB equipment with 30-watt power input, the FCC is carefully explaining to these people that Class D Citizens stations still are, as they always have been, limited to 5-watt power input. And the correspondence is being returned to the senders.

The sudden influx of correspondence regarding 30-watt CB operations, FCC officials point out, has apparently resulted from mention in a national publication that the Commission is considering permitting the assignment of two additional channels —27.235 and 27.275 megacycles—to the Class D service on a shared basis with other services. These other services can now use 30-watt equipment, but the FCC "split-channel" plan does *not* include allowing CB units to use more than the present 5-watt maximum.

In the "form" letter accompanying the correspondence being returned, the FCC emphasizes the present 5-watt restriction for Class D units, and comments that "A person desiring to obtain greater communication range than can be obtained by Class D stations should investigate the possibility of using Class A Citizens stations (which are permitted up to 60 watts power, but operate on frequencies in the 460-470 mc. band) or stations in one of the other services in which he may be eligible . . ."

The FCC letter further points out that: "In connection with your apparent desire to operate a station in the 'Citizens Band' with up to 30 watts input power, it should be noted that only those frequencies listed in section 19.31(d) of the rules are available for assignment for use by Class D stations. The frequencies 27.235, 27.245, 27.265 and 27.275 mc. are *not* available for use by any Class D station, but are available for assignment to licensed stations in many other services, such as the local government radio service, the business radio service, etc. In those services, stations are limited to 30 watts input power on the above frequencies

FCC Report

(*Continued from page 8*)

and may be authorized to utilize antennas having greater antenna height than is permitted Class D stations."

New CB Petition. Relative to the same subject, one of the latest petitions filed with the FCC (by an Ohio radio equipment manufacturer) asks the Commission for Class D rule changes to specify that no Class D units manufactured after a certain date "shall have a final stage capable of delivering more than 25% above the 5 watts maximum authorized power regardless of what changes are made in circuit components preceding the final stage."

The company urged that CB equipment manufacturers be required to certify that their units meet the proposed rule, and, further, "that manufacturers not supplying such certification, or not complying with the '25% above 5 watts' limitation, or engaging in misleading advertising relative to the capabilities of the equipment, shall be subject to fine."

More on "Forfeitures." As expected, President Kennedy signed the Communications Act changes permitting the FCC to levy fines of from $100 to $500 on radio licensees, including CB'ers, for violations of 12 specific provisions of the agency's rules. The Commission has begun putting the new enforcement tool into effect.

Also signed by the President was legislation permitting the agency to stop requiring that applications be notarized. It may take a while for all FCC application forms to catch up with the new procedure, but CB'ers can now feel free to ignore the notarization requirement. (An article entitled "New Form for CB," intended to serve as a guide in filling out the revised FCC Form 505, appeared on p. 55 of our August issue.)

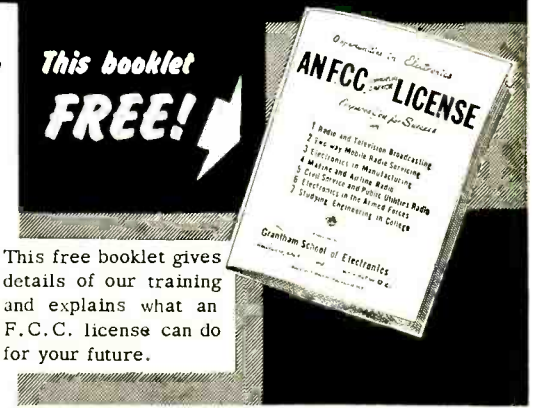
CB Club Asks Help. The Five-Eleven Radio Club, of Pittsburgh, Pa., is one of a number of CB clubs which have formally asked the FCC's "help" in clearing up the "misuse" of the Class D radio service in their areas.

The club listed the "primary" offenses in the area as "(1) lengthy transmissions; (2) unmodulated carriers; (3) extreme profanity; and (4) general horseplay on the air." The letter to the Commission pointed out that "different offenders have publicly stated that they defy the FCC or any other organization to notify them of violations," while "others have stated that they received citations and bragged that they use them for wallpaper."

Campaign for More Frequencies. Advance planning for an informational program to give the American public and Congress a

F.C.C. COMMERCIAL OPERATOR LICENSE

Training . .



This free booklet gives details of our training and explains what an F.C.C. license can do for your future.

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To better serve our many students throughout the entire country, Grantham School of Electronics maintains four Divisions—located in Hollywood, California; Kansas City, Mo.; Seattle, Wash.; and Washington, D.C.

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Edward R. Barber, 907 S. Winnifred, Tacoma, Wash.	1st	20
M. A. Dill, Jr., 20 Cherry St., Gardiner, Maine	1st	12
Bernhard G. Fokken, Route 2, Canby, Minn.	1st	12
Kenneth F. Foltz, Broad St., Middletown, Md.	1st	12
James C. Greer, Mound City, Kansas	1st	12
Thomas J. Hoof, 216 S. Franklin St., Allentown, Pa.	1st	22
Clyde C. Morse, 7505 Sharronlee Dr., Mentor, Ohio	1st	12
Louis W. Pavek, 838 Page St., Berkeley 10, Calif.	1st	16
Wayne Winsauer, 2009 B St., Bellingham, Wash.	1st	12

Accredited by the National Home Study Council

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FCC Report

(*Continued from page* 10)

true picture of the importance of two-way radio communications to the country should be well on the road by the end of this year. This program could result in CB'ers being asked to stand up and be counted in what could be a pretty hectic political dispute before it is all over.

The thrust of the campaign is to get some more usable frequency space for the spectrum-starved two-way radio services. The mobile radio interests leading the program are more than a little disappointed at the manner in which Congress totally ignored the vital needs of the two-way field in legislation earlier this year calling for all-channel television receivers in the future, and they can be expected to enlist all possible allies in proving their case.

The mobile radio campaign appears to be headed principally toward Congress and the people, in a move to side-step the broadcaster-dominated FCC Commissioners. Just a few of the present 6-mc.-wide TV channels, of course, could make a lot of narrow-band mobile radio channels. —30—

COMING NEXT MONTH

Taping off the air is a "natural" for any SWL or ham—it's one sure way to squash the skeptics and prove that your "finds" are no mere boasts. This information-packed story tells you exactly how to get in on all the fun.

ON SALE
SEPTEMBER 25

- **UHF-TV CONVERTER**
  One transistor and one diode team up in this home-brew device to allow you to tune in all of the 83 new TV channels. Battery-powered, it can be hooked up to any TV set.
- **2 TUBES FOR 2 METERS**
  Build this sensitive, line-operated superregen receiver, and get set to listen to the 144-148 mc. ham band.
- **NATURE'S ELECTRONICS**
  Bionics, the infant science of patterning electronic equipment after living creatures, has opened a new world to scientists and may soon offer exciting new contributions to the art of electronic technology.

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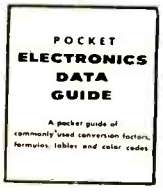
Puts all the commonly used conversion factors, formulas, tables, and color codes at your fingertips. Yours absolutely free if you mail the coupon today. No further obligation!



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- ☐ Manufacturing
- ☐ Amateur Radio
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- ☐ Home Experimenting
- ☐ Telephone Company
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In what kind of work are you now engaged? .....

In what branch of Electronics are you interested? .....

Name ..... Age .....

Address .....

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

PE94

LETTER TRAY

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

Commerial Fish Finder

■ We read with interest the underwater thermometer article ("The Fish Finder") in your July 1962 issue. You'll probably be interested to know that our company maufactures a combination underwater thermometer and depth measuring instrument (photo enclosed). Called the "Thermo-Fishometer," it sells for $29.95. It has been on the market for over a year, and has been enthusiastically received by fishermen in the United States and many other countries.

BURT PHILLEY
Bright Radio Laboratories, Inc.
222 East 2nd St., Mineola, N.Y.

"Drainpipe 8"

■ I noticed an error in "Clean Sound from the Drainpipe 8" (June 1962 issue). The 38" dimension on the drawing of the speaker system (p. 62) should actually be 44".

S. BERGLUND, W7TNG
Portland 1, Oregon

Right you are, sir; sorry for the misprint.

American FM Rebuttal

■ We at Station KPFA would like to offer a few words of comment on Robert Angus' article "What's Wrong with American FM?" which appeared in your June 1962 issue. While we don't challenge the author's general premise that FM is a "classical juke box," we do suggest that he might have cited some important exceptions to the rule. Among them are the Pacifica Foundation stations in Berkeley, Calif. (KPFA), Los Angeles, Calif. (KPFK), and New York City (WBAI). These three non-commercial stations are sustained by listener subscriptions of $12.00 (or more) per year. At present, there are some 30,000 subscribers (8,000 of them to KPFA) and independent surveys estimate our complete audience at 200,000.

The activities of KPFA are typical of those of the two other stations in this "network." Here at Berkeley, we strive to make up for the woeful deficiency in live FM programming—and recently undertook to offer 12 hours of it in one day. An-

(*Continued on page* 20)

NOW! Enjoy Quality Stereo Hi-Fi at Lowest Cost!

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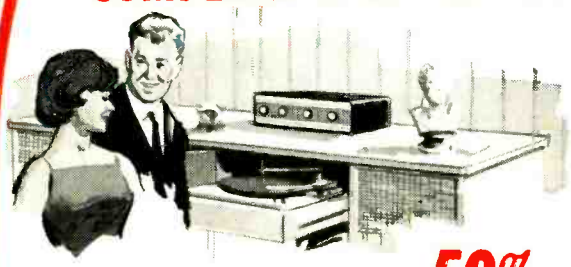

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Genuine Knight-Kit KA-25 20-Watt Stereo Amplifier—Full array of controls for complete, simple adjustment of sound; dual-concentric, clutch-type level control regulates volume of either channel or both together; ganged bass and treble controls; unique selector switch provides choice of inputs as well as selection of stereo, stereo reverse, or monophonic; ± 1 db, 30-15,000 cps response at full rated output. Handsomely styled metal case. Easy to assemble with step-by-step instructions.

Famous Admiral 4-Speed Stereo Changer—Complete with ceramic turnover stereo catridge and dual sapphire needles—plays both Stereo and monophonic LP's, 78's, 45's and 16⅔ rpm records. Automatic shutoff; handles ten 12" records; intermixes 10" and 12" records.

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Free Placement Service. RCA Institutes graduates are now employed in important jobs at military installations with important companies such as IBM, Bell Telephone Labs, General Electric, RCA, and in radio and TV stations all over the country. Many other graduates have opened their own businesses. A recent New York Resident School class had 93% of the graduates who used the FREE Placement Service accepted by important electronics companies . . . and had their jobs waiting for them on the day they graduated!

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PACIFIC ELECTRIC BLDG., 610 S. MAIN ST., LOS ANGELES 14, CALIF.

RCA The Most Trusted Name in Electronics

Letter Tray

(*Continued from page* 14)

other example: in 1960, and again this year, we sponsored the Pacifica Radio Awards in Musical Composition for contemporary composers; the winning compositions are guaranteed a concert performance, and recordings of the performance are distributed to foreign, non-commercial broadcasting systems. These are but two of the reasons why we offer a resounding plea of "not guilty" to Mr. Angus' indictment.

LESLIE STRICKLAND
Promotion Director, KPFA

We regret that Mr. Angus neglected to report such notable exceptions to the rule, Mr. Strickland. Though we still feel—as I'm sure you'll agree—that much remains to be done to bring American FM programming up to the European level.

Fire Fighters Need Converter

■ We're writing on behalf of ten volunteer firemen who would like to have converters, covering 150-162 mc., for their auto radios. These units must be adaptable to cars with either 6- or 12-volt batteries. Commercially built models are too

expensive, so we offered to construct the converters in our shop—*if* we could find an appropriate schematic diagram and parts list. Can any of your readers help?

STOWE'S RADIO & TV
390 Vernon Ave.
Lebanon, Mo.

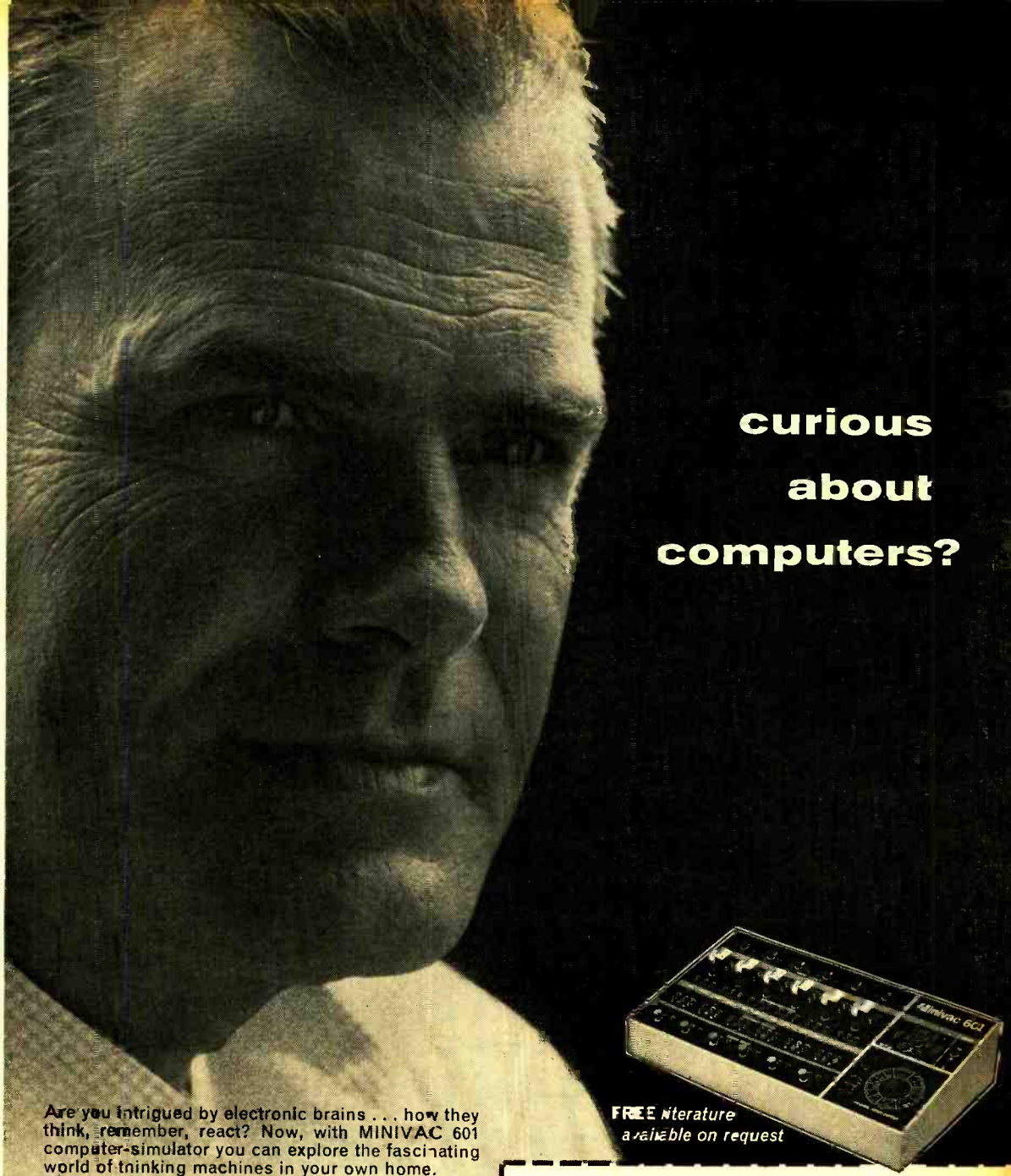
Checking Speakers

■ I take exception to the suggestion that a solder gun be used for checking speaker continuity (see "Tips and Techniques," June, 1962). A solder gun makes an effective demagnetizer, and moving the tip near enough to the speaker to touch its voice-coil terminals would probably result in a weakened magnet. A safer test might be to bring the gun tip near the output transformer and listen for speaker hum. I make it a practice never to place an energized solder gun closer than four inches to a speaker magnet.

LOUIS J. PHILIPP
Paulsboro, N. J.

Your objections are certainly theoretically correct, Mr. Philipp. We doubt, however, that the field around a solder gun is strong enough to weaken a speaker magnet in the short time required to carry out the test. The output transformer check might be a good one to try initially—but if you didn't hear any hum, you couldn't be certain whether or not the output transformer or the speaker was defective.

(*Continued on page* 22)



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MINIVAC is not a toy. It is a scientific training device created by Dr. Claude Shannon of M.I.T. to teach the basic concept of the modern digital computer. It opens the way to exciting experimentation with circuitry that makes decisions and solves problems. MINIVAC can simulate missile control systems, data processing, play games, perform all basic operations of the modern computer. And, no knowledge of electronics or advanced mathematics is required.

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I understand that if I am not completely satisfied, I can return MINIVAC *in ten days and my money will be refunded in full.*

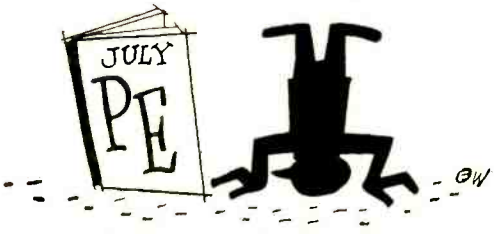
For more information, read the MINIVAC story on page 67 of this issue of Popular Electronics.

Letter Tray

(*Continued from page* 20)

Collector's Item

■ I just received your July issue, and this time you've really outdone yourselves (or maybe your printer has). Look at the "Electronic Coupling Quiz" on page 80. Notice anything odd? You



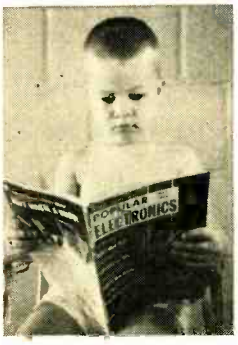
should. The schematics are printed upside down!

Seriously, though, I truly enjoy your magazine and I think it is tops in its field. Keep up the good work.

PHILLIP MILKS
Lancaster, N.Y.

You're one of our luckier readers, Phil! Our high-speed presses ran off only a few thousand copies of this collector's item before we caught the error. We don't even have a copy here in the office.

Youngest P.E. Fan



■ I enjoy your magazine very much—it's quite readable and easy to understand. As proof of the latter part of that statement, I'm enclosing a photo of Chris, my 2-year-old son, who is an avid P.E. reader. Keep up the good work and we'll keep reading.

N. F. LAVIGUE, JR.
Airman Third Class
Tyndall AFB, Fla.

Thanks for the bouquets, Airman Lavigue. We're sure that Chris's absorption in P.E. reflects his superior intelligence rather than the level of our articles. —30—

CB Directory Change

On page 79 of the August 1962 issue, CB Directory section, a price of $249.00 was given for Tram Electronics' Model TR-27B transceiver. This price pertains to the company's Model TR-27. The price of the TR-27B, with Turner microphone, is $265.00. Also, the conversion frequency of the TR-27B, listed as 3.0 mc., is actually 4.5 mc.

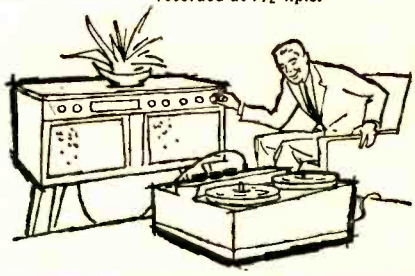
LOWER THE COST OF FUN
WITH VERSATILE TARZIAN TAPE

Talk Long Distance for Only 10¢ per Hour

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

Turn Free Sound Waves into a Complete Music Library

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



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

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

*DuPont trademark for polyester film

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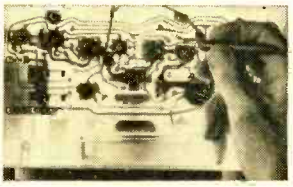
Tips and Techniques

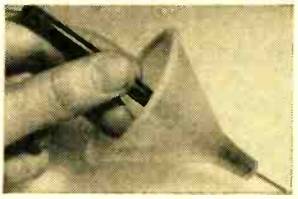
SEEING THROUGH PRINTED-CIRCUIT BOARDS

Many printed-circuit boards have the leads on one side and the components on the other, making it difficult for a serviceman to trace the circuit—unless he has a way of looking at both sides of the board at once. Luckily, this is easy to arrange. Just prop up the board on end and place a strong light behind the component side. The shadows of the components can then be plainly seen while tests are being carried out on the leads. Don't get the lamp too close to the board, though, or you may overheat some of the components. *—Art Trauffer*



PLASTIC FUNNEL IS SHOCK PROTECTOR

When using test prods around activated transmitters or high-voltage power supplies, you can employ a 2-ounce plastic funnel as a shield to protect your hand (see photo). The "spout" of such a funnel is just the right size to slip over a standard test prod and can be cemented permanently in place if desired. Though this arrangement may seem unwieldy, it will save you from unpleasant (and possibly fatal) shocks and burns. *—Jerome Cunningham*

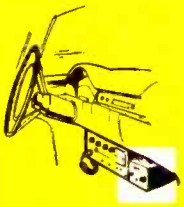


ADAPTER FOR ABOVE-CHASSIS MEASUREMENTS

When you have to measure tube voltages during servicing, it's sometimes inconven-

(*Continued on page* 26)

No More GOBBLE-DE-GOOK!



only $59.95

MONOCALL Gives Privacy to Your Two-Way Radio

Introducing the Monocall, a selective call device for use with Citizens Band and Communication systems. No more gobble-de-gook. No need for continuous monitoring. Your set and those in your system are "silent" until you call them or they call you. Easy, single switch operation. Exclusive multiple tone burst and unique circuitry prevent false triggering. Available in 72 codes and can be field modified by changing just two wires to give any one of six code combinations.

Single switch, easy operation. Three positions: Selective Receive, Normal, and Call.

Multiple tone burst. Most selective call devices use a single tone burst. With a single tone system the decoder is subject to false triggering because of squeals and voices. Monocall's multiple tone burst and computer circuitry all but eliminate this undesirable property.

Inexpensive. Monocall Encoder - Decoder, $59.95. Monocall Encoder, $29.95.

The advance design of the Monocall provides a reliability superior to devices using conventional tube or transistor circuitry.

Easy to install. Only minutes required to attach Monocall to your existing Citizen Band or Communication unit. Also, a number of Citizen Band sets are already wired for immediate Monocall "plug-in" use. They include the Starcaster Citizens Band Units Mark I, Mark II, and Mark III; the Realistic TRC-8 Citizen Band Unit; and Metrotek Citizen Band Transceivers.

Metrotek Deluxe
Citizen Band Transceiver $149.95

Eight crystal control channels on both transmitter and receiver. Fully tunable double conversion receiver provides reception on all CB channels. Complete with S-meter, dual power supply for either 12 volt d.c. or 110 volt a.c. operation. Includes "plug-in" for Monocall.

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Metrotek

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Please send me complete details, including name of nearest supplier, for the:

☐ **Monocall Selective Call Device**
☐ **Metrotek C.B. 2-Way Radio**

Name _____

Address _____

City _____ Zone ____ State ____

Tips

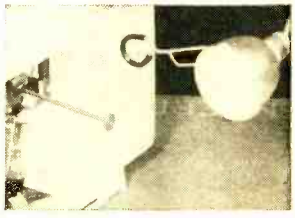
(*Continued from page* 24)

ient to do it under the chassis. But you can make an adapter (for octal tubes) that will allow you to do your measuring from above. Break off the base of an old octal tube, clean it out, and clear the pins of solder. Connections are then made from these pins to the corresponding lugs of a matching socket. Pull the wires tightly through the lugs, drawing the socket firmly against the base. To use the adapter, remove the tube in question from its socket, plug it into the adapter, and plug the adapter into the tube socket. Then turn on the equipment under repair and make your measurements at the lugs of the adapter socket.

—Stanley E. Bammel

REFLECTOR LAMP FACILITATES SERVICING

A small reflector lamp mounted on a spring clip (available at many hardware or photographic supply stores) makes a handy addition to any serviceman's kit of tools. It can easily be clipped to the back of a radio or TV set under repair and will provide much better illumination than the usual flashlight.



—H. Leeper

SCRUB BRUSH IS SOLDERING AID

Next time you're looking for a way to hold wires to be soldered or tinned, use a scrub brush—the stiff bristles will firmly support a wire in whatever position you want it. This technique is particularly useful when soldering lugs to wire ends. And a scrub brush also makes a good support for a small chassis which must be uprighted for servicing.

—John A. Comstock

CONTINENTAL '100' (EL 3585) shown on top: transistorized 7 lb., battery portable • records 2 hours on 4" reel, from any source • plays back thru self-contained speaker as well as radio, TV or record player • response: 100-6000 cps • tapes interchangeable with other 2-track 1⅞ ips machines • constant-speed operation • complete with dynamic microphone.

CONTINENTAL '200' (EL 3541) shown bottom right: 4-track stereo head output direct to external stereo preamp for portable high fidelity tape-deck applications • completely self-contained for 4-track mono record and playback • mixing facilities • lightweight, compact • dynamic microphone.

CONTINENTAL '300' (EL 3542) second from top: 4-track stereo playback (tape head output) • self-contained 4-track mono record-playback • 3 speeds • mixing facilities • dynamic microphone • self-contained phono/P.A. amplifier/speaker system • ideal for schools, churches, recreation centers, etc.

CONTINENTAL '400' (EL 3536) bottom left: Four-track stereo and mono recording and playback • 3 speeds • completely self-contained, including dual recording and playback preamplifiers, dual power amplifiers, two loudspeakers (second in lid) and dual element stereo dynamic microphone • can also be used as a quality hi-fi reproducing system, stereo or mono, with tuner or record player • frequency response: 50 to 18,000 cps at 7½ ips • wow and flutter less than .15% at 7½ ips • signals-to-noise ratio: —48 db or better • cross-talk: —55 db

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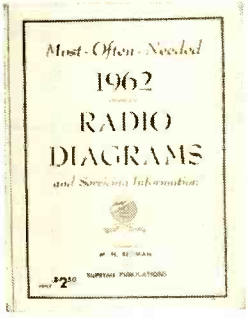
compiled by M. N. Beitman



Volume 22 in the popular series of Supreme radio service manuals, this book contains material on 1962 models of all major manufacturers. All types of radios, including AM and FM sets, radio-phonograph combinations, stereo receivers, transistor portables, and auto models, are covered. The style of the preceding volumes in the series is followed, but improved arrangement and reference systems conserve space, permitting the inclusion of a greater amount of servicing data. As usual, circuit diagrams, alignment techniques, printed-board views, voltage values, and other valuable data are given.

Published by Supreme Publications, 1760 Balsam Rd., Highland Park, Ill. 160 pages. Soft cover. $2.50.

USING THE SLIDE RULE IN ELECTRONIC TECHNOLOGY

by Charles Alvarez

The slide rule provides a means for rapid solving and double-checking of mathematical problems. This book is intended for the student or technician who wants to develop speed and accuracy in using the slide rule by mastering the most efficient methods of doing so. Three basic types of slide rules are discussed here: the *general purpose,* or Manheim slide rule; the *duplex* slide rule; and the *log-log* slide rule. There are 20 chapters in the book, each including practice problems and examples. A separate section contains answers to the problems.

Published by John F. Rider Publisher Inc., 116 W. 14th St., New York 11, N. Y. 120 pages. Soft cover. $2.50.

(*Continued on page* 30)

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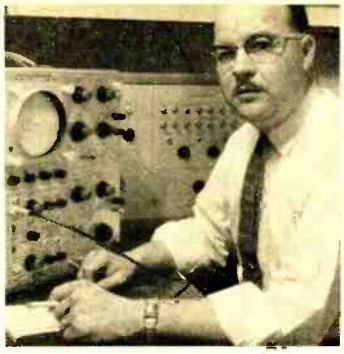

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Bookshelf

(Continued from page 28)

ELECTRONICS EXPERIMENTS & PROJECTS

by Len Buckwalter

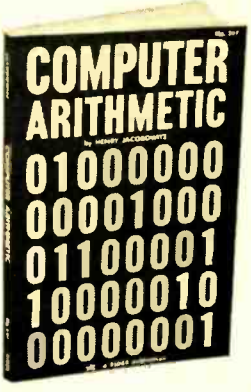
Electronics Experiments & Projects teaches the principles of electronics through experimentation and construction. The initial experiments demonstrate the design and purpose of all basic electronic components, and the reader actually builds some of them — including batteries, resistors, and capacitors. Later sections show how to incorporate these parts into practical devices, such as a burglar alarm, simple telephone, radio receiver, electroplating system, etc. Each project is illustrated with photographs and large diagrams, and the inexpensive components employed are re-used many times.

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

COMPUTER ARITHMETIC

by Henry Jacobowitz

Computer technology has grown greatly in recent years and in so doing has stimulated a need for personnel trained in the fundamentals of computer arithmetic. This book is designed to refresh trainees, and to interest other readers in the basic arithmetical operations of all positional number systems—the decimal and the binary, as well as other systems that find application in computers. After an initial survey, the book goes on to explain in detail the fundamentals of binary, octal, hexadecimal, and ternary arithmetic. Appropriate practice exercises



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Bookshelf

(*Continued from page* 30)

are included, and the final chapter describes several methods for converting one number system into another.

Published by John F. Rider Publisher, Inc., 116 West 14th St., New York 11, N.Y. 128 pages. Soft cover. $3.00.

GENERAL ELECTRIC TRANSISTOR MANUAL

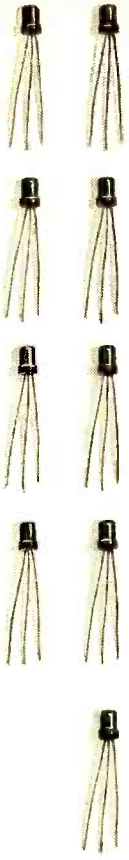
The sixth edition of the *Transistor Manual* is a greatly expanded, up-to-date version of the 64-page publication which first made its appearance in 1957, and it contains over 100 more pages than the fifth edition. The book discusses almost every aspect of transistors, including the many new developments that have taken place in the semiconductor field during recent months. There are chapters on basic semiconductor theory, how to interpret a transistor specification sheet, and making transistor measurements. Hi-fi circuits, audio amplifiers, and radio receiver and tuner circuits are also discussed at length. In addition to many charts, diagrams and schematics, a current listing of JEDEC transistor types is provided—with specifications and interchangeability information.

Published by the General Electric Co., Semiconductor Products Dept., Electronics Park, Syracuse, N.Y. 410 pages. Soft cover. $2.00.

SINGLE SIDEBAND COMMUNICATIONS HANDBOOK

by Harry D. Hooton, W6YTH

Slanted toward the advanced radio amateur, this book opens with a discussion of basic SSB theory and practice. It then proceeds to a tube-by-tube, resistor-by-resistor analysis of several popular SSB transmitters and receivers. The equipment covered



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(*Continued from page* 32)

is restricted almost exclusively to Collins, Hammarlund, and Johnson products.

Published by Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind. 284 pages. Hard cover. $6.95.

New Literature

Photoconductor characteristics and manufacturing techniques are outlined in a free booklet called "Sylvania Photoconductor Devices." The booklet places special emphasis on the Sylvania 8100, a device whose spectral response approximates that of the human eye. Write to Sylvania Electric Products Inc., 1100 Main St., Buffalo 9, N. Y., for a copy.

The Sams 32-page spring-and-summer 1962 "technical booklist," containing data on 147 currently available books on electronics, TV, radio, audio, and related subjects, can now be obtained free of charge by writing to Technical Book Division, Howard W. Sams & Co. Inc., 2201 East 46th St., Indianapolis 6, Ind.

For a free 8-page catalog on electrical clips and insulators, write to Mueller Electric Co., 1600V East 31st St., Cleveland 14, Ohio. The catalog (No. 250) lists sizes, capacities, and other characteristics, and gives complete shipping information.

Design considerations and application data for epoxy silver "solders" and conductive epoxy paint are given in a four-page bulletin available free from Joseph Waldman & Sons, Epoxy Products Division, 133 Coit St., Irvington, N.J. Included is a table containing complete specifications on the "solders" and paint.

"Data Sheet NC-105" includes complete details and specifications for the National NC-105 "general coverage" receiver as well as instructions on how to use the set. It can be obtained free of charge by writing to National Radio, Dept. RP, Melrose 76, Mass.

Descriptions and basic specifications for the full line of Amperex tubes are given in a 33-page catalog which is available at no charge. The types described include cold cathode trigger tubes, entertainment and audio tubes, rectifier diodes, and thyratrons. Write, on company stationery, to Amperex Electronic Corp., Advertising Dept., 230 Duffy Ave., Hicksville, L. I., N. Y. for your copy. —30—

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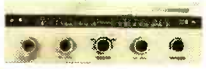

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THE LODESTAR

Transistorized metal locator pinpoints metals by a change in pitch

THERE'LL always be plenty of uses for metal locators in addition to the most "rewarding" one—prospecting for precious metals. During World War II and the Korean conflict, for example, metal locators used as mine detectors saved countless lives. Out West, weekend "prospectors" combing through "ghost" towns call on their trusty metal locators to uncover pistols, rifles, and dozens of similar "prizes." Still other "prospectors" are busily ferreting out pipes and other metallic objects buried in the

By **CHARLES CARINGELLA,** W6NJV

COVER STORY

THE LODESTAR

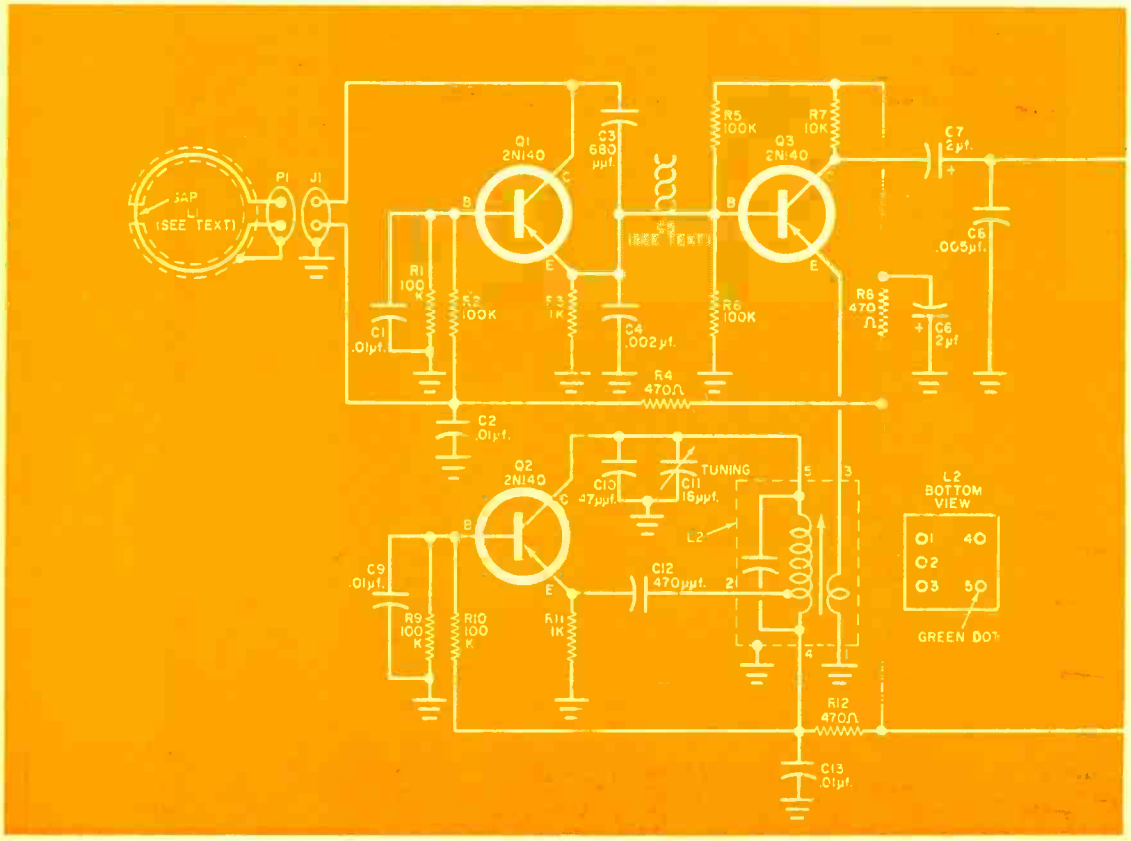
ground or hidden in walls of buildings.

The transistorized metal locator pictured here operates on the "beat frequency" principle. Though this mode of operation is hardly new, the fact that transistors are used does update the device. The result is a metal locator that is compact, rugged, and easy to handle. In addition, its power requirements are decidedly low when compared to those of an equivalent vacuum-tube unit.

About the Circuit. The "Lodestar" 's "front end" consists of two oscillators (*Q1* and *Q2*), each operating in the vicinity of 1000 kc. Each oscillator's output is fed to transistor *Q3*, which

PARTS LIST

B1—9-volt battery (Burgess 2U6 or equivalent)
C1, C2, C9, C13—0.01-μf. paper capacitor
C3—680-μμf. silver mica capacitor
C4—0.002-μf. paper capacitor
C5—Gimmick capacitor (optional—see text)
C6, C7—2-μf., 10-w.v.d.c. electrolytic capacitor
C8—0.005-μf. paper capacitor
C10—47-μμf. silver mica capacitor
C11—16μμf. variable capacitor (Hammarlund HFA-15B or equivalent)
C12—470-μμf. ceramic or mica capacitor
J1—2-conductor shielded jack (Amphenol 80-PC2F or equivalent)
J2—Open-circuit phone jack
L1—Sensing coil—see text
L2—455-kc. transistor oscillator coil (Meissner 14-9006, J. W. Miller 2021, Stancor RTC-9080, etc.)

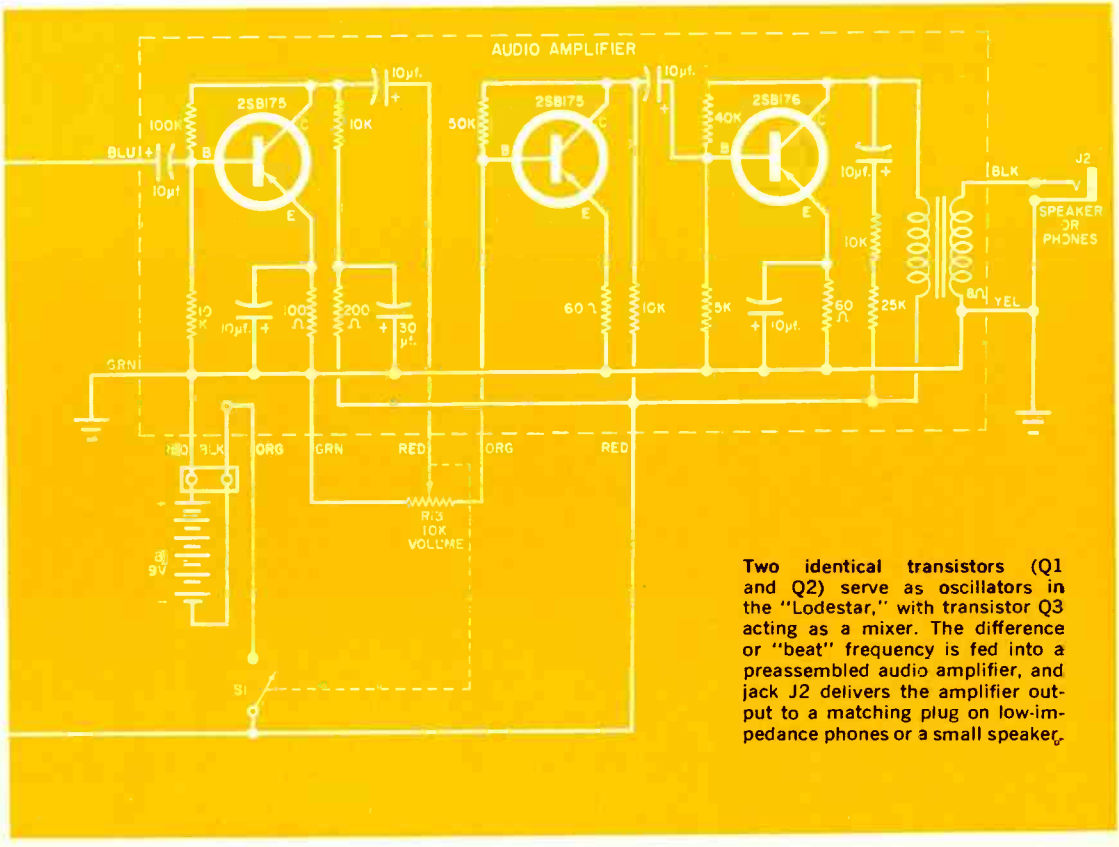


"mixes" the two signals in the same manner as a mixer in a superheterodyne receiver. The mixer output consists of both the sum and difference of the two signals fed into it, but the difference or "beat" frequency is the one of interest in this application. We'll see why in a moment.

If the two oscillators are oscillating at precisely the same frequency, the beat frequency will be "zero"—in other words, there won't be any "beat frequency!" However, if one of the oscillators is de-tuned slightly, the beat frequency will occur at an audible rate, and the beat note can be amplified and heard through a pair of phones or a speaker. This is accomplished in the unit shown by the three-stage audio amplifier following the mixer.

Now here's how the unit succeeds in detecting the presence of metal. Note that the sensing coil (*L1*) is part of the resonant circuit or "tank" of the first oscillator. If a metallic object enters the field of the sensing coil, eddy currents are induced which effectively decrease the inductance of the coil; as a result, the frequency of oscillation is increased. The second oscillator, however, shielded within the enclosure, remains at a fixed frequency. Since the first oscillator has changed frequency with respect to the

P1—2-conductor shielded plug (Amphenol 80-MC2M or equivalent)
Q1, Q2, Q3—2N140 transistor (RCA)
R1, R2, R5, R6, R9, R10—100,000 ohms
R3, R11—1000 ohms *All resistors*
R4, R8, R12—470 ohms *¼ watt, 10%*
R7—10,000 ohms
R13—10,000-ohm potentiometer with switch S1
S1—S.p.s.t. switch (part of R13)
1—Three-transistor subminiature audio amplifier (Lafayette PK-522—see text)
1—5¼" x 3" x 2⅛" aluminum utility box (Bud CU-2106-A or equivalent)
1—5' length of 2-conductor shielded microphone cable (Belden 8422 or equivalent)
1—6½' length of 5-conductor intercom cable (Belden 8445 or equivalent)
1—6½' length of ⅜"-diameter copper or aluminum tubing
Misc.—Phenolic board, Masonite board, wooden handle, transistor sockets, knobs, screws, hookup wire, solder, etc.



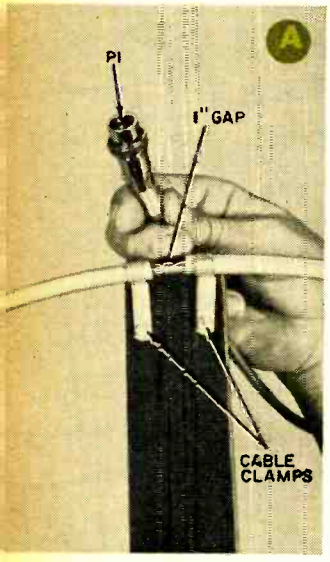
Two identical transistors (Q1 and Q2) serve as oscillators in the "Lodestar," with transistor Q3 acting as a mixer. The difference or "beat" frequency is fed into a preassembled audio amplifier, and jack J2 delivers the amplifier output to a matching plug on low-impedance phones or a small speaker.

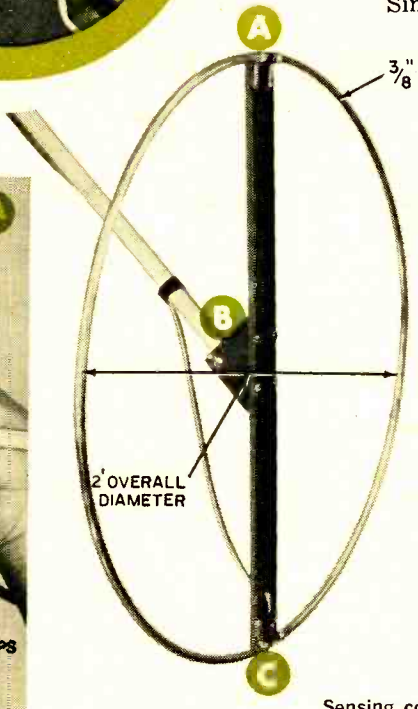
THE LODESTAR

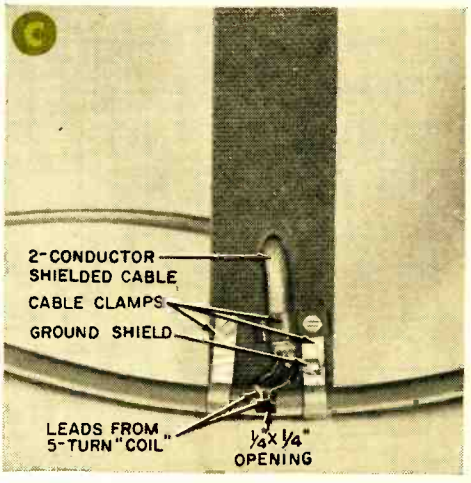
second, the presence of metal is then evident as a change in the audio pitch heard in the phones.

In actual operation, the second oscillator is initially tuned (by means of capacitor *C11*) to a frequency which beats with that of the first oscillator and produces a tone which is comfortable to your ear. (This adjustment, of course, must be made with the unit well away from metal objects). Then, as metal is approached, the pitch will go up or down, depending on whether the reference oscillator (*Q2*) is above or below the search oscillator (*Q1*) in frequency.

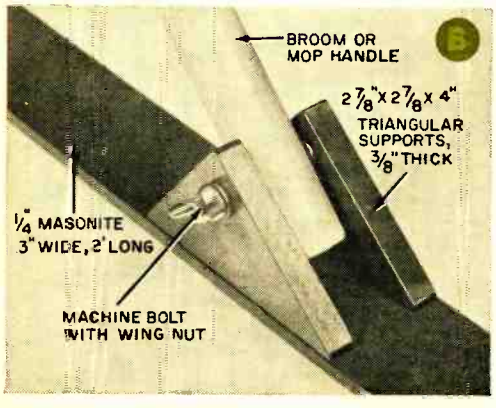
Since the d.c. biasing methods are

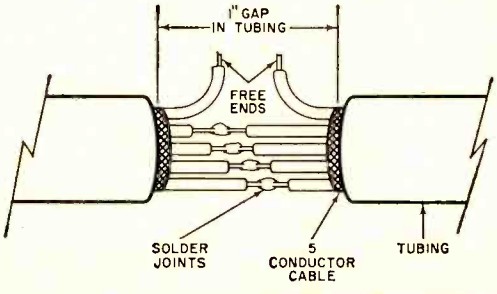


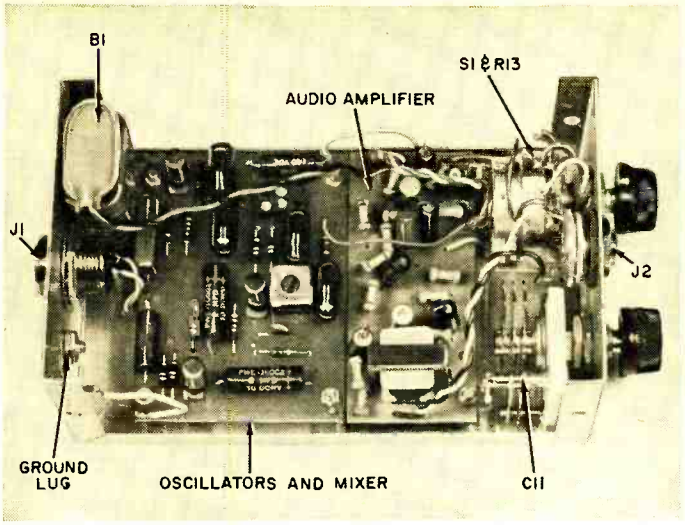




Sensing coil L1 will go together smoothly with aid of photos and drawing shown here. Details A, B, and C picture, respectively, 1" gap, pivot for wooden handle, and method of connecting coil to shielded cable. "Alternate" leads in 5-conductor cable are soldered together to form 5-turn coil (below).







Completed Lodestar fits snugly in a 5¼" x 3" x 2⅛" box. To operate it, simply plug the sensing coil into jack J1, headphones or speaker into jack J2.

identical and the temperature coefficients of the transistors are the same, frequency drift between the two oscillators is minimized. The frequency drift of the two circuits will be nearly the same, and in the same direction, resulting in no apparent change in the beat note.

The operating frequency of 1000 kc. is actually a compromise between two important effects. At higher frequencies, a smaller change in inductance brings about a larger change in frequency; therefore, the higher the frequency of operation, the more sensitive the unit will be. However, beginning at frequencies of several megacycles, the depth to which the signal will penetrate begins to drop; therefore, a "happy medium" is reached at about 1000 kc.

So far, we've discussed only the effects of inductance on the unit's operation. However, non-metallic objects and the earth itself cause capacitive effects at these frequencies, and the audio beat note would change every time the search coil was brought near any object or near the ground if these effects weren't taken care of. Any capacitive effects are virtually eliminated with a shield which completely encloses the sensing coil except for a 1" "gap" which keeps the shield from acting as a shorted turn.

Putting It Together. The electronic portion of the Lodestar is housed in an aluminum utility box measuring 5¼" x 3" x 2⅛". The tuning capacitor (*C11*), volume control (*R13*), and phone jack (*J2*) are mounted on one end, and the jack (*J1*) for the sensing coil on the other.

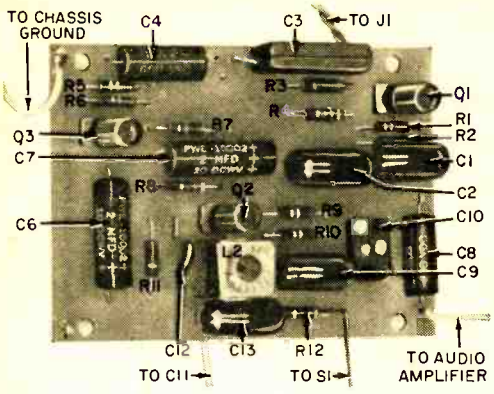
The "front end," which consists of both oscillators and the mixer, is assembled on a piece of phenolic board; the drawing shows how the components are secured to the board as well as how the board is mounted in the enclosure.

Direct, point-to-point wiring is used throughout, and the entire assembly should be rigid enough to be substantially free from mechanical vibrations. If it isn't, you'll find yourself troubled with frequency instability.

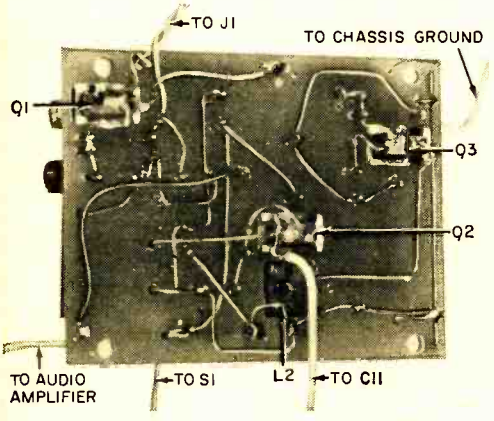
To make assembly that much simpler, a three-stage transistorized audio amplifier was purchased, factory-wired and ready-to-go. This amplifier* delivers enough power to drive a speaker directly, and phones can be used as well. (Unless you happen to have a pair of 8- or 10-ohm phones on hand, there will be some mismatch between the output transformer and the phones, but this won't be critical.) The audio section is mounted in the enclosure in the same manner as the board which holds the "front end."

The Sensing Coil. As in the balance of the unit, the leads to the "sensor" or

Catalog number PK-522, the amplifier is available from Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, L. I., N. Y., for $3.75, plus postage.



"Front end" of Lodestar is mounted on a small phenolic sheet, about 2 1/16" wide and 2 13/16" deep. Top and bottom views show location of all components as well as details of interconnecting wiring.



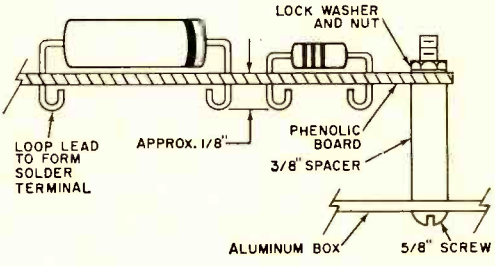
search coil must be as rigid as possible to prevent slight motions or jarring from pulling the oscillator off frequency. The ⅜" tubing, which can be either copper or aluminum, serves a dual purpose—it acts as a shield, and it also rigidly supports the coil.

A 5-turn coil is fabricated from one length of 5-conductor cable by connecting the ends in such a manner that they form a single coil. The outer jacket holds the five conductors together, so that they are not allowed to move with respect to one another. Any movement of these wires would change the inductance and stray capacitance of the coil, and, again, the oscillator would be unstable and pull off frequency whenever the coil was jarred.

The first step in fabricating the search coil assembly is to form the ⅜" tubing into a loop about 2' in diameter with a gap of about 1" between the ends (this will require a piece of tubing approximately 6' 3" in length).

Next, cut a ¼" square in the tubing directly opposite the 1" "gap." Connections to the coil will be made through this opening a little later in the construction process.

Now, feed the length of 5-conductor cable into the tubing and trim it so that



Attach components to board by drilling holes, then inserting and looping leads to form solder terminals.

about 1" protrudes from each end of the tubing. Strip the outer plastic jacket from the ends of the cable, leaving the five wires, each 1" in length, exposed at each end of the tubing. Connect and solder the ends of alternate wires so that one continuous 5-turn coil is formed (there will be four solder joints and two free ends).

If you "stagger" the solder joints somewhat, you should be able to wrap one turn of plastic tape around each of the four wires and the respective solder joints to insulate them from each other and also from the metal tubing. Be sure to leave the two unsoldered wires free, since you'll need them to connect the coil into the circuit.

Once the cable has been taped, work it around inside the tubing so that the taped portion is located at the ¼" x ¼" opening. Next, "fish" the two free leads through this opening and connect them to the 2-conductor shielded cable. Keep the leads as short as possible so they won't vibrate, and ground the cable shield to the cable clamp near the opening in the tubing.

A piece of ¼" Masonite, about 3" wide and 2' long, will serve to support the loop. Fasten a wooden handle to the

(*Continued on page* 108)

Throughout the past eight years, audiophiles—or "stereophiles" as they are now called—have avidly read the hi-fi equipment test reports furnished by the Hirsch-Houck Laboratories. This independent testing service specializing in audio and hi-fi products is presently supplying test reports for both ELECTRONICS WORLD *and* HIFI/STEREO REVIEW *(our sister publications).*

Beginning with this issue, certain Hirsch-Houck reports will become a part of our new monthly department, Hi-Fi Lab Check. *In this department, you will find discussions on two or three new items of hi-fi and stereo equipment every issue. In the case of a kit, we will tell you how easy, or how difficult, it is to assemble. Special circuit innovations will be noted, and a few editorial observations passed along about functional design, operating ease, etc. Definitive results from the tests performed on the equipment by the Hirsch-Houck Laboratories will round out each installment.*

In the next Hi-Fi Lab Check *we will discuss the Scott LT-110 FM/multiplex tuner kit, the Harman-Kardon Award A-50K kit, and EICO's multiplex adapter kit. Subsequent installments will cover the Heath integrated transistorized stereo amplifier and a Heath basic stereo power amplifier. Allied Radio's Knight-Kit line will be represented by their 32-watt integrated stereo amplifier/AM/FM/multiplex receiver and new transistorized integrated amplifier.*

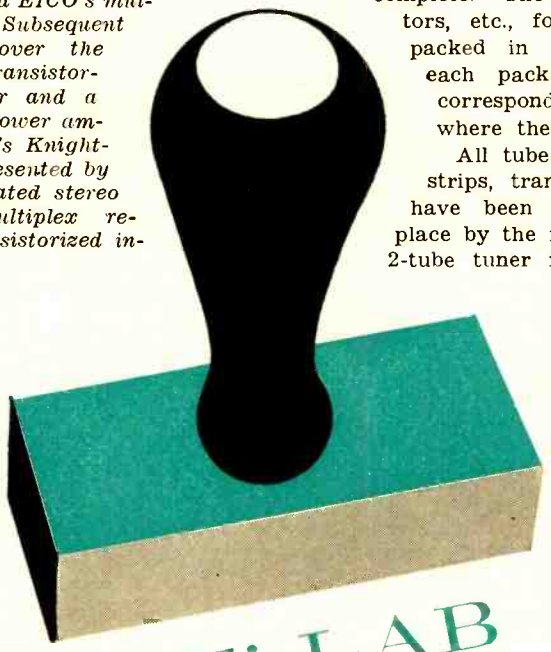
FISHER KM-60 FM Tuner StrataKit

Manufactured by Fisher Radio Co., 21-21 44th Drive, Long Island City 1, N. Y.

Prices: $169.50 (kit); $219.50 (Model KM-61, factory-wired); $24.95 (walnut or mahogany cabinet); $15.95 (metal cabinet); slightly higher in far west.

THE KM-60 is one of the new family of hi-fi kits in which the assembly work load is divided into logical stages. The instructions pertaining to each stage occupy exactly one right-hand page in the manual while the facing page is a pictorial diagram of the work you must complete. The resistors, capacitors, etc., for each stage are packed in plastic bags, and each pack is numbered to correspond to the stage where the parts are used.

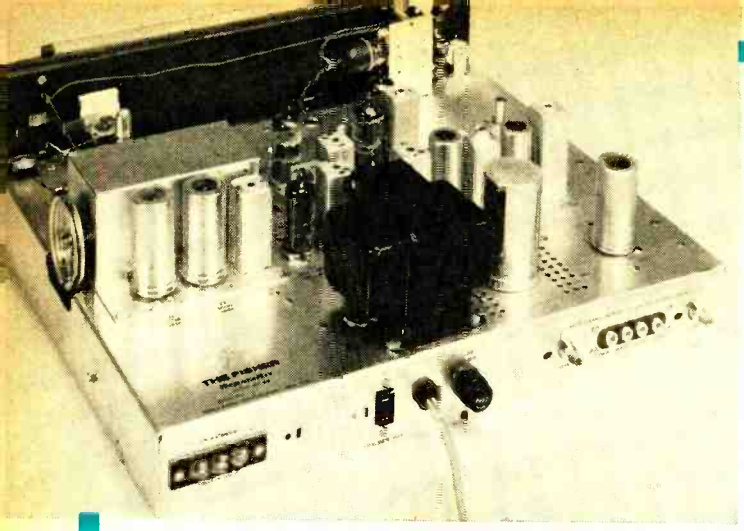
All tube sockets, jacks, tie strips, transformer tins, etc., have been neatly riveted in place by the manufacturer. The 2-tube tuner front end and the



Hi-Fi LAB CHECK

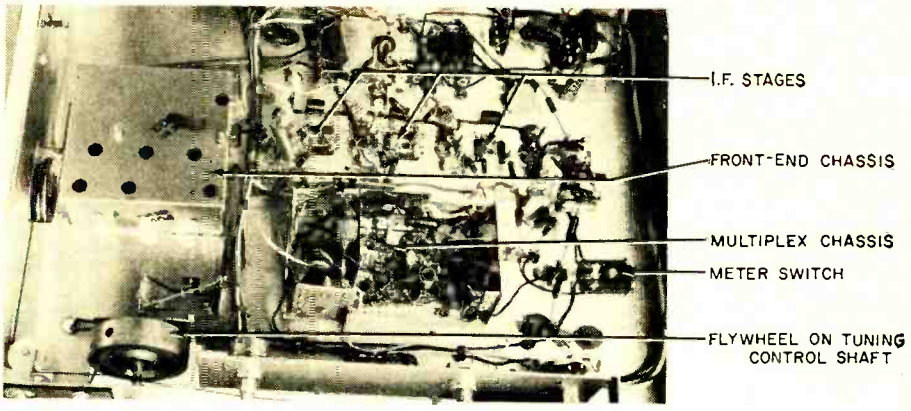
A NEW MONTHLY DEPARTMENT

Assembly and factual test reports on new hi-fi/stereo equipment; this month the Fisher KM-60 and Paco ST-26 kits are featured



The Fisher KM-60 has a clean topside parts layout. Arrangement on rear skirt is (left to right): antenna terminals, switched a.c. socket, line cord, fuse, output jacks and level controls.

Under-the-chassis view further verifies the clean-cut appearance mentioned above.



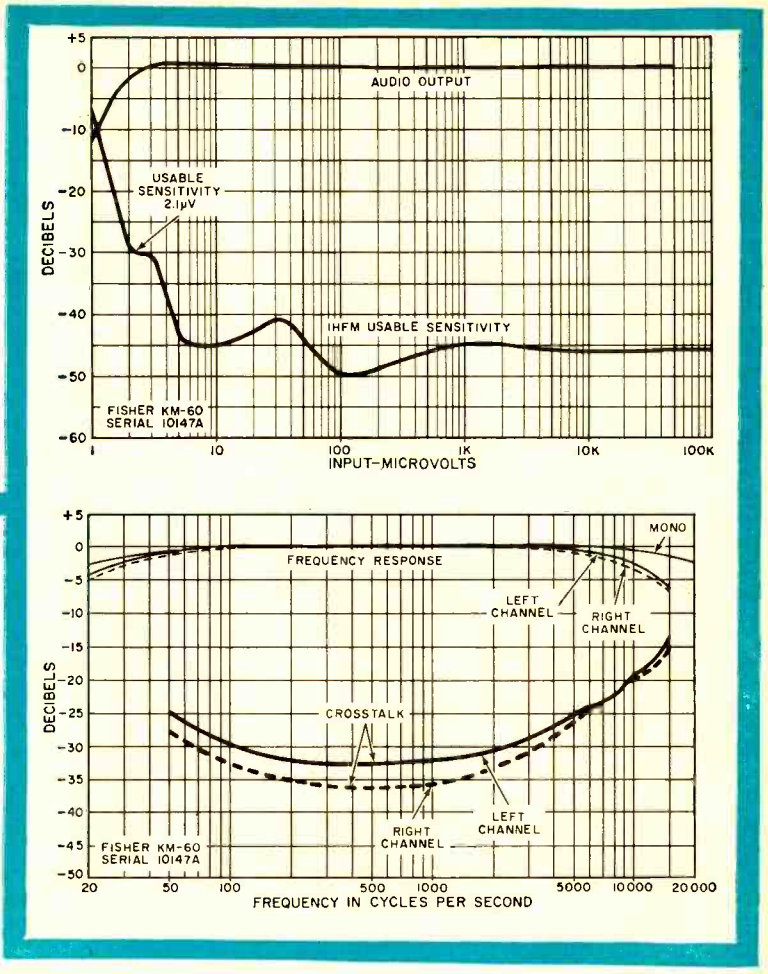
3-tube multiplex demodulator are factory-wired and tested; you wire in the i.f. stages, filament and high-voltage leads, ratio detector, a.f. voltage amplifier, and power supply. Your total wiring time should range from 15 hours (experienced builder) to 21 hours (very careful builder).

CIRCUIT REPORT: The KM-60 has a sealed front end, tabbed the "Golden Cascode." It uses an ECC88/6DJ8 cascode low-noise r.f. amplifier and an ECC85/6AQ8 mixer-oscillator. This is followed by four stages of 10.7-mc. i.f. amplification using EF94/6AU6 tubes. The last two i.f. stages also serve as limiters before feeding a solid-state ratio detector.

A selector switch on the front panel feeds the output of the ratio detector either into both triode sections of an ECC83/12AX7 in parallel for *Mono,* or routes it through a multiplex demodulator for *Stereo.* Level controls permit setting up a balanced output to your amplifier. Also connected to the multiplex demodulator is an EM84A/6FG6 beam tube used to indicate whether or not a station is transmitting FM stereo.

A tuning meter on the front panel measures second limiter grid current (approximate signal strength), or (via a chassis mounted switch) it can be used to set ratio detector and i.f. alignment.

HIRSCH-HOUCK LAB CHECK: The completed FM multiplex tuner met or exceeded all of the manufacturer's advertised specifications in all but one instance (see P. 45). It did so without the aid of a test instrument alignment—a very remarkable per-



Maximum output of the KM-60 was measured at 3.2 volts. The usable sensitivity curve plots total hum, noise, and distortion as referred to 100% modulation.

Frequency response curve suggests excellent listening quality of the KM-60. Not shown in this graph is the curve for left channel "Stereo Filter" that reduces stereo separation by about 13 db at 2500 cycles.

formance on the part of any FM tuner.

The difference between the manufacturer's claim of 1.8 μv. sensitivity and the tested 2.1 μv. (see graph at top of page) is negligible—and may easily be due to component tolerances and test instrument errors. With a 2.1-μv. value the KM-60 is still one of the most sensitive FM tuners on the market at this writing. Further alignment using test instruments made no measurable difference either in sensitivity or performance of this kit.

Audio frequency response from the KM-60 is excellent in *Mono* and very good in *Stereo* (see graph above). Some loss of high-frequency audio is to be expected when receiving multiplex, due to the inevitable use of ultrasonic filters to remove the 19-kc. pilot carrier. Stereo separation between right and left channels is also excellent—about the best of any FM/multiplex tuner presently available.

A "Stereo Filter" can be used with the left channel to further eliminate very high frequency audio signals. This filter has a minor effect on frequency response in the audio spectrum and a slightly greater effect on separation (not graphed). However, the stereo effect is not particularly diluted.

IN CLOSING: The Fisher KM-60 is (in the words of our assembler) very easy to build and if you follow the wiring instructions to the letter, the manufacturer could eliminate the last paragraph in the manual, "In Case of Difficulty." The Hirsch-Houck Lab simply says that the KM-60 is a superb tuner.

(*Continued on page* 100)

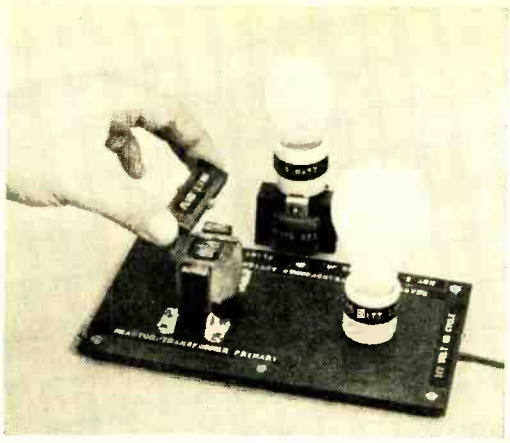


Fig. 1. Operator removes flux link from choke L1, reducing inductance of the choke and causing series-connected, 60-watt lamp L1 to glow brightly.

"SEEING" INDUCTIVE REACTANCE

By ROY E. PAFENBERG

IT'S not too difficult for the novice to grasp the principles of simple d.c. circuits, but the relationships existing in a.c. circuitry are harder to visualize. The simple demonstrator described here is designed to "bring to life" the concepts of inductive reactance and transformer action in a way that no textbook could hope to do. Using a couple of replacement filter chokes and a few other inexpensive components, the unit costs little to put together and is ideal for a class demonstration or science fair project.

Choke Construction. The two filter chokes employed in the demonstrator have laminated cores composed of two basic sections—one of them shaped like an "E," the other like an "I." Each choke coil is wound on the center leg of the "E" section, and the "I" section covers all three legs—closing off the open end of the "E."

In both of these chokes, the "I" section has been made removable from the "E" section. In the case of the choke mounted on the board (see Fig. 1), the open end of the "E" points upward and the "I" (marked "flux link") is held in the operator's hand. The choke with the bulb mounted on it is sitting on the open end of its "E" section.

How Demonstrator Works. Choke *L1* and lamp *I1*, the two components mounted on the demonstration board, are wired in series and connected across the a.c. line (see diagram on next page). The other choke and lamp (*L2* and *I2*) are wired in parallel and fastened together to make a single unit.

The first part of the demonstration, illustrated in Figs. 1 and 2, requires only the demonstration board proper. Though *L2/I2* appears in the background, it is not used.

In Fig. 1, the operator is removing the "flux link," or "I" section of choke *L1*. With the flux link removed, the magnetic flux path of the choke's core is not complete. Consequently, *L1* acts more like a resistor than a choke—the voltage drop across it resulting mainly from the d.c. resistance of its winding (approximately 100 ohms). Therefore lamp *I1*, having only about 100 ohms in series with it, lights fairly brightly.

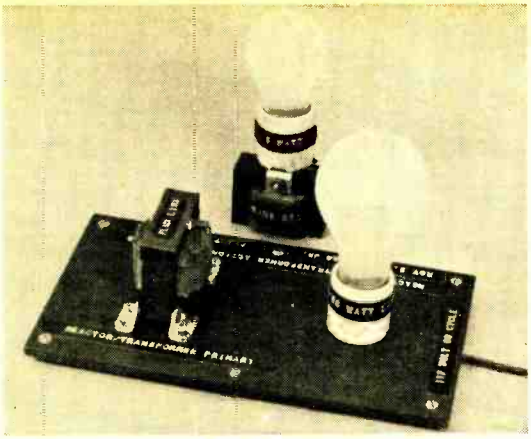


Fig. 2. With link replaced on L1, the choke regains full inductance and the voltage drop across it becomes high enough to cause lamp I1 to go out.

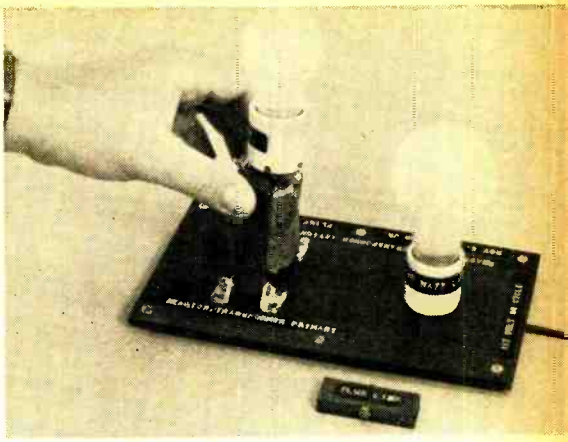


Fig. 3. Here transformer action is demonstrated by placing L2/I2 atop L1. Enough voltage is then induced in L2 to make 15-watt lamp I2 glow brightly.

In Fig. 2, the flux link has been replaced on *L1*. Since the flux path is now completed, the voltage drop across the choke is much greater—being caused by the full inductive reactance of the choke as well as the d.c. resistance. Accordingly, lamp *I1* goes out.

The last part of the demonstration, shown in Fig. 3, illustrates transformer action. With the open "E" section of *L2* placed over that of *L1*, the flux path of *L1* is completed as before and *I1* goes out. At the same time, *L1* becomes a transformer primary and *L2* a secondary. Enough voltage is induced in *L2* from *L1* to cause *I2* to glow at about half brilliance.

Building the Demonstrator. Though construction can follow any style, the breadboard mounting shown here is both simple and safe. Any material, as long as it is an electrical insulator, can be used for the board. Mount a rubber foot at each corner to provide clearance for the wiring and to avoid scratching furniture.

Choke *L1* is a Thordarson 26C88 (2.5 henrys, 130 ma., 100 ohms); *L2* is a Stancor C-2304 (2.3 henrys, 150 ma., 60 ohms). Remove from each choke the metal channel surrounding the core. Next, remove the "I" core sections from both *L1* and *L2*. Both channels, and *L1*'s "I" section, can be discarded.

Drill out the two holes punched in *L1*'s "E" section to take No. 4 machine screws. Do the same for the single hole

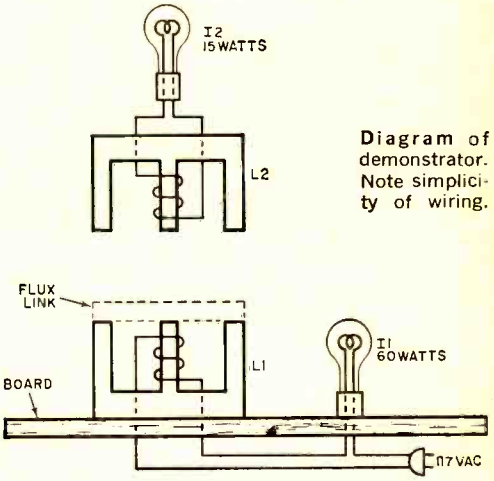


Diagram of demonstrator. Note simplicity of wiring.

in *L2*'s "E" section and that in *L2*'s "I" section. To make the flux link, pass a No. 4 machine screw through the "I" section and fasten it securely with a nut. This will hold the laminations together.

Four angle brackets, attached to *L1*'s "E" section by means of machine screws passed through the holes mentioned above, are used to mount the "E" section to the board. The socket for *I2* is attached to *L2*'s "E" section by means of an angle bracket mounted via the hole in that section. (The sockets used for both *I1* and *I2*, incidentally, are the ceramic-insulated type sold for replacement in lighting fixtures.) Always use a 60-watt lamp at *I1* and a 15-watt lamp at *I2*. -30-

The MASTER MAGNET

Pick up aluminum, silver, or other non-ferrous metals with an a.c. electromagnet

By WALTER B. FORD

EVERYONE KNOWS that magnets are supposed to attract only ferrous metals like iron or steel. That's why the unusual electromagnet described here makes such an excellent "crowd stopper" at science fairs or similar gatherings. Seeming to defy the laws of physics, it will pick up half-dollar-sized pieces of copper, aluminum, silver, gold, and other non-ferrous metals.

Of course the magnet will attract ferrous metals much more strongly. And the sight of a seething mass of nails, screws, or washers dangling a foot or more from its bottom is not easily forgotten. So, if you're looking for something different in the way of a demonstration unit, or if you'd just like to build a big electromagnet for your own pleasure, here are the details.

The Magnet's Secret. Since the electromagnet's windings are powered by a.c., an alternately increasing and decreasing magnetic field is set up in its center core. When this varying field passes through a set of copper washers fastened at the end of the core, a large current is induced in them. The washers, then, act essentially as a transformer secondary.

The induced current sets up a strong, varying magnetic field in the washers. And the direction of this field is such that the washers and the core repel each other. If the washers were not anchored in place, they would spring out of their mounting as soon as the current was turned on.

The point is, though, that the varying field in the washers will induce, in turn, a large current in any metal object (ferrous or not) brought near them. This current, of course, sets up a magnetic field in the object. And the direction of the field will aways be such that the part of the object in contact with the outside face of the set of washers will

have the opposite magnetic polarity from that face. Therefore, the object will be attracted.

Building the Magnet Cores. Begin construction by cutting a 3½"-long section from a mailing tube about 2" in diameter. Then make a frame for the inner core of the magnet as shown in Detail "A." The diameter of the three wooden discs forming the frame should be such that they will fit snugly inside the tube. Four ¼"-diameter dowels pass through holes drilled in the discs and are glued in place—holding the assembly together. The ¾"-diameter holes drilled in the centers of the discs will later accommodate the core material.

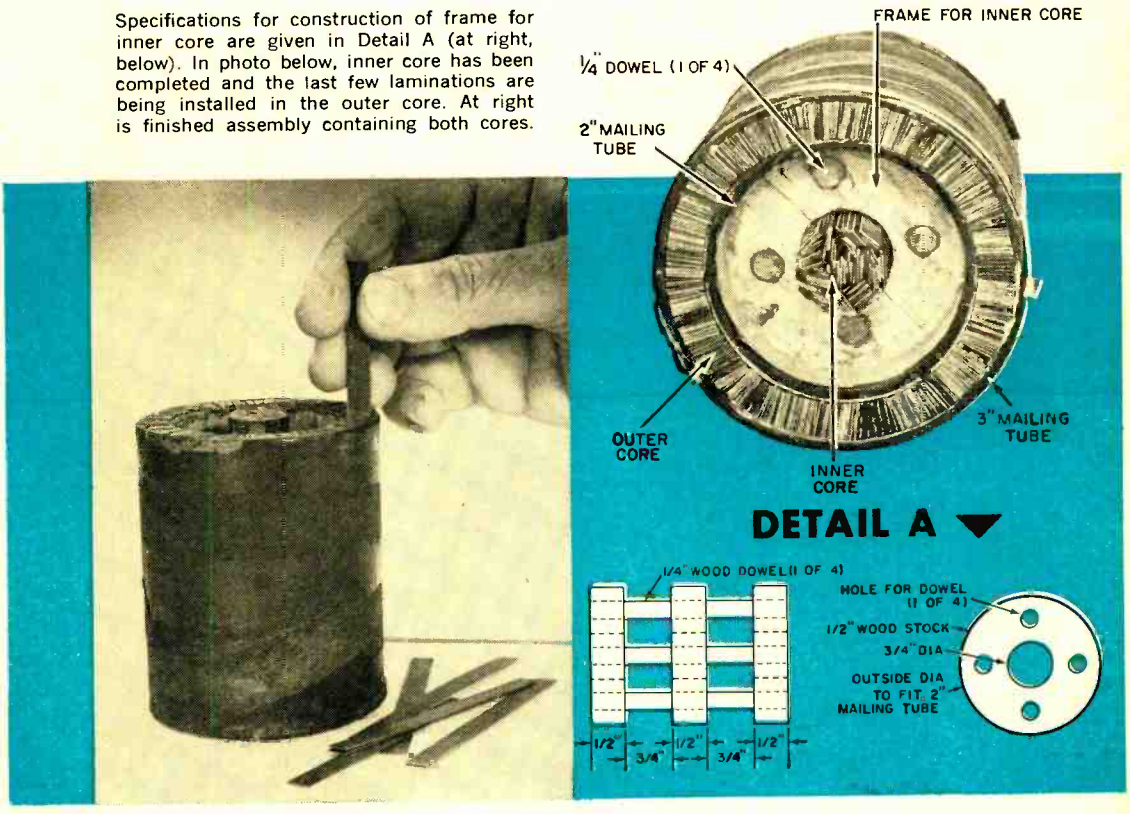
Now slide the completed frame into the mailing tube and glue it in place. One end of the frame should be flush with one end of the tube—leaving a ½"-space at the other end of the tube. Three copper washers will later be installed in this space (see Detail "B"—side view).

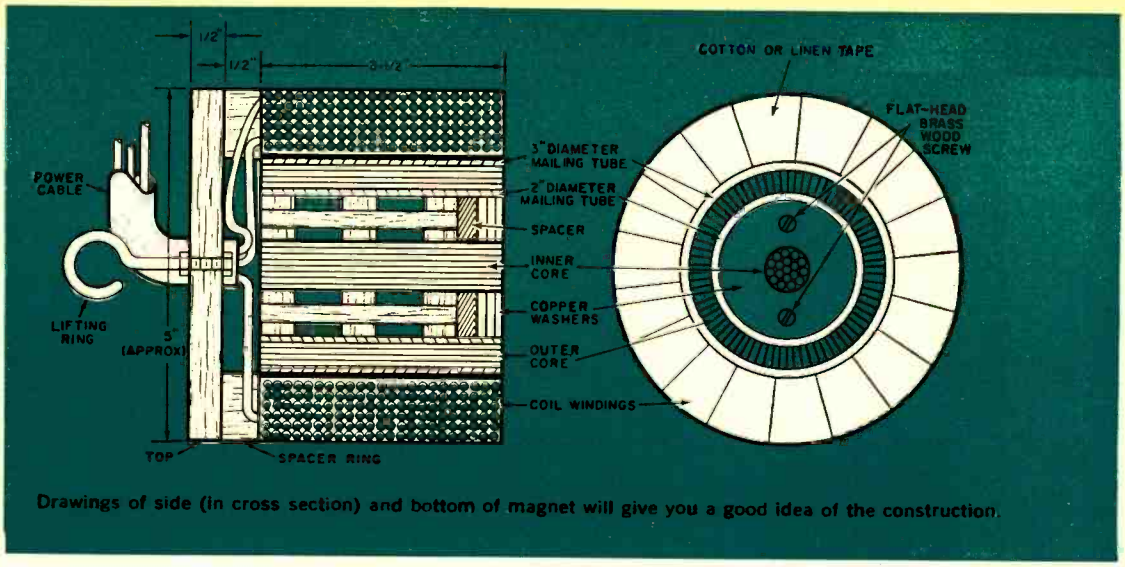
Set the tube on a table top with the "closed" end down and pack the center of the frame with a core of 3½"-long, approximately ¼"-wide, laminations. The laminations can be taken from an old transformer but, if one is not available, 3½"-long pieces of 18- to 22-gauge soft iron wire may be substituted. Whether you use laminations or wire, the top ends of the pieces should be cut square so that they will present a smooth surface when packed together.

Slide a 3½"-long and approximately 3"-diameter piece of mailing tube over the finished inner core assembly and place the assembly at the exact center of the tube. Fill the space between the assembly and the tube with an outer core of 3½"-long pieces of transformer laminations or 18- to 22-gauge soft iron wire. If laminations are used, they should be wide enough to make a snug fit when packed radially around the inner core assembly (see Detail "B"—end view).

Winding the Coil. For this job you will need a jig similar to that shown in Detail "C." It consists of a wooden cylinder (3½"-long and $\frac{1}{16}$" larger in diame-

Specifications for construction of frame for inner core are given in Detail A (at right, below). In photo below, inner core has been completed and the last few laminations are being installed in the outer core. At right is finished assembly containing both cores.

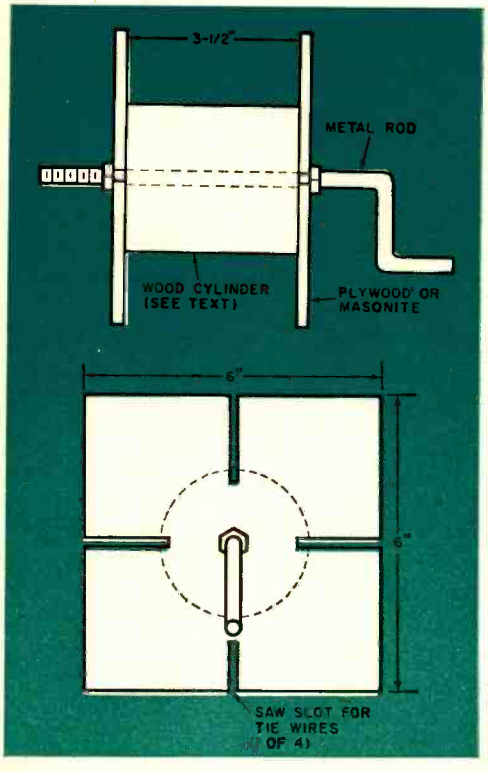




Drawings of side (in cross section) and bottom of magnet will give you a good idea of the construction.

DETAIL B ▲

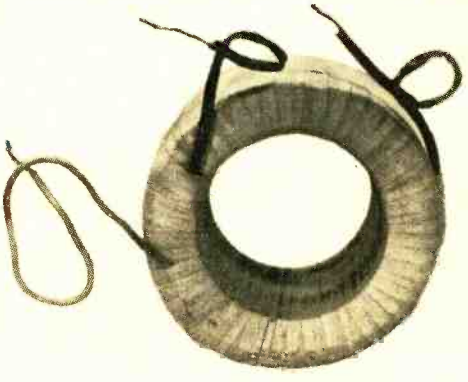
DETAIL C ▼

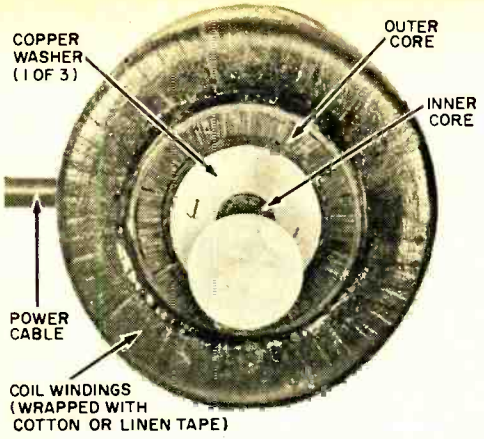


ter than the outside diameter of the mailing tube) fitted with two end-pieces. Slots are sawed in the end-pieces for the accommodation of temporary tie wires (see next paragraph), and a rod with a crank handle runs through the center of the cylinder as illustrated.

With the jig prepared, center a 12" piece of hookup wire across each of the four sets of slots and push it, through the slots, flat against the cylinder. The coil will be wound over these wires, and they will be used to hold the coil together temporarily when it is removed from the jig. Now drill a hole to fit the jig

Magnet coil is wound on a special jig (see Detail C at left). After windings are completed, they are wrapped with an overlapping layer of cotton or linen tape (below). Lead at left of coil is the tap.





Photograph of magnet bottom shows the coil, inner and outer cores, top washer. Circular object partially covering washer and cores is a half-dollar.

BILL OF MATERIALS

1—Cardboard mailing tube, 3½" long, approximately 2" in diameter
1—Cardboard mailing tube, 3½" long, approximately 3" in diameter
4—Wooden dowels, 3½" long, ¼" in diameter
1—Roll ½"-wide cotton or linen tape
1—Heavy brass or copper hook (for lifting ring)
1—Line plug
1—80-μf., 250- or 600-volt capacitor bank—see text
1—Wood or metal enclosure for above
1—6' length of #14 stranded 3-wire cable (for magnet power cord)
1—6' length of #14 stranded 2-wire cable (for line cord)
9—pounds of #14 cotton- or enamel-covered magnet wire
Misc.—½" wood stock for center core frame, magnet top and spacer ring, 1/16" sheet copper for washers, old transformer laminations or 18- to 22-gauge soft-iron wire for cores, parts for winding jig, flat-head brass wood screws, cement, insulating varnish or enamel, etc.

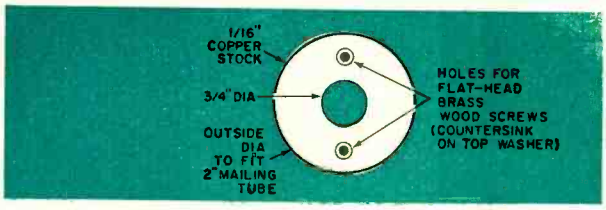
rod in a block of wood and clamp the block in a vise; this hole will serve as a bearing for the straight end of the rod while you crank the other end.

The coil consists of 600 turns of #14 cotton- or enamel-covered magnet wire tapped at the 350th turn; approximately nine pounds of wire will be needed. Push the end of the wire on your supply spool through a saw-slot in one of the jig's end-pieces (leave about 6" sticking out), insert the straight end of the jig rod into the block of wood, and begin winding the wire, in layers, onto the cylinder.

When you reach the 350th turn, tap on a 6" length of wire and bring it out through a saw-slot. The point of tapping can be varied as much as 10 turns in either direction in order to bring the tap out at the end of a layer and on the same side of the coil as the original 6" lead. Continue winding until you reach the 600th turn, bring the end of the wire out through a saw-slot on the same side of the coil as before, and cut it off (leaving another 6" lead).

DETAIL D

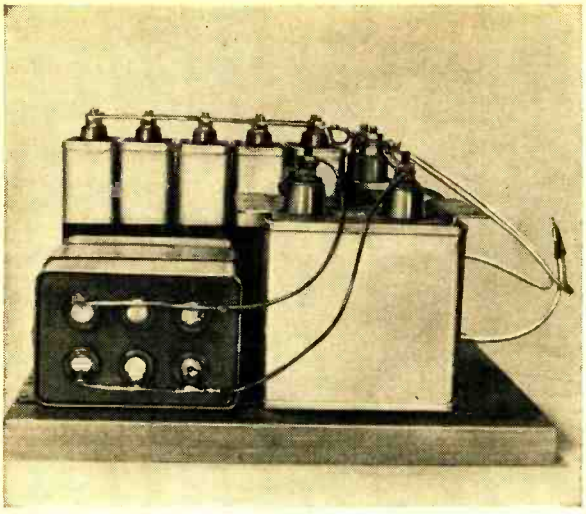
Three washers like that illustrated below are required (see Detail B). Countersink screw holes on one of them.



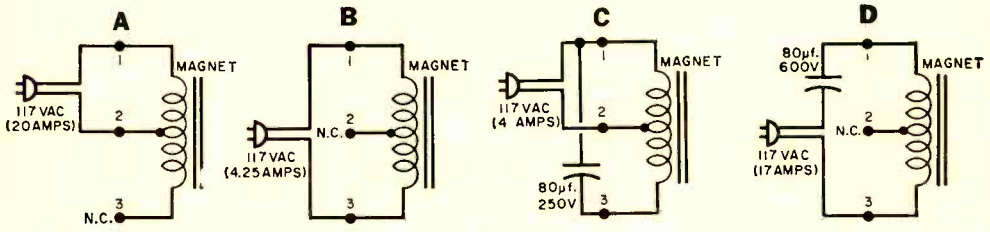
Final Assembly. Tie the windings together, using the wires previously inserted for this purpose—then disassemble the jig and remove the coil. The coil should now be completely wrapped, from the inside to the outside, with an overlapping layer of ½"-wide cotton or linen tape. Coat with glue the outside of the 3"-diameter mailing tube enclosing the magnet cores, and also coat the inside of the coil. Next, slip the coil over the cores (with the leads at the end opposite that on which the copper washers will be mounted) and allow the glue to dry.

Make a wooden ring, from ½" stock, with an outside diameter equal to the outside diameter of the coil and a 3" inside diameter. This will serve as a spacer between the coil and its wooden top (see Detail "B"—side view). Cut grooves in the spacer for the coil leads and glue it to the top of the coil, bringing the leads out through the hole in the center.

A circular wooden top having the same outside diameter as that of the ring is now cut from ½" stock. Mount a lifting ring (made of either brass or copper) on the center of the wooden top and also drill a hole for the power cable (a 6'



The four schematic diagrams below indicate various methods of connecting magnet coil to a.c. line. The hookup of "C" or "D" will give you a stronger pull than that of "A" or "B," but both the "C" and "D" hookups require the use of an 80-μf. capacitor. This capacitance can be built up by paralleling a number of smaller units as shown in the photo at left.



TERMINAL 1 = START OF WINDING
TERMINAL 2 = TAP
TERMINAL 3 = END OF WINDING

length of #14 stranded, 3-wire conductor). Push one end of the cable through the hole, connecting the coil leads to the cable leads.

The leads at the free end of the power cable should be marked "start of winding," "tap," and "end of winding" for later identification. This done, the wooden top can be secured to the spacer ring with brass wood screws. Glue the cable into its hole so that the connections cannot be pulled apart by accidental flexing, and coat the entire magnet with black insulating varnish or enamel. The coating will give the unit a professional appearance, protect it from moisture, and help to secure the cotton or linen coil wrappings.

The last job to be done in the construction of the magnet is the forming and installation of the copper washers which fill the remaining space between the ends of the inner and outer magnet cores. Specifications for the washers are given in Detail "D." The author has found that three washers (each $\frac{1}{16}$" thick) work well, but you might like to try a different number.

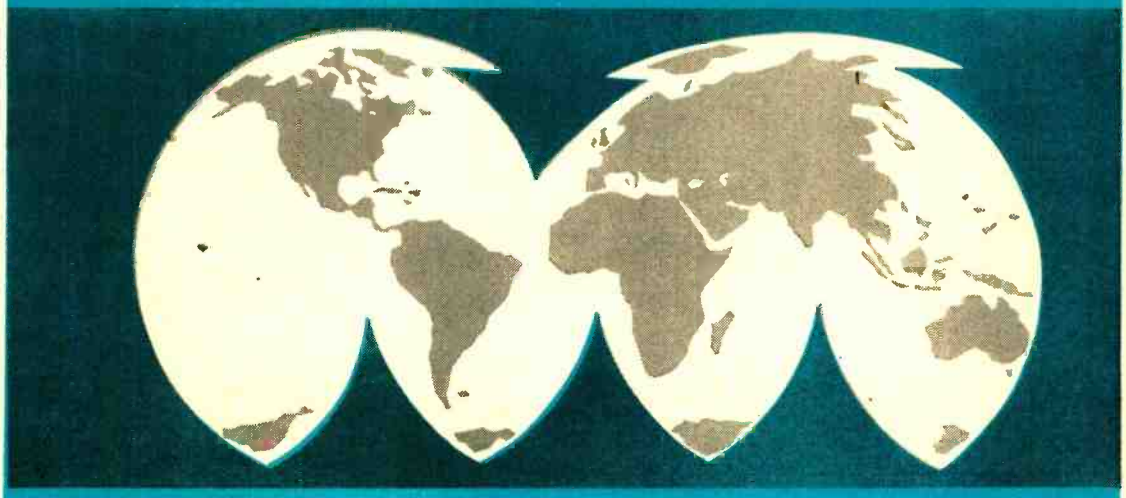
The washers are secured with flathead brass wood screws driven into the frame of the inner core. Countersink the screwholes in the top washer so that the heads of the screws will be flush with the copper surface. Whatever space remains between the washers and the inner core should be filled with cardboard or wood spacers—so that the top washer will be flush with the ends of the inner and outer cores.

Do not, incidentally, substitute any other metal for the copper. The heavy current induced in the washers requires that they be made of extremely low resistance material. And, except in the unlikely event that you have silver

(*Continued on page* 108)

EXCLUSIVE

DIRECTORY OF WORLD-WIDE NEWSCASTS



For the first time: a listing of 'round-the-clock short-wave broadcasts to let you tune in on the news direct from the world's trouble spots!

IT GOES WITHOUT SAYING that the news of the world is made up of facts. But it's also pretty well known that there's a world of difference in news from London, Melbourne, or Washington, and news from Moscow, Peking, or Havana. Want to find out what newscasters in other countries are saying about the United States and the rest of the world? Better yet, want to tune in on events *while they're happening?* The exclusive listing on the following four pages is a cross-section of foreign English-language newscasts, broadcast around the clock around the globe.

Not all of the newscasts listed here are intended for North American listeners, but these stations can often be picked up just the same. Other broadcasts, especially those beamed directly to North America, usually come in clear as a bell; the frequencies on which these stations are heard appear in boldface type. All times listed are Eastern Standard, and both times and frequencies are naturally subject to change. Good luck—and good listening!

By STEWART WEST, WPE2LH

SEE NEXT FOUR PAGES ▶

TIME (EST)	STATION LOCATION	NAME OR CALL	FREQUENCIES (kc.)
0340[1]	Wellington, N.Z.	Radio New Zealand	11780, 6080
0400	Port Moresby, New Guinea	VLT6	6130
0400	Suva, Fiji	Fiji Broadcasting Service	4756
0400	Melbourne, Australia	Radio Australia	11710, 9570
0400	Tokyo, Japan	General Overseas Service	15195, 11855, 11725
0430[2]	Wellington, N.Z.	Radio New Zealand	9540, 6080
0450	Georgetown, Guiana	Radio Demerara	5980, 3265
0500[3]	Vatican	Vatican Radio	21490, 17840
0500	Delhi, India	All India Radio	17855, 15310, 15105, 11730, 11715
0510	Taipei, Taiwan	Voice of Free China	11825, 9720, 9660, 7130, 6095
0530	Bangkok, Thailand	HSK9	11910
0530	Kabul, Afghanistan	Radio Kabul	15425
0600	Tokyo, Japan	General Overseas Service	11780, 11725
0600[4]	Tokyo, Japan	Far East Network	15257, 11750, 6160
0615	Djakarta, Indonesia	Voice of Indonesia	11770, 9585
0700	Tashkent, Uzbek S.S.R.	Radio Tashkent	11952, 9600
0700[5]	Cap-Haitien, Haiti	Radio 4VEH	9770, 6120, 1035
0730	Port Moresby, New Guinea	VLT6	6130
0730	Pyongyang, North Korea	Korean Central Broadcasting Station	6250
0730[6]	Warsaw, Poland	Radio Warsaw	17800, 15120, 11800
0745	Melbourne, Australia	Radio Australia	**11710**
0800	Tokyo, Japan	General Overseas Service	11780, 11725
0800	Paris, France	This Is Paris	21620, 17765, 15290
0800	Colombo, Ceylon	Radio Ceylon	9520
0815	Dakar, Senegal	Radio Senegal	11895
0830	Lisbon, Portugal	Radio Lisbon	17895, 15125
0830	Delhi, India	All India Radio	15365, 11810
0830	Karachi, Pakistan	Radio Pakistan	15192, 11672
0900	Stockholm, Sweden	Radio Sweden	**17840**
0900	Hilversum, Holland	Radio Netherlands	17810, 15445
0900	Peking, China	Radio Peking	15410, 11740, 9660, 9480, 7335
0900	Tashkent, Uzbek S.S.R.	Radio Tashkent	11952, 9600
0905	Quito, Ecuador	HCJB—Voice of the Andes	**17890, 15115**
0910	Cologne, Germany	Voice of Germany	17815, 15275
0930	Seoul, Korea	Voice of Free Korea	15125
0945	Djakarta, Indonesia	Voice of Indonesia	11770, 9585
0948	Berne, Switzerland	Switzerland Calling	17795, 15315, 11865
1000	Vatican	Vatican Radio	15120, 11740, 9645

TIME (EST)	STATION LOCATION	NAME OR CALL	FREQUENCIES (kc.)
1000	Copenhagen, Denmark	Voice of Denmark	15165
1000	Bucharest, Rumania	Radio Bucharest	15380, 15250, 11810
1015	Melbourne, Australia	Radio Australia	11710
1030	Belgrade, Yugoslavia	Radio Belgrade	15240, 11735, 9505
1100	London, England	BBC—North American Service	17810, 15310
1100	Vatican	Vatican Radio	17840, 11740
1140	St. George's, Grenada	Windward Islands Broadcasting Service	15235, 9520
1200	Montreal, Canada	Radio Canada	17820, 15320, 11720
1230	Athens, Greece	Radio Athens	15345, 11720
1300	Peking, China	Radio Peking	15095, 12055, 11715, 9785, 9755, 9550
1315	Vatican	Vatican Radio	15120, 11740, 9645
1330	Lisbon, Portugal	Radio Lisbon	17880, 11915
1345	Abidjan, Ivory Coast	Radio Abidjan	11820
1530	Berne, Switzerland	Switzerland Calling	9545, 7210
1545	Cairo, Egypt	Radio Cairo	17690
1545	Brazzaville, Congo Republic	Radio Brazzaville	15190
1600	Delhi, India	All India Radio	11955, 9690, 9635, 7235
1630	Damascus, Syria	Damascus Calling	15165
1630	Jerusalem, Israel	Voice of Israel	11915, 9520, 9009
1348	Brussels, Belgium	ORU	15335, 11850, 9745
1415	Tehran, Iran	Tehran Calling	15105, 9660, 7024
1430	Accra, Ghana	Radio Ghana	11805
1445	Havana, Cuba	Radio Havana Cuba	15285
1515	Hilversum, Holland	Radio Netherlands	11730, 9715, 6020
1515	Leopoldville, Republic of the Congo	Radio Leopoldville	11755
1630	Cairo, Egypt	Radio Cairo	11915
1645	Ankara, Turkey	Radio Ankara	7285
1650	Jerusalem, Israel	Voice of Israel	9009
1700	Moscow, U.S.S.R.	Radio Moscow	12010, 11965, 11790, 11730, 9740, 9680
1700	Budapest, Hungary	Radio Budapest	9833, 7220, 6236
1700	Seoul, Korea	Voice of Free Korea	11950
1700	Belgrade, Yugoslavia	Radio Belgrade	9505, 7100, 6100
1730	Bucharest, Rumania	Radio Bucharest	9570, 7195
1740	Cologne, Germany	Voice of Germany	9605, 6100
1800	London, England	BBC—General Overseas Service	15375, 15070, 12040, 11780, 11750, 9510
1800	Montreal, Canada	Radio Canada	15190, 11760, 9740
1800	Buenos Aires, Argentina	Argentina Calling	11730
1815	Ankara, Turkey	Radio Ankara	9515
1845	St. George's, Grenada	Windward Islands Broadcasting Service	9820, 3280

TIME (EST)	STATION LOCATION	NAME OR CALL	FREQUENCIES (kc.)
1900	Brussels, Belgium	ORU	**9705**, 9745, 6000
1900	Budapest, Hungary	Radio Budapest	**11910, 9833**, 9770
1900	London, England	BBC—General Overseas Service	**11780, 11750, 9510, 7230**
1930	Tokyo, Japan	Radio Japan	17895,15390, 15135
1930	Delhi, India	All India Radio	11895, 9765
1930	Rome, Italy	Radio Rome	**11905, 9575**
2000[9]	Peking, China	Radio Peking	17765, **15115, 11975,** 11730, **11945, 9480**
2000	Prague, Czechoslovakia	Radio Prague	15285, **11990, 9795, 9550, 7345**
2000[10]	Moscow, U.S.S.R.	Radio Moscow	**12030, 12010, 11870,** 11820,**11730,** 11690, **9740, 9720, 9680, 9570**
2000	Sofia, Bulgaria	Radio Sofia	**9700**
2000	Cologne, Germany	Voice of Germany	**9605, 6145**
2000	Cap-Haitien, Haiti	Radio 4VEH	9770, 6120, 1035
2000[11]	Montreal, Canada	Northern Service	11720, 9585
2015	Brazzaville, Congo Republic	Radio Brazzaville	**11725**
2015	Amman, Jordan	This Is Amman	**9560**
2030	Melbourne, Australia	Radio Australia	25735, 21540, 17870
2030	Bucharest, Rumania	Radio Bucharest	15380, **11900,** 11810, 9510, **7195,** 6190
2030	Hilversum, Holland	Radio Netherlands	**9590, 6035, 5985**
2033	Berne, Switzerland	Switzerland Calling	**11865, 9535, 6165**
2045	Stockholm, Sweden	Radio Sweden	**11805** (or 9725)
2100	London, England	BBC—General Overseas Service	**11780, 11750, 9510, 7230**
2100	Lisbon, Portugal	Voice of the West	**9740, 6025**
2100[12]	Tokyo, Japan	General Overseas Service	17755, 15195, 15105
2100	Colombo, Ceylon	Radio Ceylon	15265
2100[13]	Monrovia, Liberia	ELWA	**11825,** 9590
2100	Leopoldville, Republic of the Congo	Radio Leopoldville	**11755**
2100	Cologne, Germany	Voice of Germany	**9640, 6100**
2100[1]	Copenhagen, Denmark	Voice of Denmark	9520
2100	Belize, British Honduras	British Honduras Broadcasting Service	3300
2145	Taipei, Taiwan	Voice of Free China	15225, 11825, 9665, 6095
2200	Havana, Cuba	Radio Havana Cuba	**11875, 11840**
2200	Bucharest, Rumania	Radio Bucharest	**11900, 11810, 9570** 9510, **7195,** 6190
2200[14]	Moscow, U.S.S.R.	Pacific Coast Service of Radio Moscow	**15140, 11755, 11850, 11705, 9540**
2200	Buenos Aires, Argentina	Argentina Calling	**9690**
2205	Rome, Italy	Radio Rome	**11905, 9575**

TIME (EST)	STATION LOCATION	NAME OR CALL	FREQUENCIES (kc.)
2215	Madrid, Spain	Voice of Spain	9363, 6130
2215	Stockholm, Sweden	Radio Sweden	11805 (or 9725)
2230	Leopoldville, Republic of the Congo	Radio Leopoldville	11755
2230	Budapest, Hungary	Radio Budapest	9833, 9770, 7220
2230[12]	Moscow, U.S.S.R.	Radio Moscow	12010, 11960, 11820, 11730, 9700, 9680, 9660
2230[1]	Copenhagen, Denmark	Radio Denmark	9520
2245	Cologne, Germany	Voice of Germany	9735, 6145
2245	Lisbon, Portugal	Voice of the West	9740, 6025
2300	Sofia, Bulgaria	Radio Sofia	9700
2315	Madrid, Spain	Voice of Spain	9363, 6130
2315	Tokyo, Japan	Radio Japan	15235, 11780, 11705, 9505
2315	Bangkok, Thailand	HSK9	11910
2318	Berne, Switzerland	Switzerland Calling	11865, 9535, 6165
2330	Prague, Czechoslovakia	Radio Prague	11990, 11745, 9795 9550, 7345
2330	Bucharest, Rumania	Radio Bucharest	11900,11810, 9570, 9510, 7195, 6190
0000	Cologne, Germany	Voice of Germany	9640, 9575, 6100
0000	Havana, Cuba	Radio Havana Cuba	11875, 11840
0015	Brazzaville, Congo Republic	Radio Brazzaville	11725, 9730, 7105, 5970
0015	Madrid, Spain	Voice of Spain	9363, 6130
0025	Cologne, Germany	Voice of Germany	9735, 6145
0030	Seoul, Korea	Voice of Free Korea	15125, 11925
0030	Ibadan, Nigeria	Western Nigeria Broadcasting Service	3204
0100	London, England	BBC—General Overseas Service	11955, 9640, 9620, 9510, 7230, 6110
0100	Port Moresby, New Guinea	VLT9	9520
0100	Buenos Aires, Argentina	Argentina Calling	9690
0100	Monrovia, Liberia	ELWA	11975
0155	Freetown, Sierra Leone	Sierra Leone Broadcasting Service	3316
0200	Melbourne, Australia	Radio Australia	11710, 9570
0200	Monrovia, Liberia	ELWA	11975, 4770
0200	Monrovia, Liberia	ELBC	3255
0230[1]	Wellington, N.Z.	Radio New Zealand	11780, 6080

1. *Not broadcast on Sundays.*
2. *Sundays at 0400.*
3. *Repeat at 0520.*
4. *Other news every hour on the hour.*
5. *Sundays at 0615.*
6. *Repeat at 0830.*
7. *Tuesdays, Thursdays, and Saturdays.*
8. *Repeated at 1830.*
9. *Repeated hourly through 2300.*
10. *Also at 2100.*
11. *Other news every hour through 0200.*
12. *Repeated every hour through 0000.*
13. *Tuesdays only.*
14. *Repeated hourly through 0200.*

FREQUENCIES IN BOLD FACE INDICATE STRONG SIGNALS EASILY HEARD IN NORTH AMERICA

FIRST RIG

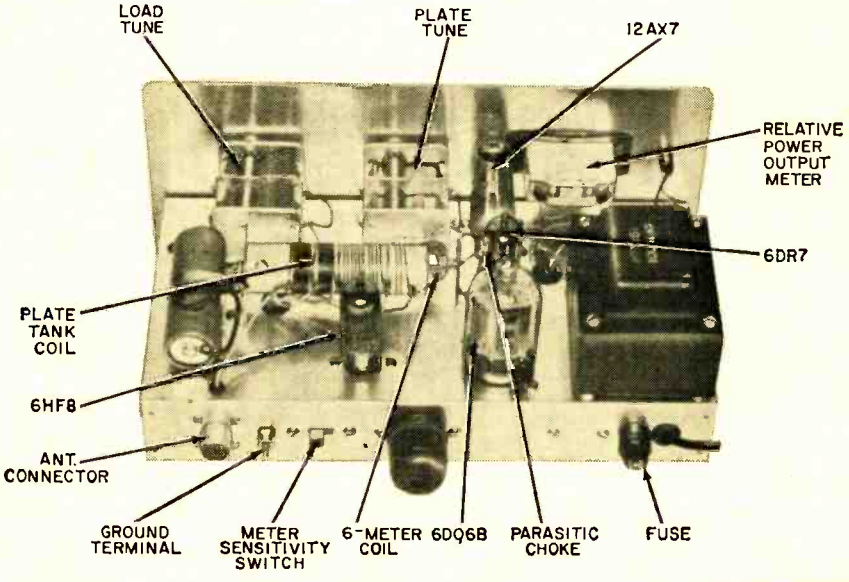
for the "plan ahead" Novice

IF you're a brand-new Novice, you can run down to the local radio supply house and pick up a rig easily enough, but putting your first transmitter together yourself is an exciting and educational experience. Allied Radio (100 N. Western Ave., Chicago 80, Ill.) has come up with an ideal "first rig" kit that you can grow with. Reasonably priced at $49.95, the Knight-Kit T-60 transmitter is designed for 80- through 6-meter operation. Its 60 watts input power and frequency coverage make it suitable for the Technician and General Class ham as well.

The circuit uses the triode section of a 6HF8 as a crystal oscillator and the pentode section as a buffer and frequency-multiplier amplifier. A tuned band-switched pi-network between the pentode section and the power amplifier (6DQ6B) serves as a series tuned circuit for the plate of the former and control grid of the latter. The 6HF8 multiplier provides all the necessary frequency step-up except on 6 meters where the plate circuit of the final acts as a doubler. Phone operation requires the use of two tubes, a 12AX7 and a 6DR7, which provide controlled-carrier operation. The carrier is suppressed in the absence of voice signals and increased by the audio up to 100% modulation.

Easy to assemble and even easier to get on the air, the T-60 performs handsomely on 6 meters as well as on the 80- to 10-meter bands.

Packing a lot of parts in its 5" x 12" x 7" cabinet, the Knight-Kit T-60 has a neat and uncluttered chassis. Output meter in antenna circuit indicates relative r.f. output.



CB RIG DOUBLES AS PA SYSTEM

By ROBERT B. KUEHN
16Q0744

Simple modifications equip almost any CB transceiver for public address work

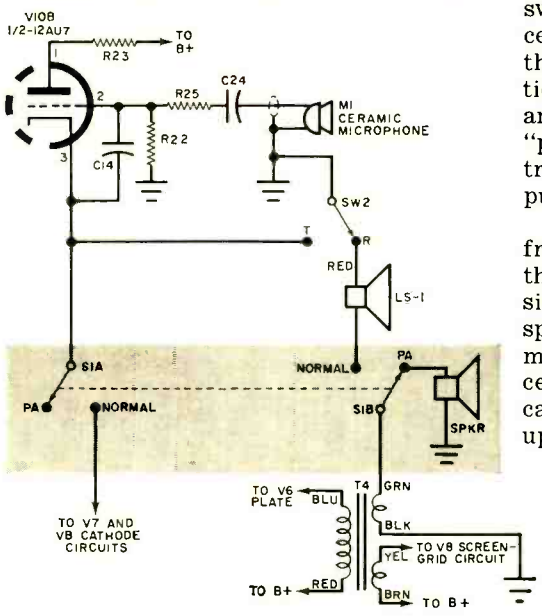
RECENTLY, officials in a large Midwestern city determined to install public address equipment in their municipal Civil Defense vehicles for use in controlling traffic, addressing crowds, etc. After a little thought, they came up with a plan which was much simpler and cheaper than you might expect.

Since the vehicles were already equipped with Johnson "Messenger" Citizens Band transceivers, it was decided to modify these CB rigs slightly and use *them* as p.a. amplifiers! This proved to be an easy task, and one which you might like to duplicate with your own mobile CB equipment.

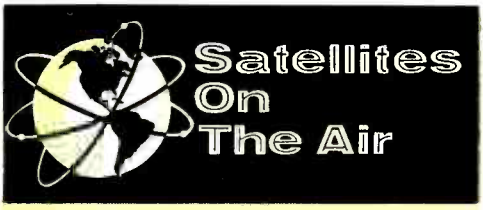
How It's Done. The modification requires only the addition of a d.p.d.t. toggle switch on the front panel of the transceiver and an auxiliary speaker under the hood of the car. All normal functions of the transceiver are retained, and throwing the toggle switch to the "p.a." position temporarily disables the transmitter and connects the audio output to the auxiliary speaker.

As an unexpected bonus, the output from the receiver can also be fed into the auxiliary speaker and heard at considerably increased volume, since this speaker will ordinarily be larger and more efficient than the one in the transceiver itself. This means that a driver can leave his car and still receive calls up to several hundred feet away. The

(*Continued on next page*)



Adapting the Johnson "Messenger" for p.a. service requires only the addition of a d.p.d.t. switch (S1).



The following satellites, launched by the United States and the Soviet Union, were reported to have beacon and telemetry transmissions as of July 10, 1962. The satellites are listed by their code names, according to frequency; because some transmit on more than one frequency, they appear more than once.

Explorer VII*	19.990 mc.
Cosmos II (Sputnik XII)	20.005 mc.
Discoverer XXXVI	20.005 mc.
Cosmos V (Sputnik XV)	20.008 mc.
Transit IVB	54.000 mc.
Cosmos II (Sputnik XII)	90.011 mc.
Courier IB	107.970 mc.
TIROS I	107.997 mc.
TIROS III	108.000 mc.
Vanguard I*	108.022 mc.
TIROS III	108.030 mc.
Telstar	136.050 mc.
Transit IVA	136.200 mc.
TIROS IV	136.230 mc.
TIROS V	136.235 mc.
Ariel	136.410 mc.
Injun SR-3	136.500 mc.
OSO I	136.744 mc.
Transit IVB	136.800 mc.
TIROS IV	136.920 mc.
TIROS V	136.922 mc.
Transit IIA	161.990 mc.
Transit IIA	215.990 mc.

*Signal may be very weak

At least six more satellites are in orbit and known to 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.

(*Continued from preceding page*)
volume control in the "Messenger" quiets the receiver output during periods when the unit is being used for p.a. work.

As you may already know, switching over from receive to transmit in the "Messenger" disconnects the speaker in the unit and grounds the cathode circuits of tubes *V7* and *V8* (the crystal oscillator and r.f. power amplifier, respectively). Therefore, to add the p.a. provision, one side of the d.p.d.t switch (*S1*) is wired to preclude grounding the cathode circuits, and the other side is wired to connect the auxiliary speaker to the secondary of output transformer *T4*.

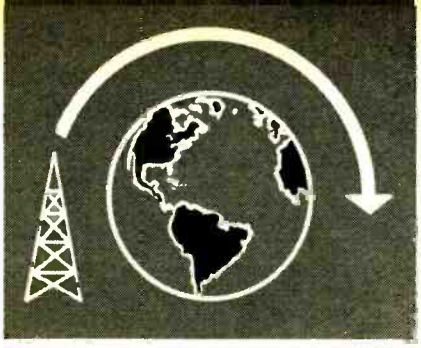
Making the Modification. First, remove the "Messenger" from its cabinet by taking out the three machine screws at the rear. Then, a hole for mounting the switch should be drilled in the bottom center of the front panel (there is plenty of room behind the panel at this point for mounting a good-sized switch without crowding).

This done, locate the terminal strip near the front panel and the black wire which runs from it to the cathode circuits of tubes *V7* and *V8* at the rear of the set. This lead should be cut and the two ends "spliced out" so that they are long enough to reach the newly installed "p.a./normal" switch. Switch *S1a* should now be wired as shown.

Turning the set right side up again, the green wire running to the speaker should be cut and the ends spliced in a like manner. They should then be connected to switch *S1b*, and the lead to the auxiliary speaker run along the inside of the chassis and out through one of the several unused holes at the rear.

Now, hook up a speaker, and your "Messenger" is ready to operate as a CB transceiver *and* a mobile p.a. unit. Incidentally, while almost any speaker will work, it's best to use one of the weatherproof paging units especially designed for this kind of operation.

Note that the above modification refers specifically to the Johnson "Messenger" transceiver. There are obviously far too many CB rigs on the market to permit presenting detailed instructions for modifying all of them in this manner. However, most of them can be rewired just as easily and made to do double-duty as a mobile p.a. system. —30—



Monthly Short-Wave Report

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

UP-TO-DATE SCHEDULE FOR VOA PROGRAM

EVERY SUNDAY the *Voice of America* broadcasts the *VOA* Amateur Radio Program to all parts of the world at various times throughout the day. The program consists of 15 minutes devoted to the latest ham-band "gossip," interviews with radio amateurs around the globe, propagation forecasts, and discussions of the latest technical news of interest to both hams and short-wave listeners.

While we covered the operation of this program thoroughly in a previous column (December, 1961), there have been many changes in times and frequencies—and even stations—used since that date. Because of the great interest in the *VOA* broadcasts, we feel it worthwhile to bring our readers up to date on them.

To review briefly, the broadcasts are all in English and are written and voiced by Bill Leonard, W2SKE, one of America's leading news commentators and an active ham operator. Gene Kern, W2BAK, produces the show; and the propagation forecasts are given by Bill Dulin, W4ETT, and George Jacobs, W3ASK. Amateurs and SWL's everywhere are invited to participate.

Generally speaking, the target areas are as follows: Europe, Africa, and the Middle East at 0230-0245; Far East and Oceania at 0245-0300; Oceania, East and Southeast Asia at 0345-0400; Europe, Middle East, and Central and West Africa at 1730-1745; and Latin America at 2230-2245. We will not indicate the exact target areas for each transmitter in the schedule listing since the large majority of our readers are in North America and should have little difficulty in picking up the program. All of the times given are Eastern Standard.

Here, then, is the complete current

Equipment in the listening post of Luis R. Mateo, WPE2FJQ, includes a National NC-190 shown on top of a Hallicrafters S-77 receiver. A retired ship operator—he spent some 20 years at sea, Mr. Mateo now operates out of New York City. To date he has 39 countries logged, 19 verified. His antenna is 61 feet long.

schedule of the *VOA* Amateur Radio Program: times when it can be heard (on Sundays only); frequencies used; and station call-signs or locations.

At 0230-0245: 6025 kc. (WLWO); 6080 kc. (Tangier); 6180 kc. (WDSI); 9545 kc. (Munich); 9720 kc. (Tangier); 9740, 9770 and 11,805 kc. (all WLWO); 11,875, 15,270, and 15,380 kc. (all Tangier); and 17,780 kc. (Munich).

At 0245-0300: 5985, 6145, 9545, and 9700 kc. (all KNBH).

At 0345-0400: 6010 kc. (Okinawa); 6075 kc. (Honolulu); 7155, 7235, and 9615 kc. (all Okinawa); 9650 kc. (Honolulu); 11,785, 11,895, 15,210, 15,250, and 15,335 kc. (all Philippines).

At 1730-1745: 1259 kc. (Courier); 3980 and 5975 kc. (both Munich); 6015 kc. (Courier); 6185 and 7205 kc. (Thessaloniki); 7130 kc. (Courier); 9530, 11,770, 15,170, and 15,225 kc. (all Munich); and 17,710 and 21,610 kc. (both WLWO).

At 2230-2245: 9650 kc. (WLWO); 9750, 11,955, and 15,325 kc. (all WBOU); 15,270 kc. (WDSI); and 15,405 kc. (WLWO).

The *VOA* has a distinctive QSL card which program listeners can obtain by forwarding their QSL cards and/or reports to either of two addresses: Bill Leonard, P. O. Box 29, Geneva 12, Switzerland; or Amateur Radio, Box 922, Washington 4, D.C.

Station TGQB. A recent feature of this column was a list of short-wave stations in Guatemala. In our June issue, one of them, TGQB, *R. Nacional,* Quezaltenango, 11,700 kc., was described as "Not heard at present; last noted, Spring, 1961."

This comment was based on information supplied us by a POP'tronics monitor in Guatemala City and "documented" by a glaring absence of any other reports on the station. Since the June issue was published, however, many DX'ers have written in to tell us that it *is* being heard.

Station TGQB is indeed back on the air, but on a very irregular schedule, and judging from the signal, with a low-powered transmitter. Recent reports indicate that it is on around 1230-1400 and 1515-1615 some days with frequent ID's and all-Spanish programming.

(*Continued on page* 109)

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

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

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

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

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

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

Receivers — Make ..... Model .....

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

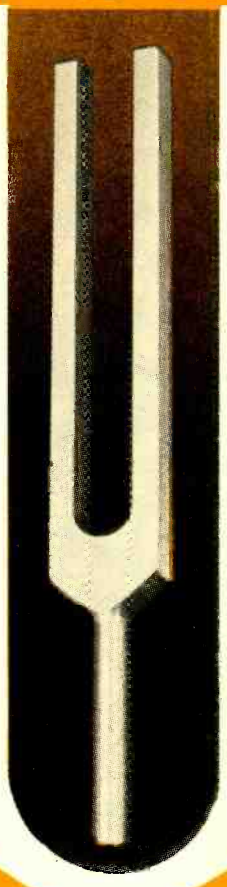
Principal SW Bands Monitored ..... Number of QSL Cards Received .....

Type of Antenna Used .....

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

The 440 Fork

Two-transistor tuning fork oscillator makes an ideal frequency standard



By
FRED IPPOLITO
and
PAT BROCATO
Sylvania Electronic Systems-Central
Sylvania Electric Products Inc.

AS you no doubt know, a tuning fork is a steel instrument designed to produce a pure musical tone of a definite pitch. But while it's a familiar object in piano tuners' tool kits, the tuning fork is seldom used to full advantage by electronics experimenters and hobbyists.

Usually, a tuning fork is set into vibration by striking it with a mallet; then, its stem can be rested against a sounding box or musical instrument to amplify its output. The disadvantage of this method, of course, is that you have to strike the tuning fork repeatedly in order to keep it going. Furthermore, there's no ready way of coupling its output into electronic circuits.

The tuning fork oscillator pictured on the following pages has no such shortcomings. It vibrates continuously and is therefore much more useful as a tone source or a frequency standard. Its design not only takes advantage of the well-known frequency stability and accuracy of a tuning fork, but it also incorporates provisions for feeding the signal into a variety of equipment. Finally, the little "440 Fork" is relatively inexpensive to put together.

Since the oscillator is intended primarily for tuning musical instruments, it is built around a 440-cycle tuning fork (this frequency corresponds to the "A" above middle "C" on the musical scale). But don't think the unit is limited to tuning musical instruments—it can also be used to calibrate audio oscillators, serve as a master oscillator for frequency divider or multiplier circuits, and so on.

About the Circuit. Transistor *Q1* is connected as a conventional common-emitter amplifier and functions as an audio oscillator; transistor *Q2*, also a common-emitter amplifier, serves as a buffer and amplifier stage. Coils *L1* and *L2* are the coil-and-magnet assemblies removed from a pair of 2000-ohm earphones; they act as "driver" and "pickup" coils, respectively.

When the circuit is first turned on, current flows through coil *L1*, which exerts a pull on the tuning fork, tending to set it in motion. Any movement of the fork will affect the magnetic field around coil *L2*, which, you'll notice, is coupled back into the base of transistor *Q1* through capacitor *C1*. The varying magnetic field around *L2*

results in a small output from the coil, which is amplified by *Q1* and again transmitted to the tuning fork through *L1*. This process continues to repeat itself, with the tuning fork vibrating at its natural frequency.

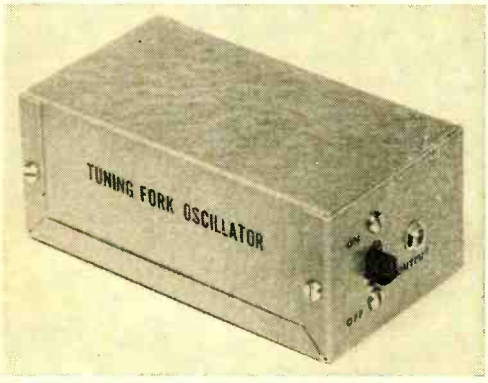
Since *Q1* is substantially overdriven, the waveshape at its collector is distorted. However, it was found desirable to overdrive *Q1* in order to obtain maximum signal through *L1*—this tends to set the tuning fork in motion much more quickly when the circuit is first turned on, and it also reduces the unit's sensitivity to shock and vibration.

Capacitor *C2* couples the 440-cycle signal picked up by *L2* into *Q2*. Due to the close proximity of *L1* and *L2*, a certain amount of unwanted coupling exists. As a result, the input waveshape to *Q2* is also somewhat distorted.

To correct this situation and deliver a sine-wave signal at the output of *Q2*, emitter resistor *R6* was not bypassed and capacitor *C3* was shunted across the output of *Q2*. This arrangement reduces *Q2*'s gain quite a bit, but *Q2* was inserted primarily for isolation and waveshaping.

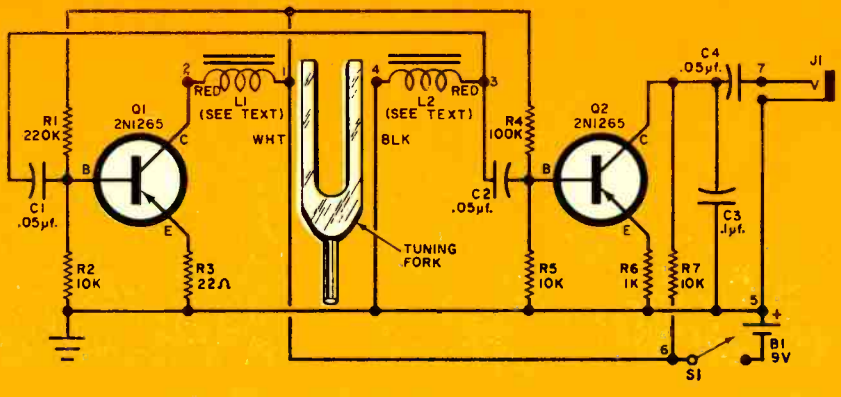
Construction Tips. As mentioned earlier, coils *L1* and *L2* are removed from a pair of 2000-ohm earphones.* To modify the earphone set, first unscrew the ear caps and remove the diaphragms. Next, unscrew the magnet and coil assemblies from their holders and remove them from the headset. Save the screws and nuts, since they'll come in handy for

Completed tuning fork oscillator is self-contained and has but one control—a s.p.s.t. on/off switch.

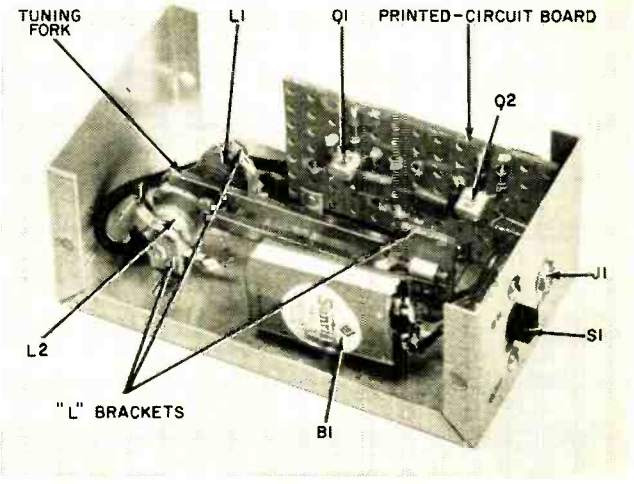


The earphones used by the authors were purchased from Olson Electronics Inc., 260 S. Forge St., Akron 8, Ohio. These earphones (Cat. No. PE-6) are no longer available, but another earphone set, The Calrad RH-40 (Olson Cat. No. PH-10) can be used instead ($1.95 plus postage). The latter phones, which have an impedance of 4000 ohms, contain a double-magnet coil and will require the use of two mounting brackets per coil.

Circuit of oscillator relies on interaction between coils L1 and L2 and tuning fork for its of Vectorbord; numbered points on schematic (left) correspond to those on pictorial (right)



Coils and fork are supported by "L" brackets. Placement of other parts isn't critical, but author also mounted Vectorbord on brackets.



mounting the coils to their brackets.

The three brackets which hold the coils and the tuning fork can be made from 1/8"-thick aluminum strips bent to form an "L"; naturally, the dimensions of the brackets will depend on the particular earphones and tuning fork you have selected for use in the devise.

Mount the tuning fork on its bracket as rigidly as possible. If desired, a small metal strip can be bent around the tuning fork base, much like a cable clamp, to facilitate attaching it to the bracket.

When mounting the coil brackets to the chassis, be sure to make some provision for adjusting the position of the coils relative to the tuning fork; the easiest way to do this is to drill out slots rather than holes. Position the coils near the tips of the tuning fork and as close to the fork as possible without allowing the magnets to actually touch it.

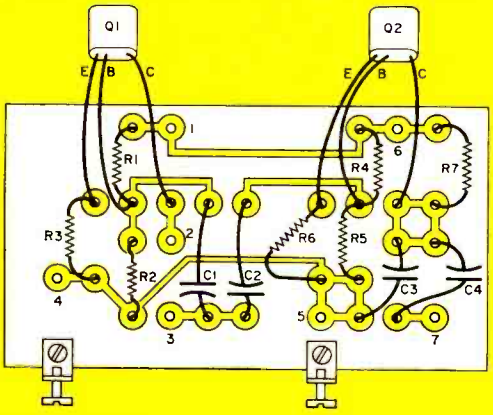
None of the circuit wiring is critical except for connecting up the leads to coils *L1* and *L2*; phasing is important here to obtain oscillation. The schematic diagram indicates the color coding and hookup for the coils used in the author's unit.

Operation. Once the oscillator has been assembled, it's a simple matter to put it in operation. A high-impedance earphone (1000 or 2000 ohms) should be connected to the output jack for monitoring the output signal while making final adjustments. Alternatively, you can feed the output into an oscilloscope or into an audio amplifier and speaker.

Switch the unit on and tap the tuning fork lightly with your finger or a pencil. You should hear a 440-cycle signal,

(*Continued on page* 107)

operation. Many components are mounted on piece and show where coils and battery should be wired in.



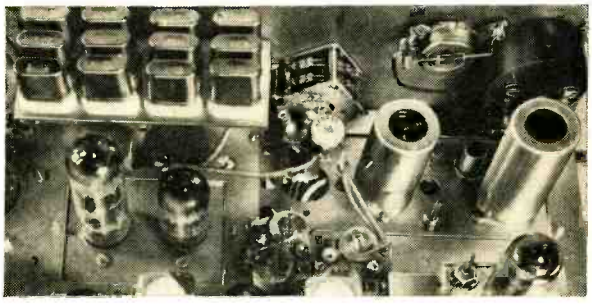
PARTS LIST

B1—9-volt battery (Burgess 2U6 or equivalent)
C1, C2, C4—0.05-μf., 75-volt ceramic capacitor
C3—0.1-μf., 75-volt ceramic capacitor
J1—Open-circuit phone jack, miniature type
L1, L2—Coil and magnet assembly removed from earphone—see text
Q1, Q2—2N1265 transistor (Sylvania)
R1—220,000 ohms
R2, R5—10,000 ohms
R3—22 ohms
R4—100,000 ohms
R6—1000 ohms
All resistors ½ watt, 10%
S1—S.p.s.t. slide switch
1—440-cycle tuning fork
1—5¼" x 3" x 2⅛" aluminum utility box, gray hammertone finish (Bud CU-2106-A or equivalent)
Misc.—Mounting brackets for tuning fork, L1, and L2; battery holder; 1¾" x 3⅜" section of Vectorbord; wire, solder, hardware, etc.

Equipment Report

Courier 1 has many extras

R.f. meter which doubles as S-meter is useful in loading down your antenna for maximum power output; r.f. gain control prevents overloading by strong signals.



Twelve transmit crystals (top, left) and transmit selector switch permit rapid channel switching. Shielded tubes, with Nuvistor between them, are set's r.f. amplifier and first two converters.

IF you're looking for a CB set that's rated tops for both mobile and base station use, you will soon learn that few of the many models on the market can fill the bill. One set in this select group is the "Courier 1." Priced to sell at $189.50, this transceiver is a product of E.C.I. Electronics Communications, Inc. (325 N. Macquesten Parkway, Mount Vernon, N.Y.). Considering all the features the Courier 1 packs in, it's surprising that the all-chrome cabinet can be tucked neatly away under the dash of your car—even if it's a "compact."

The transmitter half of the transceiver is limited only by FCC regulations, and the input to the final r.f. stage was measured by the POP'tronics staff at a full CB gallon. More important, 100% modulation was obtained with 3.2 watts delivered to the antenna. That's equivalent to batting 400 in the Majors.

It is the receiver half of the Courier 1 that is chock full of features suitable for just about any and all CB applications and situations. Utilizing triple-conversion with i.f.'s at 10.4 mc., 1505 kc., and 262 kc., and with a front end consisting of a EF183/6EH7 r.f. amplifier and 6CW4 Nuvistor first converter, receiver sensitivity is below .25 μv. Superhet converter noise is at a new design low, and adjacent channel rejection is better than 70 db down. In other words, you just don't hear the other guy on channel 14 when you are tuned to a weak signal on 15. Noise on the CB channels can be minimized, if not eliminated, by a super-acting squelch control plus a noise limiter which knocks off the peaks of those nerve-shattering noise bursts.

Besides manual tuning for all 23 channels, the Courier 1 has four fixed-tuned receive channels, which are considered vital for rapid-switching multi-channel communications. The main tuning dial is used as a vernier during fixed-tuned reception to pull in those off-frequency stations. —30—

COMPUTERS CAN THINK

By HAROLD ARNOLD

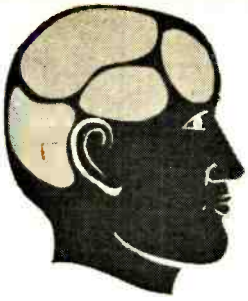
An introduction to logic circuits and how they work

CAN a computer really think? The answer to that question hinges on how we define the thinking process. If we agree that thinking is following a series of programmed steps which are logically related and which lead to a solution of a problem, then our answer must be "yes"—in this sense, a computer definitely can "think." However, if we define thinking as a creative process in which ideas are conceived, then a computer does not "think."

In other words, a computer must be "programmed" to perform each step in the solution of a problem, and it can only do what its operator or programmer tells it to do. Even so, the ability of a computer is certainly nothing to sneeze at. Although we may not know the solution to a problem, we can decide what logical steps should be taken to reach the solution. And if we program a computer to perform these logical steps, it will do the necessary "thinking" and "crank out" the answer for us.

Logic. To understand how a computer can "*think*," we must first resort to a very simple example in logic and then

COMPUTERS CAN THINK



convert our "thinking process" into electrical "hardware" that can do the thinking for us.

As an example of logical operation, let's consider the following series of statements:

A—If I press the button
and
B—If the batteries are good
then
C—The flashlight will light.

Here we have three statements which combine in a "logical" way to produce a conclusion that is "true." Let us discount the trivial possibilities involved, such as either a defective button or lamp, or other abnormal conditions, and keep the discussion limited to these three simple statements.

You can quickly see that the three statements are related in such a way that the last one is a *valid conclusion* for the information given in the first two statements. To put it another way, if the first two statements are true, then the third statement *must* be true. On the other hand, neither the first nor second statement alone can lead to the third statement or logical conclusion.

To make the facts in the previous paragraph clearer, let's restate the three statements in the following form:

A—*If it is true that*
I press the button
AND
B—*If it is true that*
The batteries are good
THEN
C—*It will be true that*
The flashlight will light.

Now, if we ignore the content of the three statements and look at only the relationships which exist between A, B, and C, we can state the general condition that

If A is true
AND
If B is true
THEN
C is true.

The relationships linking statements A, B, and C establish an exclusive set of conditions which is satisfied only when statements A and B are *both* true. Therefore, if one or both statements are false, then C must be false. Simply stated:

If A is false
AND
If B is true
THEN
C is false.

or:

If A is true
AND
If B is false
THEN
C is false.

or:

If A is false
AND
If B is false
THEN
C is false.

Switches and Relays. In the examples given above, it would be quite easy to convert the verbal statements to electrical signals for use in computers. Figure 1 shows two simple circuits which can receive two statements and indicate by means of a lighted lamp whether a third statement is true or false. The

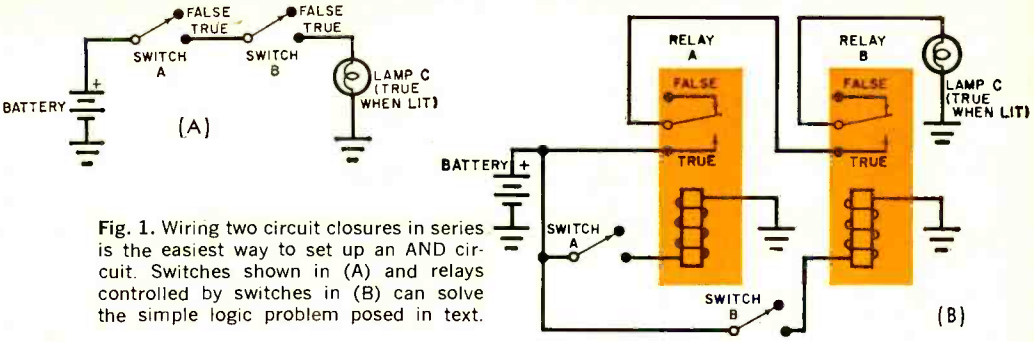


Fig. 1. Wiring two circuit closures in series is the easiest way to set up an AND circuit. Switches shown in (A) and relays controlled by switches in (B) can solve the simple logic problem posed in text.

circuit "closures" occur only for "true" statements and are accomplished by the *closing* contacts on switches in Fig. 1(A) and relays in Fig. 1(B). Actually, computers prefer faster-acting on/off switching devices such as vacuum tubes, transistors, tunnel diodes, etc. For the purpose of this article, however, switches and relays are used because they are easier to breadboard and understand while learning.

The switch-circuit shown in Fig. 1(A) can think for you when presented simple problems in logic similar to the one discussed previously. When statement A is true, switch A is closed or set to TRUE. Likewise, when statement B is true, switch B is set to TRUE. With both A and B set at TRUE, lamp C lights to indicate that conclusion C is TRUE.

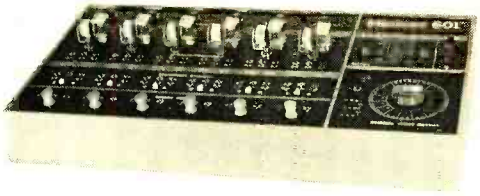
In Fig. 1(B), relays have replaced switches to do the job of lighting lamp C. The solenoids of relays A and B are energized by their respective switches, and in turn close their contacts to energize lamp C.

"AND" Circuit. Computer programmers refer to the circuits in Fig. 1 as *AND* circuits. That is, the two bits of information supplied to the switches or relays, A *and* B, must both be true in order for C to be true. To see how programmers say this in simple symbolic language, let's go back to the statement:

If A is true
AND
If B is true
THEN
C is true.

Now, let's replace *AND* with the symbol "x" and replace THEN with the symbol "=." Thus, we get: A x B = C, which simply means, "If A is true *AND* if B is true, *THEN* C is true." Remember, in the language of computer programmers "x" means AND and "=" means THEN.

"NOT" Circuit. In the case of the *AND* circuit, we are concerned with things happening together. In the *NOT* circuit, however, we are dealing with something



Science Fair runner-up and potential physicist Joseph Wiesenfeld (left) shows how he used a MINIVAC 601 computer (above) made by Scientific Development Corporation to program a schedule for a model railroad system.

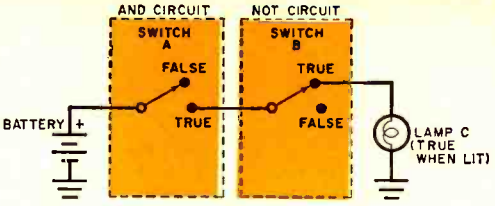


Fig. 2. Grouping of series AND and NOT logic circuits sets up a program that requires one event to occur and another not to occur for lamp C to light.

that will happen *if* something else does *not* happen. Let's return to the now familiar example concerning the switching on of a flashlight and consider the following series of statements:

A—If I press the button

AND

B—If the batteries are *NOT* dead

THEN

C—The flashlight will light.

Symbolically, the above statements can be stated as

$$A \times \overline{B} = C$$

The line over the symbol ($\overline{B}$) is used to express the concept *NOT* in symbolic form.

The programmed circuit representing the verbal and symbolic statements given above is shown in Fig. 2. Switch A functions as it did for the operation of the circuit in Fig. 1(A). Shown in its normal position for the beginning of a problem, switch A must be set to the TRUE position to provide a circuit closure. However, switch B functions in the circuit in the reverse of switch A. That is, since it is wired for *NOT* operation, lamp C will light only if switch A is closed and switch B is *not* "closed" or flipped from its normal position.

Mind-Reading Computer. By grouping several *AND* and *NOT* logic circuits into a computer that you can build, you may make others believe that your computer can read minds.

Say you ask a person to think of a whole number between 0 and 7 (zero being a whole number). It is possible, by then asking him three "yes-no" questions, to determine the number he is thinking of. Through a careful choice of questions all but the correct answer can be eliminated. The questions which provide the key to the problem are:

A—Is the number greater than 3?
B—When the number is divided by 4, is the *remainder* greater than 1? (e.g., 6 divided by 4 is 1 plus a *remainder* of 2; similarly, 1 divided by 4 is zero plus a *remainder* of 1.)
C—Is the number odd?

Exactly how these three questions can find the undisclosed number is demonstrated in the flow chart in Fig. 3. This chart indicates each step in the decision process and shows the sequence which leads to the final result. To understand how the flow chart works, pick a number from 0 to 7 and follow the chart, starting from the top.

In the flow chart, the answer to question A separates the possible numbers into two groups: those greater than 3 (4, 5, 6, 7) and those not greater than 3 (0, 1, 2, 3). Then, the answer to question B separates each of these groups into pairs. Finally, question C determines which number in the appropriate pair is not excluded, or, in other words, determines the number you originally picked.

Back to Logic. Using the symbolic language of computer programmers, we obtain the following definitions:

A—The number is greater than 3
$\overline{A}$—The number is *not* greater than 3
B—The remainder is greater than 1
$\overline{B}$—The remainder is *not* greater than 1
C—The number is odd
$\overline{C}$—The number is *not* odd

Using these definitions, we can express as logical operations the conditions for

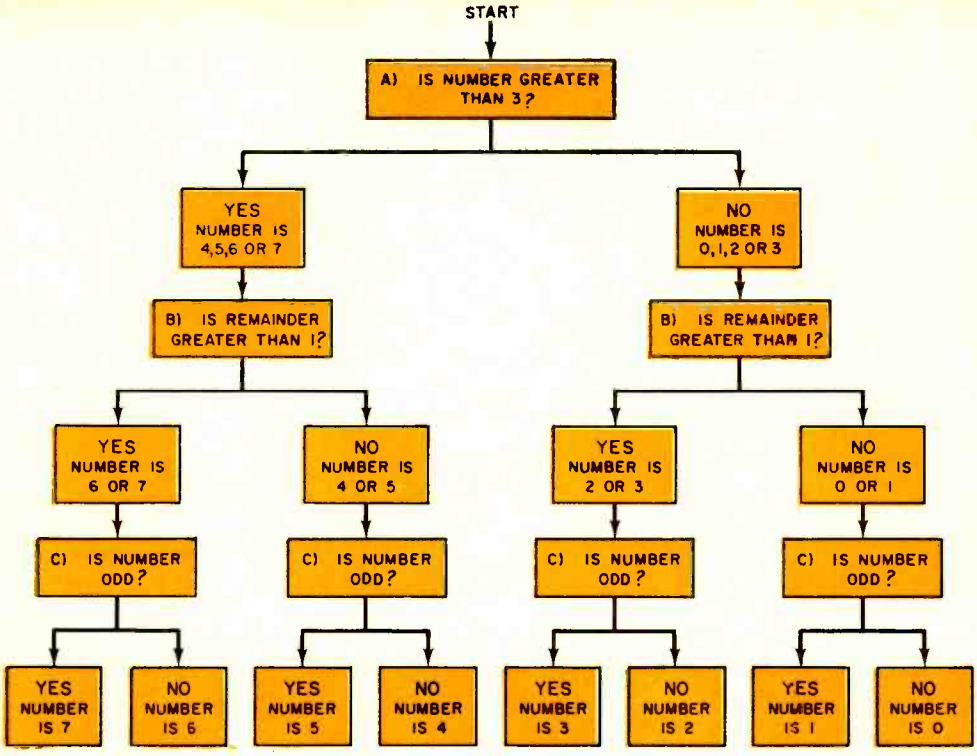


Fig. 3. Flow chart shows each step in decision process and how it leads to solution of problem.

each number of the mind-reading operation as follows:

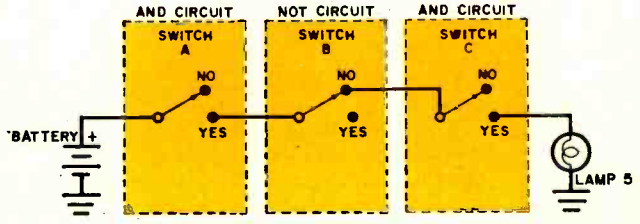
$$A \times B \times C = 7$$
$$A \times B \times \overline{C} = 6$$
$$A \times \overline{B} \times C = 5$$
$$A \times \overline{B} \times \overline{C} = 4$$
$$\overline{A} \times B \times C = 3$$
$$\overline{A} \times B \times \overline{C} = 2$$
$$\overline{A} \times \overline{B} \times C = 1$$
$$\overline{A} \times \overline{B} \times \overline{C} = 0$$

To program the "mind-reading" problem for solutions on a computer, each of the above equations is first connected into a circuit representing the equation. Then, these circuits must be combined into one large circuit for a complete program.

The circuits for the individual equations are simply combinations of the *AND* and *NOT* circuits. For example, the circuit representation for an answer of 5 is shown in Fig. 4. In order to light lamp 5, the equation tells us to set switch A at YES, leave switch B at NO, and set switch C at YES. No other combination of switch settings will light lamp 5.

Now, by setting up eight circuits for each equation, and combining common circuit elements, the computer program-

Fig. 4. The circuit for solving $A \times \overline{B} \times C = 5$ requires a series circuit consisting of two AND circuits and one NOT circuit connected across a battery and a lamp.



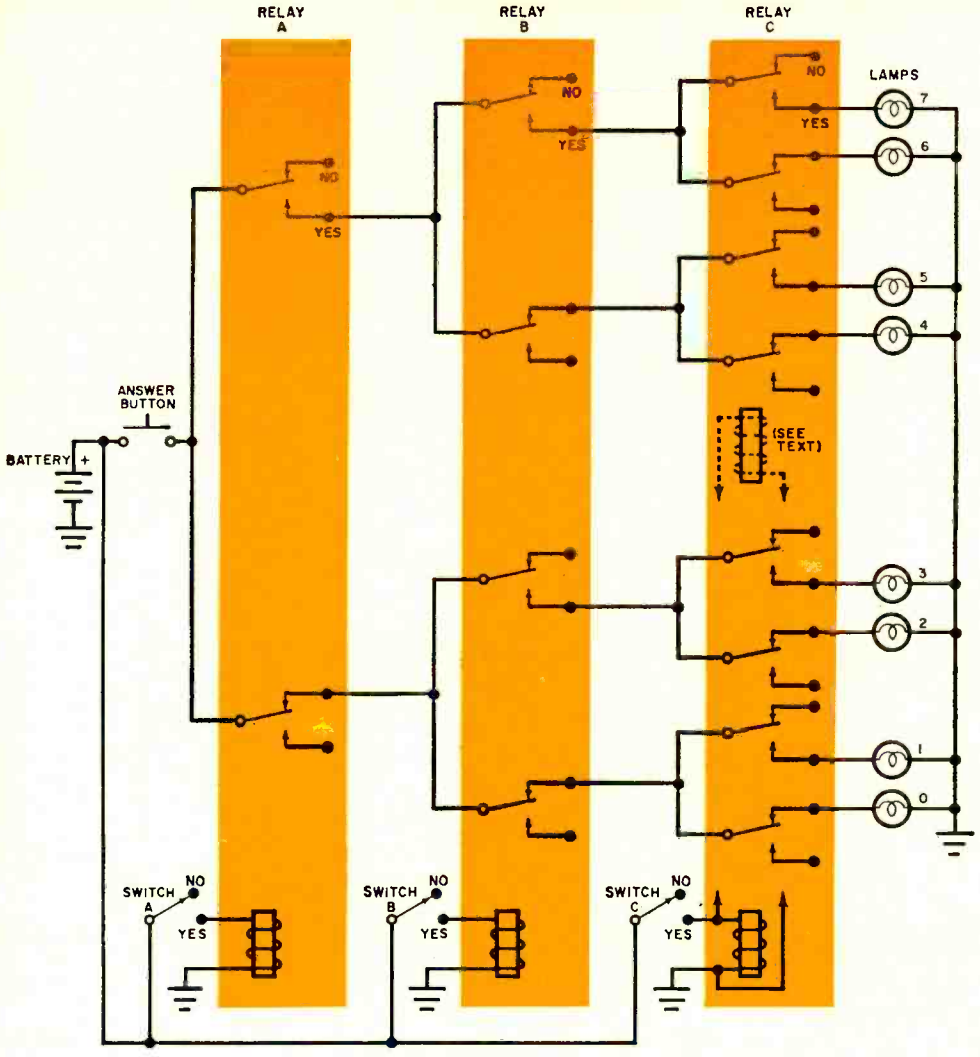


Fig. 5. The circuit for the solution of the "mind-reading" problem has the same fan-shaped appearance as the flow chart.

ıner can set up the complete circuit for the solution of the "mind-reading" problem as shown in Fig. 5. Instead of switches, relays are used to make the desired circuit connection to the lamp which will reveal the correct number. Also, an ANSWER button is added to the circuit to eliminate any false answers until switches A, B, and C are set correctly to position the relay contacts.

When answer A is "yes," switch A is closed and relay A is energized. Thus, relay A, as well as relays B and C, will be energized whenever the answer to its corresponding question is "yes," and de-energized when the answer is "no." To become familiar with the circuit's operation, pick a number and follow the flow chart in Fig. 4 while tracing the circuit in Fig. 5. Press the ANSWER button and the battery will be connected across the lamp corresponding to the unknown number.

The circuit in Fig. 5 can be breadboarded using multi-contact relays. Relay C calls for an eight-pole double-throw (8-p.d.t.) relay—an item seldom carried by electronic parts supply houses. Instead, two four-pole double-

(*Continued on page* 104)

BACK-SEAT MUSIC MAKERS

Tips on what to look for in rear-seat speaker hookups

By B. VAN SUTPHIN

ALTHOUGH a good many automobiles sold these days come with back-seat speakers already installed, an even greater number depend on auto-radio service shops and experimenters for that additional "music maker." Are you thinking about installing such a speaker? If you are, a little background material on the different types of rear-speaker hookups is in order.

The simplest type of rear-speaker system (shown in Fig. 1) involves a s.p.d.t. switch which allows you to activate either the front or the rear speaker—but never both. A slightly more complex arrangement (shown in Fig. 2) calls for a special three-position switch. With this system, you can still select either speaker, and you can also operate both of them simultaneously.

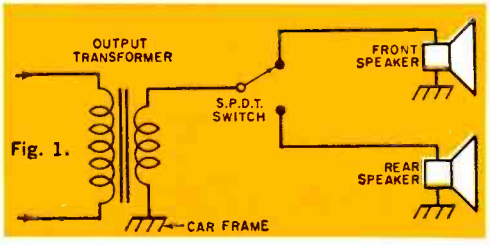


Fig. 1.

Both of the switch-controlled speaker systems have one major disadvantage, however—there is no way to adjust the volume of the two speakers independently. As a result, the system shown in Fig. 3 was developed. It enables you to control the relative volume levels from each speaker, although it doesn't permit you to silence either speaker completely. In view of the latter fact, many car owners

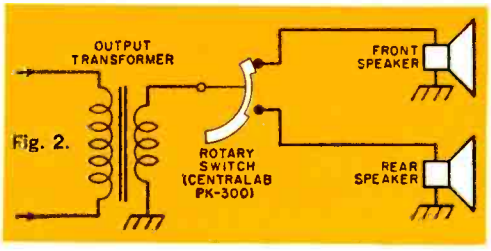


Fig. 2.

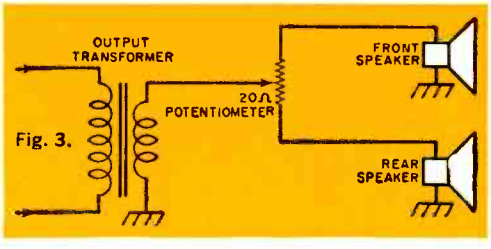


Fig. 3.

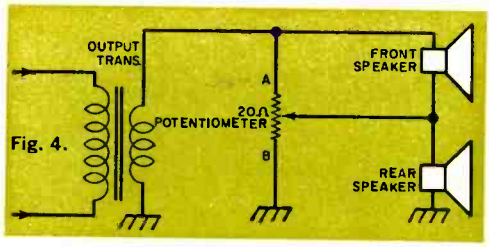


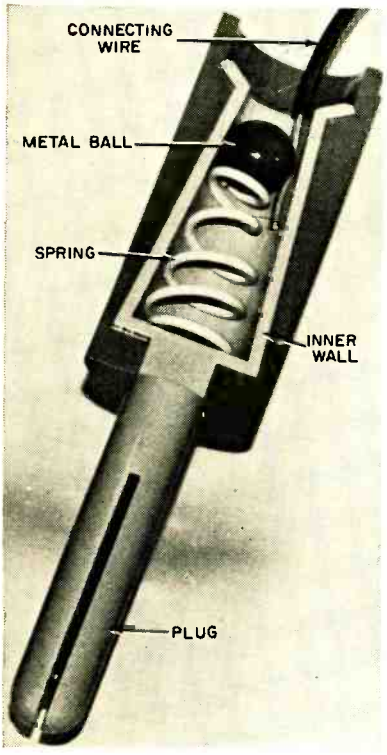
Fig. 4.

feel that even this system is still not good enough.

Figure 4 shows a circuit that can "kill" the output of either speaker and that also permits controlling the relative sound levels of both. With the potentiometer set at point *A*, the front speaker is shorted out, and full power is applied to the rear speaker. Similarly, with the potentiometer set at point *B*, the rear speaker is shorted out and power is applied only to the front speaker. Any intermediate setting feeds a portion of the output to both speakers, of course, and you can adjust the relative level of the two speakers by simply turning the knob.

Typical auto radio speaker switch is the Centralab PK300. Once the switch is installed, you can select either or both of the speakers; reverse leads to one speaker if bass seems weak in the "both" position.

Kits of parts for mounting and switching rear speakers are available at electronics parts distributors and mail order houses at reasonable prices. For best results, though, check the schematic diagram of your kit against Fig. 4 (above, left) to insure that the speaker you install will do the best possible job. –30–



Solderless Banana Plug

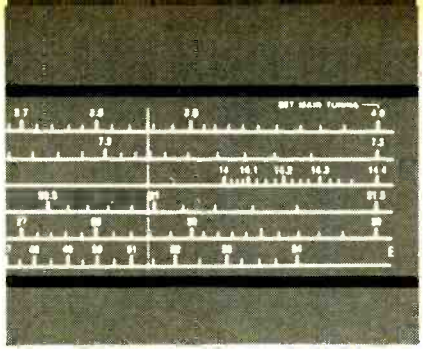
FROM the tiny principality of Liechtenstein comes an unusual banana plug for experimenters. Known as the "Kaye Text Contact" (Kaye Text Products Trust, 22 Hauptstrasse, Vaduz, Liechtenstein), it's designed for quick insertion and release of the connecting wire.

Instead of being attached via solder or screw, the wire is merely wedged in place. A spring-loaded ball riding in a conical metal casing (see photo) constitutes the wedging mechanism. Too large to escape from the mouth of the casing, the ball is tightly forced against it.

To make the connection, the wire is pushed between the ball and the inner wall of the casing, as shown. And any attempt to pull it out again will just jam it in more tightly. There are no sharp edges to cause accidental shearing and an extremely good electrical connection is made.

It's not difficult to release the wire, though—when you know how. Just insert a small screwdriver or similar tool into the top opening, retract the ball slightly, and slip the wire out.

—*Hans F. Kutschbach*



Across the Ham Bands

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

"SIX AND TWO" FOR THE NEWCOMER

FOR many people, the six- and two-meter bands are the most logical ones in which to begin a ham career. Novices who want to operate on phone, for example, can do so only on two meters. Technicians are not permitted to operate below 50 mc., and so generally use "six" as well as "two." And even General Class licensees spend much time here. This month, therefore, we're going to survey some of the advantages and disadvantages of operating on the 50- and 144-mc. bands.

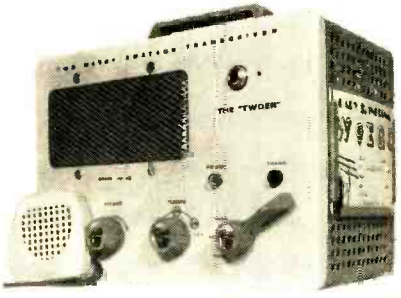
Range. The usual objection to VHF bands such as "six and two" is the limited range. Under present propagation conditions, the average distance covered per contact is under 100 miles on six meters and under 60 miles on two meters. Yet most six-meter operators work 20 to 30 states a year, and many of them have worked 48 states or more.

These records are made by taking advantage of the sudden, unpredictable changes in the VHF propagation conditions which often occur. Sometimes stations up to 1200 miles away can be heard and worked on six meters for periods ranging from a few minutes to many hours. Similarly, on two meters, the normal range is frequently increased up to ten times.

Economy. Commercially built equipment for the six- and two-meter bands, as you'll soon see, is available for very little money. Literally thousands of hams are successfully operating 5-watt transceivers purchased for less than $50.00. Used with a good antenna, such rigs allow you to work the "locals" with little trouble and even provide an occasional DX contact.

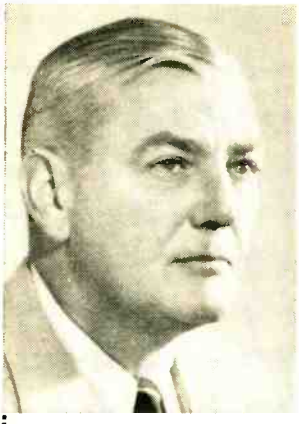
Speaking of antennas, it's possible to install efficient ones for six and two in locations which could not accommodate the larger low-frequency units. A half-wave antenna for two meters measures only about 39″—for six meters, about 112″. And being small, these VHF antennas are inexpensive to build or buy.

Equipment. Among the commercially available equipment in the under $50 class are the "Sixer" and "Twoer" transceivers offered by the Heath Company (Benton Harbor, Mich.) in kit form. These units each feature a 5-watt, crys-



Priced at only $44.95, the Heath "Twoer" transceiver kit is a complete, inexpensive, 2-meter station.

Lafayette HE-35 AWX 6-meter transceiver boasts a superheterodyne receiver, is not a kit. Price, $57.50.



NEW ARRL PRESIDENT

Herbert Hoover, Jr., son of the former U.S. President, has been elected President of the American Radio Relay League—the well-known society of U.S. and Canadian hams founded by Hiram Percy Maxim in 1914. Mr. Hoover has been interested in ham radio since 1915, and holds the call letters W6ZH. He served as Undersecretary of State from 1954 to 1957 and is now a consulting engineer with offices in Los Angeles.

tal-controlled transmitter, a superregenerative receiver, and a built-in power supply. Connected to a simple antenna in an average location, their range is 5 to 10 miles; a beam antenna can increase this distance two to four times. The actual price is $44.95 for either the six- or the two-meter model—including microphone, but less transmitting crystals.

For a bit more money, you can pick up a transceiver with a superheterodyne, rather than a superregenerative, receiver. And the superhet's greater selectivity is a big help when the band is crowded. Two factory-wired, six-meter transceivers with superheterodyne receivers are the "Lincoln," from Allied Radio (100 N. Western Ave., Chicago 80, Ill.), and the HE-35 AWX by Lafayette Radio (111 Jericho Turnpike, Syosset, L. I., N. Y.). Both units have a 7-watt, crystal-controlled transmitter and built-in power supply, and both sell for $57.50—complete with mike and crystal.

Still more sophisticated VHF transceivers are available from Gonset (801 S. Main St., Burbank, Calif.), manufacturer of the well-known "Communicators." And such companies as Heath, Lafayette, Allied, etc., also put out transceivers at prices up to well over $300.00.

If you happen to possess a good low-frequency ham receiver, a different approach to six- or two-meter operation is to add a VHF converter to your receiver and obtain a separate VHF transmitter. Converter prices start at around $35.00 and transmitters start at about $75.00.

Converting FM Units. In many areas, there are six- and two-meter ham nets using second-hand, commercial FM equipment such as is employed by police

Novice Station of the Month

Vern Cherwinski, WN8DFG, 1597 W. Stroop Rd., Dayton 39, Ohio, sent in this month's prize-winning photograph. Vern "played" with hi-fi equipment and other electronic gear for years before becoming a ham and now wishes that he had discovered amateur radio sooner. Operating on 40 meters, he uses a Knight T-60 transmitter and a Hallicrafters S-53A receiver. Being the manager of a photo-supply store makes it easy for him to turn out his own photographic QSL cards.

Vern will receive a one-year 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 also be published as space permits. Entries should be sent to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana.

departments, taxi companies, etc. While the extreme range of an FM signal is not quite as great as that of an AM signal, the converted FM equipment provides reliable, noise-free communications over distances of 20 to 30 miles.

For more information on this subject, we recommend a brand-new book: "Wide-Band FM for the Amateur" by James Aagaard, K9OJV, and John L. DuBois, K96HQ. It's available at $1.75 from James Aagaard, % Northwestern University Electrical Engineering Department, 2145 Sheridan Rd., Evanston, Ill., and tells exactly how to convert old Motorola VHF FM equipment to ham use. It also gives many tips on converting similar equipment made by various other manufacturers.

SIMPLE TVI FILTERS

If your transmitter interferes with a nearby TV receiver every time you go on the air, one of the simple TVI filters described below should help take you out of the public eye. The high-pass filter will cope with interfering signals in the 10-meter band and below, while a quarter-wave stub should take care of 6- and 2-meter interference.

High-Pass Filter. The filter shown in the schematic diagram is designed to be installed in the feed line of a TV receiving antenna. It will pass TV signals but attenuate signals below 30 mc. at least 20 db.

The filter components are supported by an "L"-shaped bracket which also provides shielding between coils *L1* and *L2* (see photo). This bracket is formed from a 1½" x 2½" piece of stock aluminum, but the dimensions are not critical. Two 2-lug terminal strips, one located on each side of the bracket, are mounted with a single screw. And a ½" hole drilled near the terminal strips passes the leads from capacitors *C1* and *C2*.

To prepare coils *L1* and *L2*, measure off two 25" lengths of #18 enameled wire. Remove approximately ¼" of enamel insulation from the center of one length and solder on a short piece of #28 or #30 wire to serve as a center tap for *L2*.

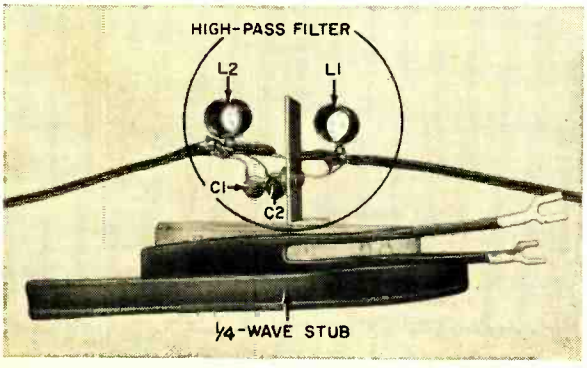
From each of the 25" lengths of wire, make a 20-turn, close-wound coil. Use a ⅜"-diameter drill shank, or any convenient rod having similar dimensions, as a form. Leave a ¾" lead at each end of each coil; before trimming *L2*'s leads, however, accurately position its center tap by winding or unwinding a fraction of a turn at the ends.

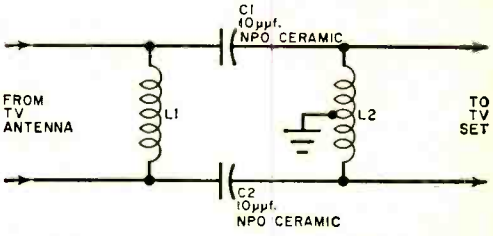
Mount each coil on a terminal strip, grounding *L2*'s center tap to the bracket and connecting *C1* and *C2* as shown on the schematic. Wire in a short length of 300-ohm twin-lead to serve as the filter's output connection.

To install the filter, mount the bracket directly on the chassis of the TV set being interfered with (as close to the tuner section as possible). Disconnect the antenna lead-in at a point close to the tuner and wire it across *L1*. The filter output lead should now be wired to the tuner in place of the disconnected lead-in.

Quarter-Wave Stubs. Interference from 6- or 2-meter signals can often be reduced by connecting a quarter-wave stub (at the interfering frequency) of 300-ohm twin-lead across the antenna terminals of the TV set. The normal connections from the TV antenna are, of course, left undisturbed.

(*Continued on page* 113)





Quarter-wave stub and high-pass filter pictured at left are two simple devices for fighting TVI. Stub eliminates 6- and 2-meter interference, filter is designed for 10 meters and below. Circuit of filter couldn't be simpler, as shown in schematic above.

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

AS YOU CAN well imagine, the editors of POPULAR ELECTRONICS—including yours truly—receive a goodly number of requests for "made-to-order" transistorized circuits. It's impossible for us to comply with such requests, however, since we don't have the facilities to do so. But there *are* numerous sources of diagrams for special transistor projects open to serious experimenters and hobbyists. And a little time spent checking these sources can be quite rewarding. You may not only uncover the particular project you're looking for, but you're likely to run across a number of other interesting projects as well.

Two primary sources, of course, are back issues of POPULAR ELECTRONICS and its sister publication, ELECTRONICS WORLD. Back issues are on file at many public libraries, or you can order individual issues from our Circulation Department in Chicago.* A useful "tip": instead of "wading through" every back issue, try checking the "Volume Index" issues of the magazines; as far as POP'tronics is concerned, these are the June and December issues.

Other important sources of special circuits are standard books, such as Coyne's *Transistor Circuit Handbook,* Gernsback's *Transistor Circuits,* McGraw-Hill's *Modern Transistor Circuits,* and Sams' *Transistor Circuit Manual.*

In addition, many semiconductor manufacturers—such as General Electric, International Rectifier, RCA, Raytheon, and Sylvania—issue booklets of practical circuits featuring their products. Quite often, these booklets include construction hints as well as circuit diagrams and detailed parts lists. They are generally available through local and mail-order parts distributors at prices ranging from 25 cents to $2.00.

Most manufacturers also publish extensive "application notes" describing tested and proven circuits. As a general rule, these "notes" are furnished on a "no charge" basis, but they must be requested individually in writing. Many companies will furnish lists of currently available publications to interested individuals or firms.

Application Notes. Abstracted from an "application note" issued by Honeywell Semiconductor Products (2753 Fourth Ave. S., Minneapolis 8, Minn.), the circuit diagram in Fig. 1 shows a 5-watt audio amplifier. (This circuit is typical

C1, C2—100-μf., 25-w.v.d.c. electrolytic capacitor
C3—500-μf., 12-w.v.d.c. electrolytic capacitor (or two 250-μf. units in parallel)
C4—4000-μf., 25-w.v.d.c. electrolytic capacitor
C5—3000-μf., 15-w.v.d.c. electrolytic capacitor (or three 1000-μf. units in parallel)
D1—1N1227 diode
D2, D3, D4, D5—1N1217 diode
F1—1-amp. fuse
F2—3-amp. fuse
J1—Input jack
L1—Auto transformer (Audio Development Co. A11649—available from ADC Products, 6405 Cambridge St., Minneapolis 26, Minn., for $45.40, plus postage)
Q1, Q3—2N1502 transistor (Honeywell)
Q2—GAIC3 transistor (Honeywell)
R1—3900-ohm, ½-watt resistor
R2—330-ohm, 1-watt resistor
R3—4.7-ohm, 1-watt resistor
R4—270-ohm, 2-watt resistor
R5, R12—120-ohm, 2-watt resistor
R6, R9—47-ohm, ½-watt resistor
R7—1000-ohm potentiometer
R8—150-ohm, ½-watt resistor
R10—220-ohm, ½-watt resistor
R11—½-ohm, 10-watt resistor
R13—1000-ohm, ½-watt resistor
S1—S.p.s.t. switch
T1—Power transformer (for bridge rectifier power supply): primary, 117 volts a.c.; secondaries, 13 or 18 volts @ 900 ma. (Stancor TP-1 or equivalent)

**Address your inquiry for back issues of P.E. to: Circulation Department, POPULAR ELECTRONICS, Ziff-Davis Publishing Co., 434 S. Wabash Ave., Chicago 5, Ill., enclosing 35 cents for each copy of issues less than six months old, 40 cents for each copy of older issues.*

of those found in manufacturers' literature.) The amplifier employs three *pnp* transistors—two (*Q1* and *Q2*) are in the amplifier proper, while the third (*Q3*) serves as a ripple filter in the power supply, eliminating the need for a heavy (and expensive) filter choke. In operation, *Q1* acts as a driver stage, and *Q2*, a tetrode, as a class A power amplifier. Choke, rather than tranformer, output coupling is used. Designed for 117-volt a.c. operation, the amplifier has an input impedance of 300 ohms, an output impedance of 10 ohms, and a power gain of 12 db at 50,000 cycles.

In addition to the application note on the audio amplifier, Honeywell has recently issued similar "notes" on a voltage sensing switch (for battery chargers) and a mobile power supply (delivering 115-volt, 60-cycle a.c. at 200 watts from a 12-volt d.c. source).

Pacific Semiconductors, Inc. (14520 Aviation Blvd., Lawndale, Calif.) has issued application notes on: "Citizens Band Transmitters" (No. 1A); "VHF Transistor Oscillator" (No. 2A); "A Class C 100-Watt 10-Mc. Power Amplifier" (No. 6A); "A 20-Mc. 100-Watt Class C Power Amplifier" (No. 7A); "A Class C 100-Watt 3-Mc. Power Amplifier" (No. 9A); "Transistorized Relay Drivers" (No. 1S); and "Inverter Design" (No. 3S).

Another firm, Solid State Products, Inc. (One Pinegree St., Salem, Mass.), has issued a series of eight "Design Ideas" featuring circuits for such devices as silicon-controlled switches, Trigistors, and Photran light-controlled semiconductors.

Still other firms that have issued extensive application notes in the past include: Fairchild Semiconductor Corp. (545 Whisman Rd., Mountain View, Calif.); Motorola Semiconductor Products, Inc. (5005 E. McDowell Rd., Phoenix, Ariz.); and Texas Instruments, Inc. (13500 N. Central Expressway, Dallas 22, Texas).

To obtain copies of a manufacturer's application notes, first write to the firm and request a list of currently available literature. Then write them again and ask for individual copies of specific publications. Since most firms have only a limited number of copies available, few —if any—will honor requests for "all your application notes and literature."

Reader's Circuit. A number of readers have pointed out that the "click" of an automobile's directional turn indicator

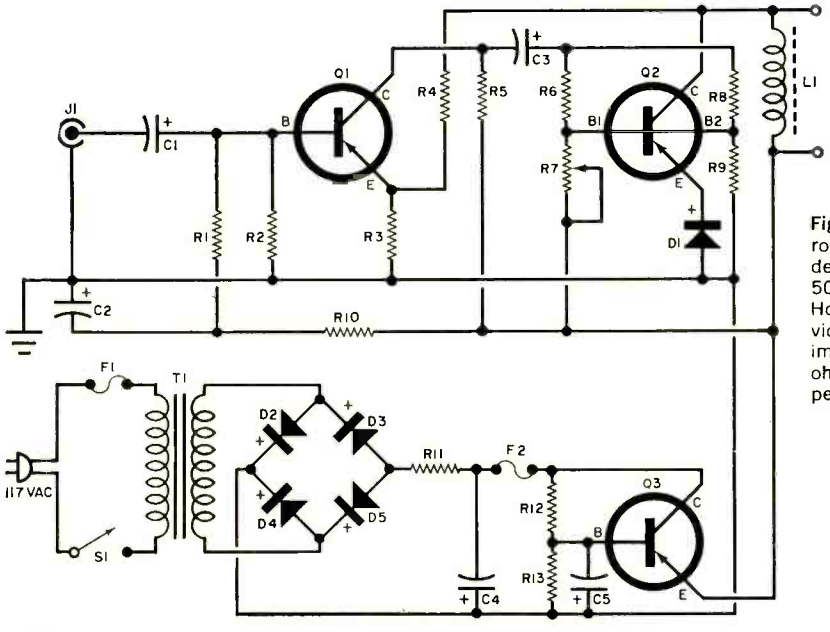
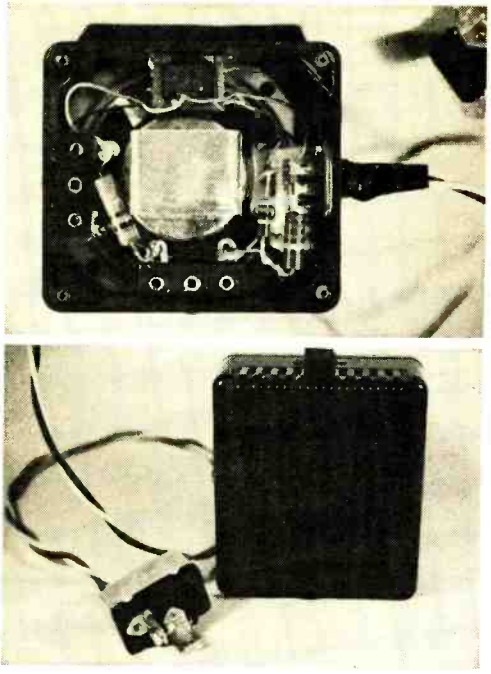


Fig. 1. A power tetrode transistor (Q2) delivers 5 watts at 50,000 cycles in this Honeywell circuit. Device has an input impedance of 300 ohms, an output impedance of 10 ohms.



Interior and exterior views of reader W. J. Fisher, Jr.'s audio "beeper" show the unit mounted in plastic speaker box.

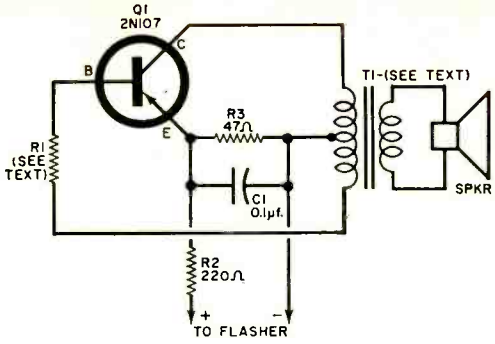


Fig. 2. A handy auto accessory, this audio "beeper" for directional turn indicators is built around a single transistor and will operate from either a 6- or 12-volt source.

may be inaudible against traffic noises; this is evidenced by the large number of drivers who leave their direction indicators flashing after they have completed a turn. One solution is a transistorized "beeper" which will provide an easily heard audio tone whenever the flasher is operating.

Reader W. J. Fisher, Jr. (Bernard Rd., Armonk, N. Y.) has come up with a circuit for such a device, as shown in Fig. 2. This is essentially a modified Hartley audio oscillator using a single *pnp* transistor in the common-emitter configuration to drive a small PM speaker. The components are standard and readily available through regular suppliers.

Resistors *R1* and *R3* are ½-watt units, while *R2* is rated at 1 watt. Capacitor *C1* is a 0.1-μf., 200-volt tubular unit; transistor *Q1* is a Type 2N107 (GE). The output transformer, *T1*, has a center-tapped 500-ohm primary winding and a 3.2-ohm secondary (an Argonne Type AR-119 will do very nicely). Almost any size PM speaker can be used, although a small (2½" to 4") unit with a 3-4 ohm voice coil is preferred. The value of *R1* will fall somewhere between 500 and 1000 ohms, and should be determined experimentally for best tone and volume when the unit is fully wired and ready for installation.

Since neither layout nor lead dress is critical, you may follow whatever assembly technique suits your fancy. It's a good idea, though, to construct the entire circuit in a small wooden, metal, or plastic box which will also serve as the speaker baffle. Some firms can supply small PM speakers with matching plastic cases; such a combination would be ideal for this project.

Once the wiring is completed, circuit operation can be checked by temporarily connecting a standard flashlight battery across *R3*, with the positive terminal to the emitter. Proper operation is indicated by a steady tone.

After check-out, install the "beeper" in your car wherever it is convenient—clamp it to the steering post, for example, or mount it below the dash. Flexible leads should be used for connecting the unit to the "pulsating line" leading to the flasher terminals, with special care being taken to observe the indicated d.c. polarity.

Transistorized Oscilloscopes. Some months ago (in February 1961, to be

(*Continued on page* 106)

On the Citizens Band

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

FOR THE PAST several years, hurricanes have battered the eastern and gulf coasts all too frequently during the month of September. Last year, in many locations, a number of CB clubs with emergency programs gave valuable assistance during such periods of natural disaster.

While it may be too late to whip up a good emergency CB communications setup for the hurricane season now upon us, we have been receiving enough mail on the subject to warrant a discussion of such an organization for the benefit of those clubs that have no clear-cut plans of their own. The following setup is based upon what some clubs have already done, plus various ideas "swiped" from public safety and military sources.

A base station, designated as the master control point, should supervise the entire operation. Wherever possible, this station should be in the same building as the headquarters of police, fire, Civil Defense, and other emergency agencies which may be involved. Second best would be to have the base station tied in with these organizations by direct, secure telephone lines. In any event, the full cooperation of the public service officials must be assured.

"Master control" should consist of a transceiver plus a receiver for each of the channels which subordinate units use, as outlined below. In addition, it is wise to have the station equipped to receive all local police, fire and "ham" emergency frequencies—one receiver and one operator per frequency.

Depending upon the area involved, the "master control" would communicate either directly with a group of no more than seven mobiles, or up to four or five subordinate control points. If subordinate control units, or "area stations," are employed, they would communicate directly with mobile, temporary-fixed, and walkie-talkie units, up to about ten in number (more than ten might prove a hardship to the operators). The mo-

Growing Up With CB

Getting off to a good start is Shoreline Chapter 1 of the Citizens Band Association of Connecticut. The parent organization, C.B.A.C., grew up too quickly—it boasts about 150 active members. So, Shoreline Chapter 1, the first offshoot of the C.B.A.C., was organized, now has 35 members, and is still growing strong. In May, the Chapter's first slate of officers was elected, the club's newspaper was in its second issue, and various activities were planned—in general, the wheels of this club began to turn. One sure sign of success was the planning of meetings during the summer, a time of the year when weaker CB clubs fade away.

Club officers are: (left to right, standing) Robert C. Wilcox, 1Q3523, Secretary and Editor; Charles Palmer, 1W7911, Treasurer; Charles Collins, President of C.B.A.C.; and (seated) Nelson King, 1W8078, President of Shoreline Chapter 1. Robert A. Stevens, Sr., KBA1632, Vice President, missed the shutter session.

bile and walkie-talkie units should be assigned certain strictly designated areas, and each should cruise an area small enough so that any point in it can be reached within three minutes.

To insure strict channel discipline, each area should be on a separate channel (full duplex operation). As an example, the "master control" might receive on channel 1 and transmit on channel 3. "Area control #1" would transmit to "master control" on channel 1, receive from "master control" on 3, and transmit to mobiles on, say, channel 2, while receiving from mobiles on channel 4.

This system allows a one-channel "guard" between similar groups. Assuming that reasonably good receivers are used, it will prevent "horseplay" between like units. If your setup requires more than one area control station, you can use the same channels between it and the master control station, but add channels as required to insure that mobiles on the south side, for example, cannot communicate directly with mobiles on the north side.

Roll calls, initiated by "master control," should be held every hour. Under such a system, each "area control," after checking all of its mobiles, reports back to "master control." Both the master control and area control stations should announce the time every 15 minutes.

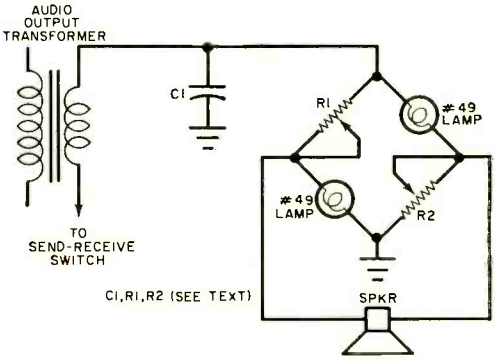
Mobile units should be staffed by at least two persons; one to drive the car and the other to operate the transceiver. (Let's not go whipping around town with one hand on the wheel! As a matter of fact, many localities have laws prohibiting the operation of a mobile radio while driving.) A third person in the mobile unit could assist in the actual emergency activities, leaving one person to man the transceiver at all times.

Basically, that's all there is to an effective emergency CB setup. But, that's only a small part of the story. Just how well the organization performs depends upon the amount of training each member has and what duties are assigned to him.

Tech Notes. Having trouble snaking weak signals out of the hiss and noise? Here are a couple of hints for you if your units often get out to the "fringe areas" of communication.

First, try lowering the high-frequency response of your receiver's output. One way to do this is by connecting a capacitor across your set's loudspeaker terminals. It's the simplest way, and it won't change the frequency response of your modulator, which might lower your set's modulation figure. The value of capacitance you use will depend a lot on your own preference as to how natural you want the signal to remain. The capacitor will cut out a lot of noise because noise is made up of many high audio-frequency components. Try values of .05μf. and greater. For a 3-4 ohm speaker, we personally prefer about .47μf., but the receiver characteristics and even car acoustics also enter the picture.

Another "QRN-cutter" is the simple, lamp-bulb audio squelch which was popular a few years ago when everyone was using superregenerative receivers; it was described in this magazine then (November 1958 issue) and was also available commercially. Basically, the unit is a bridge circuit (see diagram) which is inserted between the output transformer and the loudspeaker of your set. Most previously published circuits of this type use #47 pilot bulbs, but we prefer #49's



because they have a shorter "off-to-on" time. When used to back up the squelch already in most superregen receivers, this circuit will follow voice at a syllabic rate, instead of the longer word or phrase "rate" which is more useful in non-squelch-equipped receivers. The net result is an effective "background hiss remover" which allows any signal louder than the hiss to come through at normal volume.

The diagram shows you how to con-

(*Continued on page* 104)

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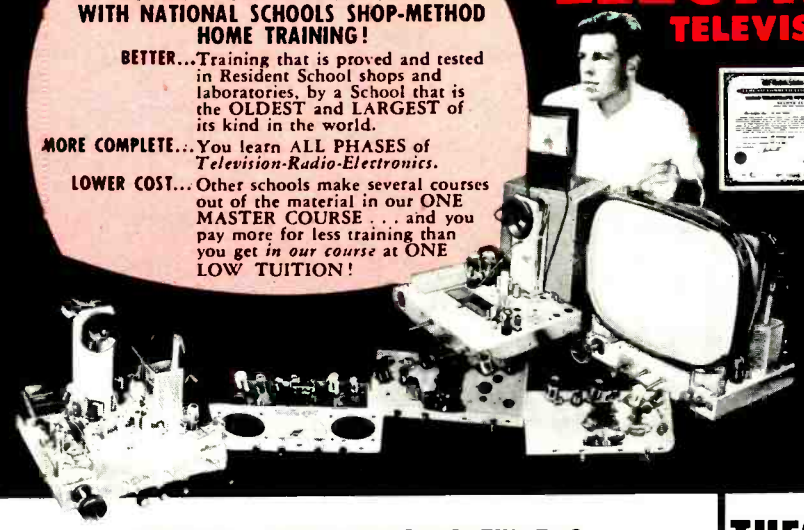

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SUCCESS IS THEIRS; IT CAN BE YOURS TOO!

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

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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.

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

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

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

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

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

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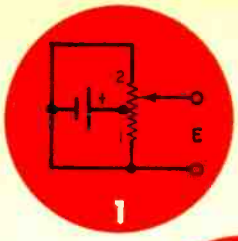
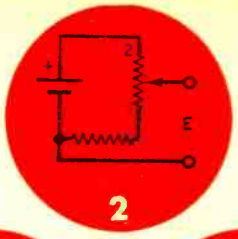
In timed, competitive tests, twin brothers — with twin backgrounds and skills — proved that Paco kits are faster, easier and more fun to build than almost-identical kits sold by other kit makers. They discovered that there's no guessing with Paco: parts are neatly packaged and precisely labeled; instruction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

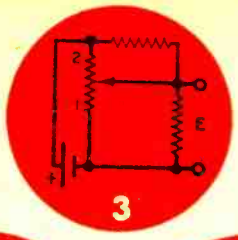
*AS PICTURED ABOVE

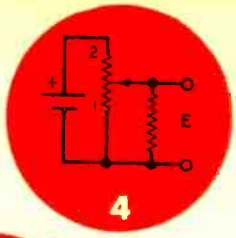
PACO KITS

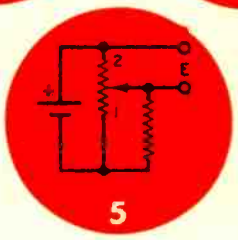
THE KITS YOU BUILD IN ⅓ LESS TIME

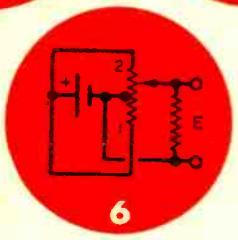


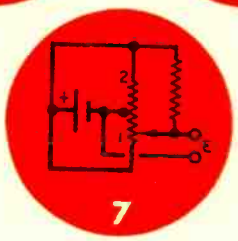


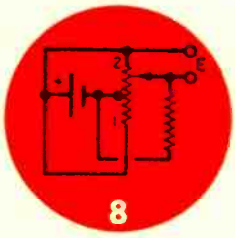












When the potentiometer wiper arm is moved from point "1" to point "2" in each of the circuits above (1 through 8), the output voltage, "E," varies as shown by one of the curves below (A through H). See if you can match them up. All resistors and linear potentiometers (some with center taps) are of the same resistance value. The correct answers appear on page 104.

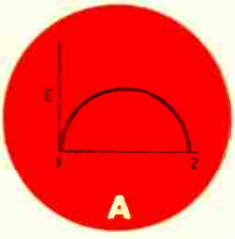
1 ____ 5 ____

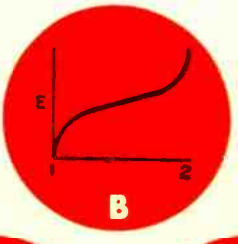
2 ____ 6 ____

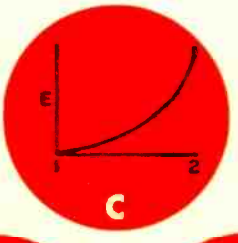
3 ____ 7 ____

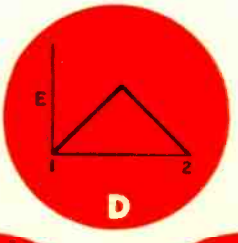
4 ____ 8 ____

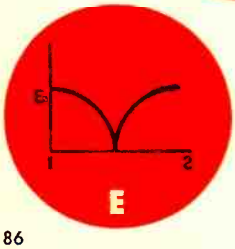
Potentiometer Quiz

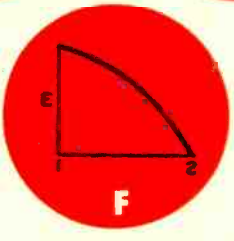


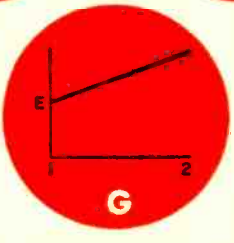


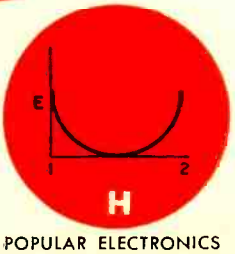












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- ★ SIGNAL TRACER
- ★ AMPLIFIER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR

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- ★ No Additional Parts or Tools Needed
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The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

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

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

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

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

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment. Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

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

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

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

THE "EDU-KIT" IS COMPLETE

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

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

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- **SET OF TOOLS**
- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
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- VALUABLE DISCOUNT CARD
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- TELEVISION BOOK ● RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE ● FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

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

FROM OUR MAIL BAG

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

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

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

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- TUBE TESTER
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- FM TUNER
- HIGH FIDELITY AMPLIFIER

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- ☐ Send "Edu-Kit" postpaid. I enclose full payment of $26.95.
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- ☐ Rush me FREE "Edu-Kit" catalog.

Name.....

Address.....

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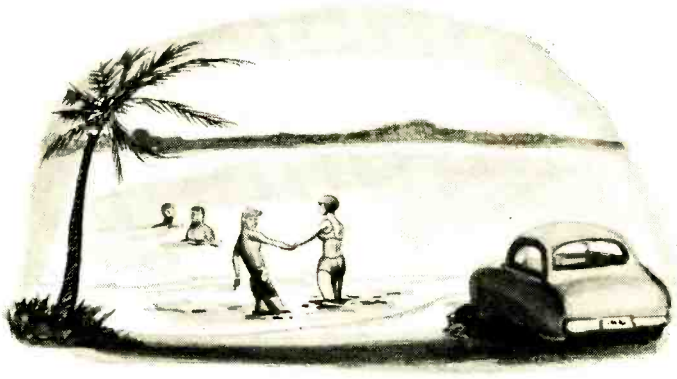
The CLINGING VINE

By
JOHN T. FRYE
W9EGV



a Carl and Jerry Adventure

CARL AND JERRY were driving down the road in their faithful 1954 Chevy. There was nothing unusual in this, but just about everything else in the scene was strange. Take the road itself. Instead of running between waving green banners of tall corn and harvested wheat and oat fields wearing their late-summer crew cuts, the road was bordered by cypress and live oak trees festooned with Spanish moss. Moreover, Carl and Jerry were not alone in the car. Seated in the front with Carl was dark-haired, lovely Jodi, whom the boys had first encountered in a tunnel beneath the campus of Parvoo University; and bouncing around on the back seat beside Jerry was a slender, vivacious, blue-eyed blonde with a dust of freckles across the bridge of her pert nose.

There was an explanation, of course. Taking a vacation trip before heading back to school, Carl and Jerry "just happened" to wind up in Panama City, Florida, where Jodi lived. As soon as she learned the boys were in town, she called her cousin, Mary, and organized this picnic at a small, secluded lake north of the city.

"Turn left onto that little sand road," she directed Carl.

"I declare, Jodi, I don't see how you remember directions so well," Mary exclaimed in a rich southern drawl that matched Jodi's. "Daddy says the only two directions I know are up and down and he'd hate to have to depend on my not mixing those up. But you always were clever. You *had* to be to find these perfectly *dreamy* Yankee boys!"

Jodi's fair skin turned pink, and she hastily changed the subject.

"What is this thing you and Jerry want to test today?" she asked Carl.

"Underwater communications equipment," he answered. "There was a fellow living in the H-3 building at school whose dad works for the Electro-Voice company in Buchanan, Michigan. Back in 1958 the company started experimenting with this sort of equipment and finally came up with a device they called 'Scubacom.' While it was decided not to put 'Scubacom' into production, several experimental units were built; and this fellow managed to get one of the speakers for us. Using that, and the information he could give us, Jerry and I built our own crude version.

"Essentially, it consists of two parts: a specially designed partial face mask that houses a microphone; and a speaker-amplifier unit that contains the power supply, amplifier, and the special speaker. The mask-microphone can be worn in

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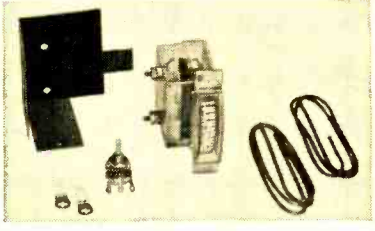

S-meter kit—easy to install as shown in photo above. $8.95

Features:

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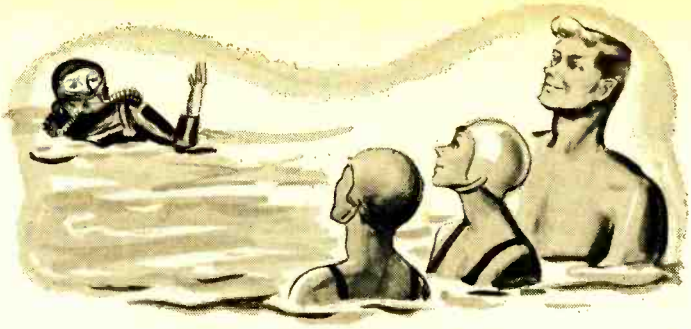

conjunction with any standard eye-and-nose diving mask, after the standard scuba mouthpiece and barrel assembly is removed. A press-to-talk button on the bottom of the mask turns the thing on and off. The speaker-amplifier is designed for neutral buoyancy and is strapped to the air tank. The amplifier is transistorized.

"The speaker is the tricky item. You see, you have to maintain equal pressures on both sides of the diaphragm to get linear operation, and Electro-Voice accomplished this with a special design that features a circular bladder arrangement. The microphone connects to the amplifier through a special waterproof interconnect cable. Power is supplied by a couple of 6-volt 'Aqualite' pressurized batteries.

"We just finished it on the night before we were to leave on our trip," Jerry added; "so we threw it into the trunk and brought it along with the idea of trying it out somewhere along the way. In both the Electro-Voice unit and our homemade one, only a transmitter is used, and the sounds from the speaker are nondirectional—they can be heard by any underwater swimmer. I'll be content if a scuba diver can hear ours at a hundred feet.

"I just love that word 'scuba,' " Mary chimed in. "I think it sounds so romantic and exotic. I just know it comes from some South Seas dialect."

"I hate to spoil your illusion," Jerry said with a broad grin; "but the word is actually made up of the first letters of 'Self-Contained Underwater Breathing Apparatus.' Well, here we are."

THEY parked beneath some short-needled pine trees and looked out across the peaceful little lake. It was about a half-mile in diameter, and the two couples had it all to themselves.

"Whew! It's hot in here when the car stops," Jodi exclaimed. "What say we take a swim before attacking the fried chicken and potato salad? You boys can change clothes in that little clump of bushes over by the point, and Mary and I will change here in the car."

A half hour later, refreshed by a dip in the cool waters of the deep little lake, they removed the scuba gear from the car trunk—including an impressive "frogman type" suit—and all took a hand in putting it on Jerry. As soon as everything was in place, he waded out into the lake and submerged. The other three, standing near the shore, placed their heads beneath the surface of the water and listened intently.

"Calling all mermaids! Calling all mermaids! This is Father Neptune calling all mermaids. Come to Daddy, girls!" Jerry's voice said clearly and distinctly.

"Hey, how about that! It works!" Carl exclaimed as he raised his head from the water.

"Isn't he cute, calling all mermaids?" Mary asked with an appreciative giggle.

"Could you hear me?" Jerry called from where he had surfaced and was treading water a short distance away.

"Roger; you were five by nine," Jodi answered in ham parlance.

"Great! I'll swim out a ways and call from the bottom. I want to find out how far the sound carries and whether or not increased pressure affects the transducer. Give me at least a couple of minutes and then start listening."

He disappeared from sight. There was enough of a breeze to roughen the surface of the lake and conceal any air bubbles rising from the exhaust of the scuba gear. Carl and Jodi both tried to

explain to Mary how Jerry was making the sound go through the water, but she just shook her head in pretty bewilderment. After a couple of minutes, they all ducked below the surface.

"I didn't hear a thing," Carl gasped as he came up for air several seconds later.

"Neither did I," the girls chorused.

They went under again and listened intently as long as they could. Carl and Jodi came up almost together.

"He must have swum beyond range of the transmitter, or else the pressure has clobbered the speaker," Carl hazarded; "but he should come up now and let us know where he is."

"Listen!" Mary said as she popped her head out of the water, gulped a breath of air, and immediately went back beneath the surface. Carl and Jodi joined her, and they heard Jerry's voice —much fainter than before but clearly understandable.

"If you can hear me, Carl, I'm in kind of a fix." Jerry was trying hard to seem casual, but there was a note of near-panic in his voice. "I swam into a roll of old barbed wire down here on the bottom, and some of the coils are wrapped around my legs. The more I try to get loose, the tighter the coils wrap. I don't think I can make it without some sort of help. If you can hear me, try to make some sound to let me know."

Quick as a flash Mary scooped up a couple of stones from beneath her feet and struck them together in the water.

"Is that you? If so, make that sound twice." Jerry's voice was eager.

Mary struck the stones together twice.

"Good. I'm going to rest a little and go easy on my air," Jerry said. "You know, Carl, the tank was pretty low to begin with."

ALL three of them surfaced at once. Carl's face looked white and drawn as the two girls stared questioningly at him. "It's true," he said. "We knew the air in the tank was low, but we only figured on testing the talking device for a few minutes. We've got to get him out of there, and quick."

"Do you have any of those wire-cutting scissors in the car?" Mary asked,

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"Startling Realism . . . Superb Dynamic Range . . . Smooth, full power delivery . . . Fast, effortless transient response . . . Professional . . . Convenient . . . Takes full advantage of the state of transistor art . . . Simple assembly" . . . these are but a few of the enthusiastic comments of those who have heard and seen the new Heathkit AA-21 Transistor Stereo Amplifier.

Rated at 35 watts per channel by Heath standards or 50 watts per channel by IHFM music power standards, this Heathkit combination stereo preamplifier, power amplifier delivers full power over a range of 13 cycles to 25,000 cycles, ±1 db! No compromise in dynamic range, no faltering power at the important high and low extremes of response . . . just the most satisfying solid sound you have ever heard. Its other specifications are equally impressive . . . completely factual and guaranteed!

Featuring 28 transistors and 10 diodes, the latest, most advanced in RCA semi-conductor technology, the Heathkit AA-21 not only offers record-setting performance, but also provides operational characteristics unique with transistors . . . cool operation with low power line requirements . . . steady performance under wide, external temperature variations . . . complete freedom from annoying microphonics . . . instant operation.

More than two years in development, this pace-setting unit features transformerless output circuitry plus multiple feed-back loops for flat response and finest fidelity. All controls are front-panel mounted for operating convenience, with a 5-position, dual concentric input selector which permits "mixing" inputs for tape recording purposes, etc., a 5-position "mode" selector, plus dual concentric volume, bass and treble controls. A hinged lower front panel covers all input level controls, the tape-monitor input switch, a speaker phase reversal switch, and a loudness switch which converts the volume control to a loudness control for compensated low-volume levels. The right-hand section of the lower front panel is a unique On-Off switch . . . touch to turn on, touch to turn off. All input and output connections are conveniently located on the rear chassis panel. Circuit safety is assured through the use of 5 new, fast-acting, bi-metal circuit breakers . . . no more annoying fuse-fussing.

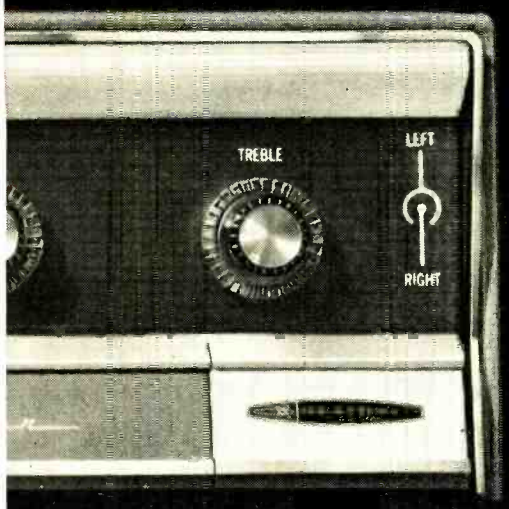
Kit assembly is fast and simple through the use of 5 circuit boards which eliminate most of the conventional, time-consuming point-to-point wiring. The preamplifier circuits are "capsulized" to reduce wiring . . . 6 epoxy-covered modules contain 70 resistors and capacitors, all factory wired and sealed, ready for easy mounting on the preamplifier circuit boards.

Styling is in the Heathkit deluxe motif of luggage-tan vinyl-clad steel with polished, anodized aluminum trim, plastic upper front panel, extruded aluminum lower panel with matching vinyl inset, and soft, refracted panel-lighting.

Designed to set a new standard of value, this finest of all stereo amplifiers carries a surprisingly low price tag . . . order yours now for early enjoyment.

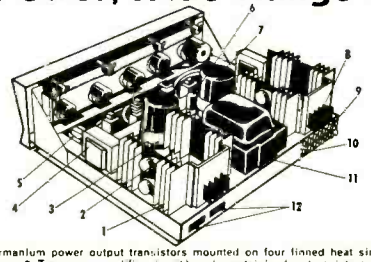
Kit AA-21, 28 lbs., no money down, $13 mo. **$134.95**
Assembled AAW-21, no money down, $21 mo. **$219.95**

SOUND LIKE A MILLION!



Build This New Heathkit Transistor Stereo Amplifier

Full Power, Wide-Range Sound As You Have Never Heard It



1. Eight germanium power output transistors mounted on four finned heat sinks. **2.** Output circuit breakers. **3.** Two power amplifier circuit boards containing four transistors and six diodes. **4.** Two driver transformers. **5.** Two preamplifier circuit boards containing six epoxy-sealed component modules and ten transistors. **6.** Two germanium driver transistors plus four electronic filter transistors. **7.** Two 3,000 mfd filter condensers and four power supply diodes. **8.** Two output terminal boards. **9.** Stereo input jacks. **10.** Tape recorder output jacks. **11.** Power transformer. **12.** AC power outlets. All primary and secondary controls accessible at front panel area!

SPECIFICATIONS—Power output per channel: (Heath rating), 35 watts/8 ohm load—26 watts/16 ohm load—18 watts/4 ohm load; (IHFM music power output): 50 watts/8 ohm load—34 watts/16 ohm load—25 watts/4 ohm load @ 0.7% THD, 1 KC). **Power response:** ±1 db from 13 cps to 25 kc @ rated output; -3 db from 8 cps to 40 kc @ rated output. **Harmonic distortion (at rated output):** Less than 1% @ 20 cps, 0.55% @ 1 kc, 2.0% @ 20 kc. **Intermodulation distortion (at rated output):** Less than 1%, 60 & 6,000 cps signal mixed 4:1. **Hum and noise:** Tapehead, 40 db below rated output; Mag. phono, 45 db below rated output; Aux. inputs, 60 db below rated output; Tape monitor, 70 db below rated output. **Channel separation:** 40 db min. @ 20 kc, 55 db min. @ 1 kc, 50 db min. @ 20 cps. **Input sensitivity:** (For 35 watts output per channel, 8-ohm load) Tapehead, 2 mv; Mag. phono, 3 mv; Tuner, .25 v; FM Stereo, .25 v; Aux., .25 v; Tape Monitor, .90v. **Input Impedance:** Tapehead, 60 K ohm; Mag. phono, 30 K ohm; Tuner, 100 K ohm; FM Stereo; 100 K ohm; Aux., 100 K ohm, Tape Monitor, 47 K ohm. **Outputs:** 4, 8, & 16 ohm and low impedance tape recorder outputs. **Controls:** 5-pos. Selector (dual-concentric), 5-pos. Mode switch, dual-concentric Volume, Bass & Treble controls, Tape monitor sw., Loudness sw., Phase sw., Input level controls (all inputs except Tape Head & Tape Monitor inputs), Push-Push on/off switch. **Semiconductor complement:** 28 Transistors, 10 diodes. **Power requirements:** 105-125 volts, 50-60 cycles AC, 35 watts (dump, no signal; 200 watts, full power out, @ 120 volts with no load on AC receptacles. **Power outlets:** 2 AC receptacles, 1 switched, 1 unswitched. **Dimensions:** 15¼" W x 5" H x 14" D.

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proving that she could speak rapidly and still retain her drawl.

"You mean diagonal cutters? Sure, I'll get them."

He was back in a few moments. Without a word, Mary took the tool from his hand and started for the middle of the lake with a professional overhand crawl stroke.

"Hey, wait! Hadn't I better—" Carl called.

"Let her go," Jodi advised. "Let's let him know we're trying to help."

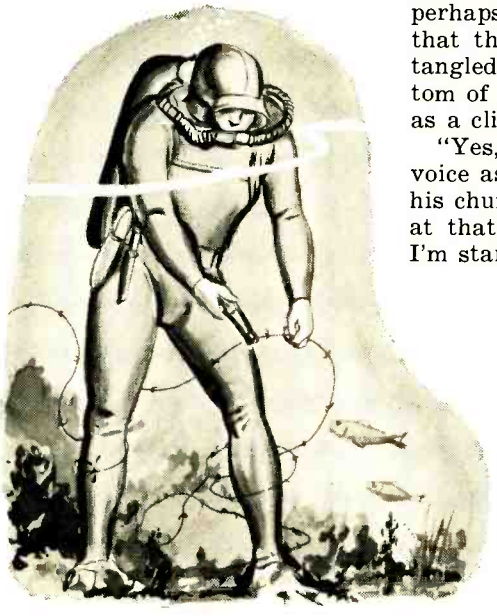
Carl beat a sharp tattoo with a couple of stones, and immediately they heard Jerry's voice. "Okay, I hear you . . . and now I hear someone threshing around in the water. There, I can see your shadow against the light. I'm over to your left. No, your left; the other way. That's right. Keep coming as you are. A little more to your right now. Okay, you're right above me."

Carl and Jodi came out of the water just in time to see Mary's slender green-clad figure arc in a bow as she started a dive. A few seconds later she came to the surface and raised a circled thumb and forefinger over her head to indicate the success of her mission.

Jerry was too busy cutting barbed wire to be playing with the push-to-talk button on his mask-microphone for the next several minutes. Eventually he came to the surface, though, and he and Mary swam together to the shore.

"I don't know about the rest of you," Jerry said after they helped him off with the scuba gear and rubber suit and he was gingerly daubing Mercurochrome from the car's first-aid kit on the superficial scratches on his legs, "but personally I've had all the swimming I want for one day."

"So have we," Jodi said. "Let's all get dressed and see what we can find in that picnic basket."



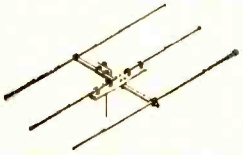
I JUST don't get it," Jerry remarked to Carl as they were putting on their clothes. "That Mary is so slender and soft and helpless; yet she brought those diagonal cutters down to me like a professional diver. On the way here I had doubts she could even swim, and I was sort of hoping I'd have to teach her."

"You can give up that dream," Carl said with a grin. "While you were playing snip-snip with the barbed wire, Jodi told me Mary was the lifeguard at the municipal pool for two years. You mustn't let these Southern girls fool you. They're smart enough to make a man feel big and strong and protective—just as long as they possibly can. I'm thoroughly convinced the first clinging vine was a Southern honeysuckle. And since your father isn't here to warn you, perhaps I'd better explain right now that that roll of barbed wire you were tangled up with down there at the bottom of the lake is not half as dangerous as a clinging vine."

"Yes, Daddy!" Jerry said in a falsetto voice as he threw a handful of grass at his chum. "I'll remember. Now let's get at that fried chicken and potato salad. I'm starved!" —30—

ATTENTION! TECHS CB & SWL HAMS

for CITIZENS BAND OPERATORS



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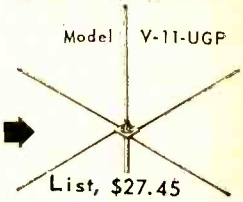
Both Ground Planes give 360 degree patterns and provide dependable base station communication over long distances. See SWR curves below.



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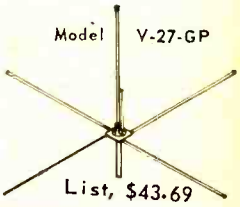

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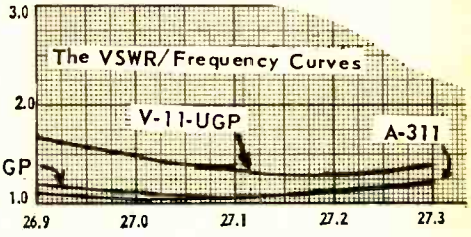

for HAMS AND TECHNICIANS

THE **Mosley CM-1** receiver is the first low priced receiver with double conversion and crystal controlled first oscillator. It is also the first receiver with 5 dual-purpose tubes of one type and 4 semi-conductor diodes which perform all functions usually requiring 12 or more tube sections. See this really new design concept in amateur receivers now on display at your dealer.

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WT-78 — — 47 - 110 mcs.
WT-165 — — 100 - 230 mcs.

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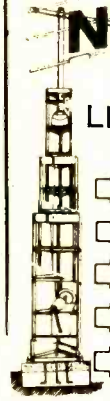
NEW! MOSLEY TOWERMASTER LINE



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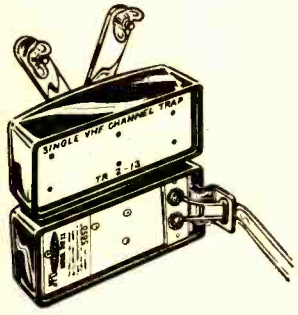
New Products

TV WAVE TRAPS

Produced by JFD Electronics Corp., a new series of wave traps provides "clear-channel" TV reception by eliminating interfering TV or FM stations. They are intended for use in conjunction with the JFD "Transistenna" (as shown in the photo) or with any other TV preamplifier. The antenna output feeds directly into the trap, where the troublesome signal is attenuated before it is boosted by the amplifier. Wave traps TR2 to TR13 "screen out" TV channels 2 through 13, respectively; TRFM eliminates interference from FM stations. Priced at $6.95 each, these traps give approximately 35 db attenuation of the frequencies they are designed to restrict. (*JFD Electronics Corp.,* 6101 16th Ave., Brooklyn 4, N. Y.)

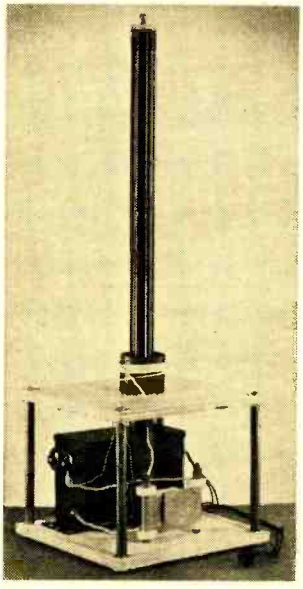


VTVM KIT

Conar Instruments (a division of National Radio Institute) is producing a VTVM kit with 24 overlapping ranges for a.c. or d.c. volts, a.c. peak-to-peak readings, and ohms. The Model 211 VTVM has a 6" meter with jeweled D'Arsonval movement; a special circuit protects the movement from overload and vibration damage. Ranges are 0-1200 d.c. volts, 0-1200 r.m.s. a.c. volts, 0-1200 a.c. peak-to-peak, and 0-1000 megohms (10 megohm center scale). An optional "TV probe" extends the d.c. range to 30,000 volts. Calibration is simple and there's no need to make readjustments when switching from one range to another. Price: $31.95 in kit form; $44.95 factory-assembled. The TV probe sells for $5.50. (*Conar Instruments,* 3939 Wisconsin Ave., Washington 16, D.C.)

TESLA COIL KIT

Morris & Lee, manufacturer of science equipment for amateur or professional experimenters, has developed a "spark-gap" type Tesla coil kit. Said to be more spectacular in operation than conventional vacuum-tube types, the coil delivers r.f. power in short bursts of 10 kw. or more. Discharges up to 12" in length can be obtained. Since the kit can be constructed "in a dangerous manner," orders will not be filled until the prospective purchaser has proven that he understands M&L's explanatory material by successfully completing a questionnaire. The price of the kit is $75.00. Send $1.00 to the manufacturer for literature, plans, experiments, and questionnaire. (*Morris & Lee,* 294 Elm St., Buffalo, N.Y.)



WIRELESS INTERCOM KIT

A completely transistorized wireless intercom in kit form has been introduced by Allied Radio. There are no interconnecting cables to install, since the two-station "Knight - Kit" system operates by simply plugging into any a.c. or d.c. power source. Each station is a "master," and has a press-to-talk button which can be locked in the "talk" position. No on-off switch is required, since each station draws no more power than an

electric clock. Any number of additional stations can be added, if desired. Price of the 2-station kit (No. 83 Y 991) is $45.90. Single-station kits (No. 82 Y 992) are $22.95. (*Allied Radio Corp.*, 100 N. Western Ave., Chicago 80, Ill.)

TRANSISTOR TESTER KIT

A kit version of the Sencore TR115 transistor and diode tester is now on the market. Model TR115K checks for leakage, current gain (*beta*), shorts, and opens. *Beta* may be read directly or on a "good-bad" scale, and provision is made for carrying out rough service checks with a minimum of adjustments. Featured are a special compartment for holding the "setup" booklets and an improved meter design. The setup instructions list Japanese equivalents of American semiconductors. Price, $15.95. (*Sencore, Inc.*, 426 S. Westgate Drive, Addison, Ill.)

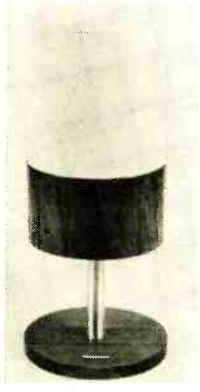
FM/AM POLICE RECEIVERS

Designed to pick up calls from police and fire departments, answering services, Civil Defense operations, and the like, the HE-51 and HE-52 communications receivers respond to both AM and FM. Both have a built-in squelch circuit which reduces background noise without affecting receiver sensitivity, and both have a 4" speaker which can be cut out with a slide switch for headphone operation. Crystal-controlled and tunable, the HE-51 covers the 30-50 mc. range; the HE-52 is tunable only and operates on the 145-175 mc. band. Each receiver is priced at $52.50. (*Lafayette Radio Electronics Corp.*, 111 Jericho Turnpike, Syosset, L.I., N.Y.) -30-

Hi-Fi Showcase

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

A LOW, "SCULPTURED" silhouette and a special, silver-blue luster to blend with darker wood hues are two features of the new Model UA16 automatic record changer from ***BSR (USA) Ltd.*** Designed by Raymond Loewy/William Snaith, Inc., the UA16 incorporates a precision-built, dynamically balanced motor with self-lubricating, lifetime bearings. The motor is suspended in rubber for vibration-free performance, and the changer's tone arm is a one-piece aluminum die-casting. The unit plays all four speeds, and you can intermix 7", 10", or 12" records of any one speed to your heart's content. Weighing less than seven pounds, the UA16 changer plays either mono or stereo discs and it can be operated either manually or automatically. . . . A valuable accessory to any stereo console is the "Satellite" speaker system developed by ***Electrohome of Canada.*** Although it looks much like a small table lamp, this compact unit contains a 6" mid-range speaker and a horn-type tweeter. Placed at either side of your console, the "Satellite" radiates high frequencies upward and outward throughout the room; low-frequency sounds, on the other hand, basically non-directional, continue to emanate from the console's "woofers." Since both speakers in the "Satellite" face upwards and there is a diffusing cone above each one, they effectively radiate a "fountain of sound" in a 360° circle; and a treble-level control permits adjusting the output to meet room acoustical requirements. The "lamp" model (illustrated) lists for $49.95; another model, housed in a smart-looking perforated metal canister, sells for $27.95. . . . Buy ***Ferrodynamics'*** color-coded "**signal**" **reels** for your tape recorder, and you'll never again wonder which side is "up." Available in both 3" and 7" sizes, the reels are supplied in packs of six—one red and five green. Tape is wound on a green reel, then transferred to the red reel as it is being played on your recorder. Thus, whenever you see tape on the red reel, you know that it must be rewound or turned over before being played again. Prices are $8.95 for the 3" reels and $13.95 for the 7" variety.



Electrohome's satellite speaker system

One of the most advanced amplifiers in the hi-fi field (its completely solid state), ***Heath***'s new AA-21 contains 28 transistors and 10 diodes for smooth response (within 1 db) from 13 to 25,000 cycles at 35 watts per channel (IHFM rating is 50 watts per channel). Available both as a kit and factory-wired (AAW-21), this superbly engineered unit features a transformerless output circuit and multiple feedback loops for finest fidelity. All controls are front-panel-mounted, and five fast-acting "bi-metal" circuit breakers mean that you'll never have to replace a fuse. Controls include a 5-position dual concentric input selector, a 5-position mode selector, and dual concentric volume, bass, and treble controls. Concealed behind a hinged lower front panel are a tape monitor switch, a loudness switch (to convert the volume control to a loudness control for compensated low-level listening), a speaker phase reversal switch, and all input level controls. If you decide to build the AA-21, you'll find that its five circuit boards eliminate most of the conventional point-to-point wiring. In addition, the preamplifier circuits themselves are "capsulated" in six epoxy-covered modules, all factory-wired and sealed, ready for installation on the circuit board. The AA-21 kit sells for $134.95 and the fully wired unit (AAW-21) is priced at $219.95 (both prices f.o.b. Benton Harbor, Mich.) . . . The AD-22 stereo tape recorder kit, another new item from Heath, can be used as part of your stereo/hi-fi system or as a portable recorder, and for recording and playing back 4-track stereo tapes or for playing mono tapes. Its heavy, die-cast frame is extremely rigid, and a test tape is included for head

Heath AA-21 Stereo Amplifier

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

alignment to insure optimum frequency response. A digital counter guarantees easy tape cueing, and two VU-type meters enable you to set record and playback levels with test instrument accuracy. Its four-pole motor provides either 7½ or 3¾ ips speeds at the push (or pull) of a knob, and there are individual bias-adjust and meter-calibrate controls for final circuit adjustments. The complete recorder kit (the AD-22) sells for $179.95, while the tape deck only (no electronics) is available as the AD-12 for $124.95; a sturdy luggage-tan carrying case for the AD-22 is priced at $37.50.

The "Citation A" all-transistor professional stereo control center from ***Harman-Kardon*** provides features and performance to satisfy even the most demanding audio perfectionist. Flat from 1 cycle to the megacycle region, it is said to produce unmeasurable harmonic distortion at 2 volts output between 20 and 20,000 cycles. There are two power switches rather than the usual single switch—one controls the power for the basic amplifier, while the second governs the preamp and associated equipment. Other controls include function, mode, equalization, tone, balance, channel reverse, low-cut, high-cut, and tape monitor. Among the special features are a push-button selector switch, a stereo headphone receptacle, and a "tape head" control to "trim" equalization for any tape head regardless of age or make. A 33-transistor unit, the Citation A is priced at $249.95 in kit form, $349.95 factory-wired and tested.

Omega's Model 1650 all-transistor FM/stereo tuner is a perfect match for the company's all-transistor 60-watt stereo

Omega 1650 FM/Stereo Tuner

amplifier; tubes have disappeared even from the tuning eye. The tuner is housed in sleek modern cabinetry: ebony, oiled walnut, and mahogany cabinets are available, along with mounting rings for custom installations. Price, $249.00. . . . Splicing 4-track stereo tape can be a mighty critical operation, but ***Robins Industries***' latest addition to the Gibson Girl line—the TS-8D "Stereo 4" tape splicer—makes it as easy as 1, 2, 3. The TS-8D's blades are preset at the factory to minimize contact with "live" tape surfaces, and an adjustment mechanism enables you to keep the blades in perfect alignment. Ideal for use with any standard ¼" tape, the TS-8D lists at $11.50. . . . Here's a reverberation device that can be installed in any electronic organ, regardless of brand or size. Designed to make even the smallest electronic organ sound like a pipe instrument, ***Schober***'s "Reverbatape" contains no springs. Instead, it makes use of a small tape-recorder mechanism with a continuous loop of tape and multiple playback heads. The result, thanks to some special circuitry, is a series of carefully spaced repetitions of sound which blend to give the characteristic gradual decay. A control enables you to vary reverberation to suit any type of music in virtually any room or auditorium. And installation should present no problem: you simply place the unit in the organ console, connect it with a tube socket adapter, and the sound will continue to come from the organ's own speakers. Price, $299.95. . . . ***H. H. Scott***'s new FM/stereo tuner has just about everything—even an "electronic brain." Tune in an FM/stereo broadcast, and the 4310 automatically adapts itself for multiplex reception. But if you're receiving in a "fringe" area, the tuner will switch itself to monophonic FM reception whenever the signal falls below a predetermined "interference threshold"—which you set by means of a unique "threshold control." When the interference clears up, the tuner instantly switches itself back to FM/stereo. Ten separate front-panel controls, including separate level controls (and separate vu meters) for each channel, cover almost every conceivable function. An automatic noise suppressor cuts interchannel "hish," and a sensitivity meter simplifies antenna orientation and makes for perfect tuning. Equipped with a silver-plated cascode front end, the 4310 employs 22 tubes and is available in a rack-mounted model for broadcast-station use. Price of the new tuner, $475.00.

Schober "Reverbatape"

BSR (USA) Ltd., College Point 56, N.Y.
Electrohome of Canada Ltd., Kitchener, Ont., Canada
Ferrodynamics Corp., Gregg St. & Rte. 17, Lodi, N.J.
Harman-Kardon Inc., Plainview, L.I., N.Y.
Heath Co., Benton Harbor, Mich.
Omega Electronics Corp., 10017 North 19 Ave., Phoenix 21, Ariz.
Robins Industries Corp., 36-27 Prince St., Flushing, N.Y.
Schober Organ Corp., 43 W. 61st St., New York 23, N.Y.
H. H. Scott Inc., 111 Powder Mill Rd., Maynard, Mass.

(*Continued from page* 45)

PACO ST-26 FM Tuner/Amplifier Kit

Manufactured by Paco Electronics Co., 70-31 84th St., Glendale 27, N. Y.

Prices: $54.95 (kit); $69.95 (factory-wired); plus $14.95 (walnut case), or $4.95 (black and gold metal case); kit sold without power stage as Model ST-25.

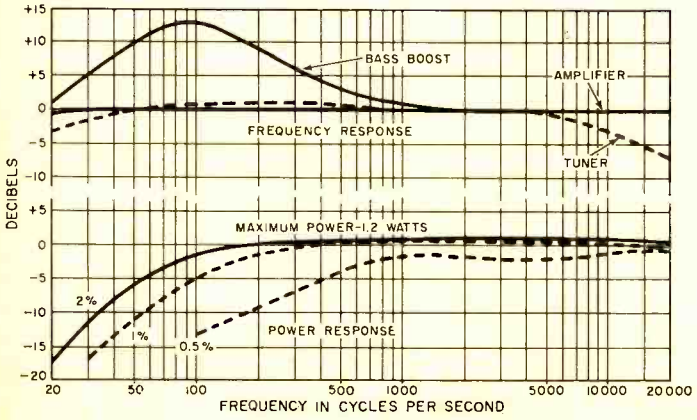
THE ST-26 is also something quite new in hi-fi kits. An economical FM tuner/amplifier, it is meant for use with an external speaker. The choice of speaker system is pretty much up to you—and depends on whether you are building the kit as a "second" FM receiver or as a low-cost music system.

This is a "you do practically everything" kit—including the mounting of sockets, tie points, jacks, etc. Assembly and wiring are not difficult, and the instruction manual is clear. But we do suggest that you pay close attention to the manufacturer's "addenda" sheets to eliminate all possible confusion.

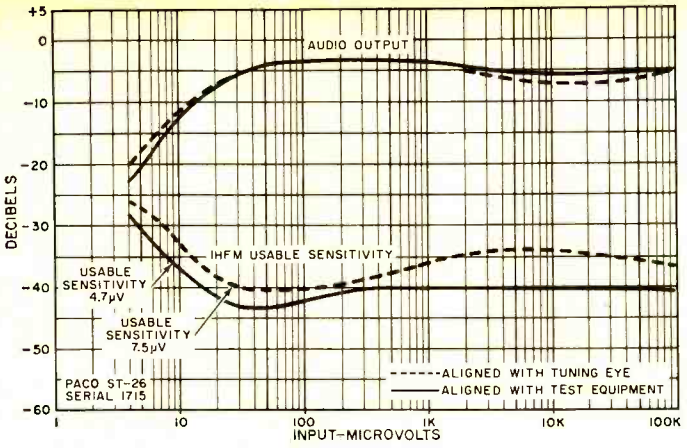
Alignment of the FM tuner section (any tuner kit, regardless of brand, should be aligned after completion) can be accomplished solely with the aid of the set's "magic eye" tuning indicator. No complicated instruments are required to achieve satisfactory performance with good limiting. Instrument alignment will add a bit more sensitivity.

Two identical ST-26's were built in the P.E. labs—one by an experienced constructor, the other by a neophyte. Construction time for the experienced man was about 13 hours; that for the neophyte was a bit longer. Both units worked as soon as they were plugged in.

CIRCUIT REPORT: The ST-26 is sold with a factory-wired, prealigned and sealed front end. A dual triode (ECC85/6AQ8) is used in this sealed unit as a low noise r.f. stage and self-oscillating mixer. A.f.c. voltage is fed to a voltage-variable solid-state capacitor for drift correction. There are two 10.7-mc. i.f. stages with partial limiting in the second stage and full limiting in a separate stage. The first i.f. stage uses a 6BA6, the second a



Response of the amplifier alone is shown in top half of this graph (solid line); bass boost involves special wiring connection and is not adjustable from front panel. (Dashed line indicates response of entire unit.) Lower part of graph shows power response curves for three harmonic distortion figures.



Sensitivity figures were obtained by the Hirsch-Houck Laboratories using the standards established for FM tuners by the Institute of High Fidelity Manufacturers (IHFM). Maximum output for the ST-26 was found to be 1.65 volts.

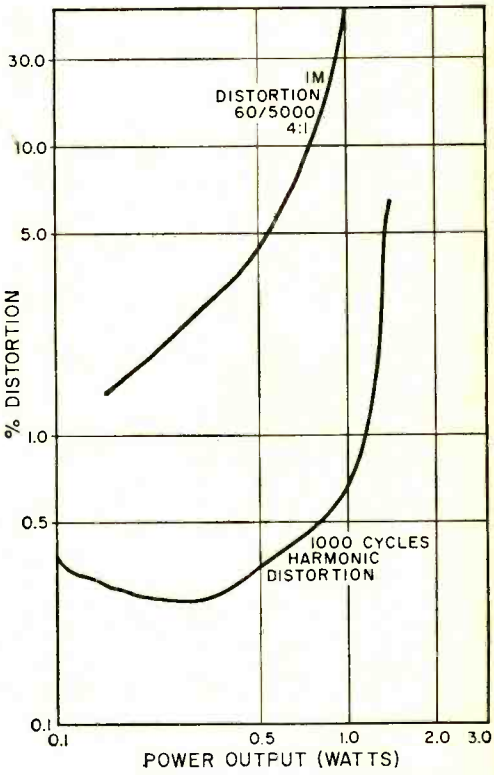
The single-tube audio stage of the ST-26 is not a powerhouse, but it does provide more than enough power (0.3-0.5 watt) at low distortion to drive a high-efficiency speaker system.

6BC5, and the full limiter is a 6AU6. Ratio detection using a 6BN8 follows the limiter; the triode section of the 6BN8 serves as an audio voltage amplifier. The Model ST-26 has an ECL86/6GW8 audio power amplifier with 4-8 ohm speaker output—a feedback loop around this stage provides optional bass boost. Provisions are made to permit multiplex take-off from the detector, to feed a high-output phono cartridge through the audio stages, and to use the FM tuner section with an external amplifier.

HIRSCH-HOUCK LAB CHECK: Sensitivity of the ST-26 is quite close to the manufacturer's advertised claim of 4.0 μv., showing it can be achieved by using simple test equipment to align the tuner. Maximum output reached 1.2 watts (better than manufacturer's claim of at least 1 watt—see graph). The output voltage is reasonably constant (regardless of whether instrument or tuning-eye alignment is used) from 25 μv. through 100,000 μv.

The manufacturer obviously does not intend the audio amplifier in this tuner/amplifier combination to produce powerhouse audio. Nevertheless, the response is flat, and if it is used with a high-efficiency speaker, where more than enough volume results from ¼ to ½ watt drive, the ST-26 has very reasonable IM and harmonic distortion figures.

IN CLOSING: Successful use of the ST-26 depends entirely on a clean, high-efficiency speaker system. Fitting this category are dozens of so-called "bookshelf" speakers employing the ducted-port or bass-reflex principle. Bass boost may or may not be needed (or desirable), and the constructor should try the tuner/amplifier both ways.



Considering the price and ease of assembly, the ST-26 makes a good "second" FM receiver. Or you can use its audio section with a record player as a good low-cost music system. -30-

On the Citizens Band

(*Continued from page* 82)

nect up the squelch unit. For best results, a 50-ohm, ganged potentiometer should be used, but since these are difficult to obtain, you can make do with two 50- or 25-ohm units, put knobs on them, and set each to approximately the same position. The proper setting of the potentiometer is where almost all background hiss will be eliminated (squelch "open").

Club Notes. The Cereal City Citizens Band Club (Battle Creek, Mich.) avoided possible chaos by providing communications for the city's annual "Parade of Parades" recently. More than 50,000 persons saw the 140 marching units in the parade. A tip 'o the hat to the breakfast-food boys! (Contact Richard J. Kline, 27 Richards Place, Battle Creek, if you'd like more information about this club.). . . . The Southern California Citizens Band Assn. (P. O. Box 17296, San Diego 17, Calif.) plans to name a "Mr. CB'er." He (or if it turns out to be a she—"Miss" or "Mrs." CB'er) will have to be, in general, a courteous person on and off the air in addition to having good operating skills. This is an excellent kind of promotion for any club to have. . . . A new club is the North Area Emergency Radio Team (NAERT), 4507 N. Charlotte, Kansas City, Mo. This group maintains a continuous "watch" on channel 21, and guarantees to help motorists stranded in the area—even at 3:30 a.m.! . . . Ever think about starting a club for walkie-talkie owners? They've done just that down in Cumberland, Md. Although walkie-talkies are unlicensed, and communications between them and regular CB'ers is forbidden, there are a lot of them around. The Cumberland "Walkie Talkie" Club boasts 34 members and has received good local press coverage. Wonder how many members will fill out "505" once the radio bug bites them. . . . "Coffee breaks" (informal club gatherings at a neighborhood eatery) seem to be an important activity for members of the Greater Dallas Citizens Band Club. Perhaps that is one of the reasons why its members seem to work together so smoothly; these informal get-togethers can turn a "guy with a call sign" into a good friend. —30—

Potentiometer Quiz Answers

(*Quiz on page* 86)

Many experimenters can intuitively come up with the correct answers to this quiz by examining each circuit, visually moving the potentiometer wiper arm, and estimating the output voltage. "E." In a sense, they plot the curves. You can do the same thing either by setting up the circuit on your workbench and measuring the voltage out as the wiper arm is rotated, or by mathematically computing the output voltage.

The computations and plotting of the curve for each problem can be easily done by drawing equivalent circuits for different positions of the potentiometer's wiper arm. In most cases, only five positions are needed. They are for wiper arm settings of zero (at point "1"), ¼ turn, ½ turn, ¾ turn and a full turn (at point "2"). Remember that all of the resistors and linear potentiometers have equal resistance value, and that a potentiometer set at ¼ turn will have one-quarter of its resistance between terminal 1 and the wiper arm and the remainder between the wiper arm and terminal 2. Potentiometers with center taps are just like the others except that the center tap permits connection to the mid-point of the potentiometer's resistance, which occurs at ½ turn of the wiper arm.

If you have a good sixth sense, or your computations are correct, you will agree with the answers given below.

1—D	3—B	5—F	7—E
2—G	4—C	6—H	8—A

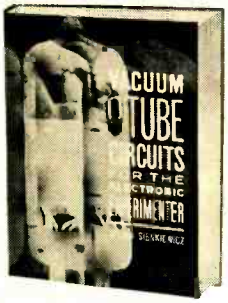
Computers Can Think

(*Continued from page* 72)

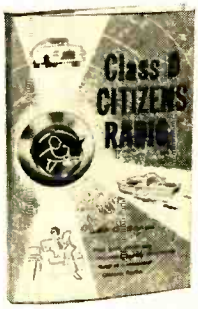
throw (4-p.d.t.) relays can be used with the coils of both relays connected in parallel.

There's Much More. You have just read how a problem in logic can be converted from a written thought into a schematic diagram; and if you care to build the simple computer, you will have converted thoughts into "hardware." Naturally, there are many more basic logical operations that cannot be covered here. Your

The most informative books for the experimenter and electronic hobbyist



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



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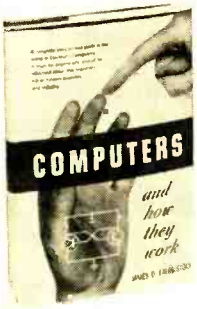

COMPUTERS AND HOW THEY WORK ***by James D. Fahnestock***
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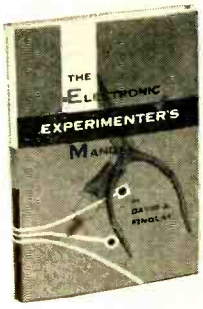

THE ELECTRONIC EXPERIMENTER'S MANUAL
by David A. Findlay
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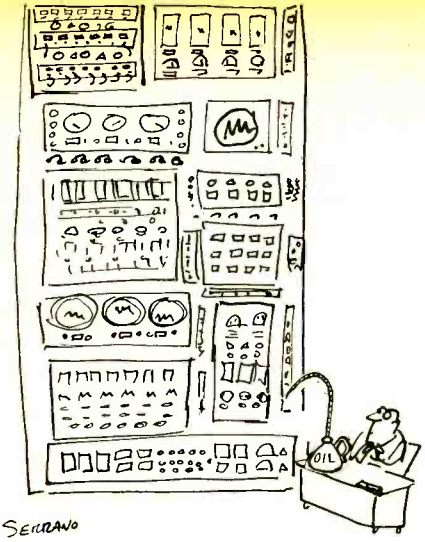

local public library or book store can be the source of a wealth of information which will open the growing new world of computers to you.

If you want to program a computer while you are learning, you may be interested in a "training" computer—the Minivac 601—a unique digital device made by the Scientific Development Corporation, 370 Main Street, Watertown, Mass. Designed to be programmed by the user, the Minivac 601 can be employed to set up the circuit in Fig. 5. Six instruction books supplied with the 601 are undoubtedly the finest beginner's guide to understanding computers. —30—

Transistor Topics

(*Continued from page* 80)

exact) we described in this column two portable transistorized oscilloscopes which were being manufactured by Tektronix, Inc. (P. O. Box 500, Beaverton, Ore.) and EI Labs (1165 Morena Blvd., San Diego, Calif.) respectively. During the intervening months, a number of other firms have developed and introduced transistorized 'scopes of their own design. Here's a quick review of the new units.

What is claimed to be the "world's first solid-state automatic digital oscilloscope" is now being offered by California Instruments Corp. (3511 Midway Dr., San Diego 10, Calif.). Identified as the Model 5000 automatic oscilloscope, it uses a 5" CRT and features a vertical amplifier with a bandwidth of 0 to 10 mc. and a maximum sensitivity of 50 mv./cm. Other features include automatic sweep speed, automatic d.c. positioning, automatic vertical sensitivity, and a digital readout on Nixie indicators. Measuring 14" x 8¾" x 22" and weighing approximately 20 lb., the Model 5000 sells for a "whopping" $1975.00.

Galaxy Laboratories, Inc. (3606 Midway Dr., San Diego 10, Calif.) is producing a portable transistorized oscilloscope with a vertical bandwidth of 0 to 15 mc. and a maximum sensitivity of 10 mv./division. Model 3015, measuring 7" x 8" x 14" overall and weighing 16 lb., is designed for operation on 105-125 volts, 60-400 cycles a.c., and draws about 15 watts. It sells for $950.00.

A husky, "militarized" transistorized oscilloscope is being offered by the Electronic Tube & Instrument Division of General Atronics Corp. (1200 E. Mermaid Lane, Philadelphia 18, Pa.). Featuring a vertical bandwidth of 0 to 6 mc. and a maximum sensitivity of 0.01 volt/division, the Model K-106 measures 8¾" x 6½" x 14" overall and weighs 23 pounds. It is equipped with a special snap-on front cover which protects the controls and CRT, and also provides space for such accessories as probes, connectors, and cables.

Allen B. DuMont Laboratories (750 Bloomfield Ave., Clifton, N. J.), a long-established name in the oscilloscope field, has introduced a "family" of solid-state 'scopes. They are available in rack-mounted, bench, and portable versions, and feature plug-in vertical amplifiers and time base (sweep) generators. Both single- and dual-channel vertical amplifier units are offered, along with a full range of accessories such as probes, cables, camera, and so on.

The DuMont instruments are somewhat larger than the other solid-state 'scopes now on the market, measuring (in the portable version) 8⅛" x 17¾" x 24" overall and weighing 27 pounds. Prices naturally vary with the plug-in amplifiers and generators you select. As an example, the basic portable oscilloscope, Model 765, sells for $645.00. A single-channel vertical amplifier, Model 7601, adds $385.00 to the basic price,

while the addition of a Model 7403 time base generator costs you $345.00 more.

Generally speaking, then, transistorized 'scopes meet a definite need, but they are still priced well beyond the reach of service technicians, hobbyists, and experimenters—except for those few individuals who have oil wells in their backyards!

Product News. A new series of 1-watt zener diodes is in production at International Rectifier Corp. (233 Kansas St., El Segundo, Calif.). Designated as Types 1N3016 to 1N3051, the diodes have voltage ratings from 6.8 to 200 volts, maximum current ranges from 3 to 100 ma., and are available in 5%, 10%, and 20% voltage tolerances.

Electrosolids Corp. (12740 San Fernando Rd. N., Sylmar, Calif.) is merchandising a unique transistorized device dubbed the Model 4000 "Son-r-lure." When the unit is placed in the water near a fishing boat, it generates a buzzing signal which attracts game fish. It sells for $8.95.

Once more, we must close. But as the "Bums" used to say, "Wait 'til next year"—or rather, next month!

—*Lou*

The 440 Fork

(*Continued from page* 65)

which should continue for as long as the power remains on. If the signal isn't sustained, move the two coils closer to the tuning fork. Also, recheck the hookup of these coils for proper phasing; if necessary, try reversing the leads to one coil or the other—not both!

Once you've obtained a continuous signal, turn the power off for a few seconds and then switch it back on. Note the length of time it takes before the signal builds up to full strength again, then adjust the position of the coils for the fastest start-up time.

With a sustained vibration of the tuning fork and a continuous 440-cycle sine-wave signal at its output jack, your tuning fork oscillator is now ready for use in any one of many possible applications. -30-

ELECTRONICS DATEBOOK

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

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

SEPT. 11-13
EIA Fall Conference
Biltmore Hotel, New York, N.Y.

SEPT. 13-14
Engineering Management Conference
Hotel Roosevelt, New Orleans, La.

SEPT. 13-14
Engineering Writing and Speech Symposium
Mayflower Hotel, Washington, D.C.

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

SEPT. 28-29
Broadcast Symposium (IRE)
Willard Hotel, Washington, D.C.

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

OCT. 2-6
New York High Fidelity Music Show
Trade Show Bldg., New York, N.Y.

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

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

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

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

The Master Magnet

(*Continued from page 52*)

available, copper best meets that requirement.

Electrical Hookup. If the a.c. line is connected between terminals 1 and 2 of the magnet coil (see Schematic "A"), current consumption will be in the neighborhood of 20 amperes—a bit excessive for use around the house. Connecting terminals 1 and 3 (Schematic "B") results in a current flow of about 4.25 amperes, but the strength of the magnet is reduced proportionately. In both cases, however, the current performs little useful work because, in this inductive circuit, it lags about 90° behind the voltage.

The lag can be partially offset by adding an 80-μf. phase-shifting capacitance as shown in the modified parallel-resonant circuit of Schematic "C." The current drawn from the line is then about 4 amperes, while the currents flowing between terminals 1 and 2 and terminals 2 and 3, respectively, are 18.5 amperes and 9 amperes. This hookup results in a more powerful magnetic field than that of either Schematic "A" or Schematic "B."

Maximum magnetic pull is obtained with the series-resonant circuit illustrated in Schematic "D." In this case, 17 amperes flows through the whole coil; and the magnet will hold six or more half-dollar coins, or an equivalent weight of any other non-ferrous metal, at one time.

The 80-μf. capacitance specified in Schematics "C" and "D" is built up by paralleling several smaller capacitors. These must be of the non-electrolytic type, with ratings of at least 250 volts if connected as in Schematic "C" or 600 volts if connected as in Schematic "D." Such capacitors are available for the least money in surplus stores—where they are usually easy to find. Units totaling less than 80 μf. could be employed, provided that they have the proper voltage ratings, but the current flowing through the magnet winding would be reduced.

Since high voltages appear across the capacitors, and since they are apt to retain their charge after being disconnected from the line, it's best to enclose them in a wooden or metal box. As an added precaution, the capacitors should always be discharged with a tool having an insulated handle before any work is done on the circuit.

Because of the peculiarities of the magnetic field around the copper washers, the magnet will not attract pieces of non-ferrous metals narrower than the inside diameter of the washers or wider than their outside diameter. Designing an electromagnet to attract pieces of metal narrower or wider than the range covered by this unit might be an interesting project for you experimenters.

A final word of caution: since the washers carry considerable current, they get quite hot under prolonged use. Heating can be kept to a minimum if the magnet is connected to the line only when necessary. —30—

The Lodestar

(*Continued from page 42*)

Masonite cross-member, and the sensing coil is ready for "prospecting!"

Trying It Out. No tricky adjustments are necessary to put the unit into operation. Set the tuning capacitor at about half-capacity, then adjust the tuning slug in coil *L2* until the "zero beat" is heard in the phones. Disregard any minor beats or whistles you may hear—the main beat-note signal will be very pronounced. If you have any doubt about the oscillators functioning, a quick excursion through the 1000-kc. region on an ordinary AM receiver will serve as an easy check.

Incidentally, capacitor *C5*, which couples the signal from the search oscillator to the mixer input, actually doesn't appear in the author's model—the proximity of this oscillator to the mixer induced enough coupling. Should additional coupling be necessary in your layout, simply install a "gimmick" capacitor for *C5*. The gimmick can consist of two 1" lengths of hookup wire which are twisted together. —30—

Short-Wave Report

(*Continued from page 62*)

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 call letters and the make and model number of your receiver.

Afghanistan—According to the latest information, *R. Afghanistan* is scheduled as follows: in Eng. to the Far East on 15,225 kc. at 0530-0600, and to S. E. Asia and Indonesia on 15,135 kc. at 0600-0630, with the Third Program on 4040 kc. at 0900-0930; in Urdu on 4040 kc. at 0830-0900; in Russian on 9705 kc. at 1230-1300; in Arabic on 15,225 kc. at 1300-1330; and in French to Europe on 15,225 kc. at 1330-1400.

Andorra—*R. Andorra* is noted on 6195 kc. from 1640 to 1800 s/off with music and ID's in Eng., French and German. Reports go to: *R. Andorra*, Post Box #1, Principality of Andorra.

Australia—Melbourne is being heard in French at 0030-0130 on 15,180 kc., in Eng. on 17,820 kc. at 2329-0045. *R. Australia* is heard well at 0600-0915 on 9570 and 11,710 kc.

Austria—OE164, Vienna, has been noted on 15,305 kc. with Eng. anmt, then native language; music to 2027; followed by weekly report. The schedule reads: to N.A. on 6155 kc. at 1800-2300; on 9770 kc. at 2000-2300; and on 15,305 kc. at 1800-2100.

Belgium—Brussels operates to N.A. at 1100-1145 on 11,850 kc., at 1615-1800 on 11,805 kc., and at 1815-2000 on 9705 kc. There is an Eng. mailbag on Saturdays at 1900.

Bolivia—One of the few Bolivians currently active is *R. Nacional*, La Paz, 5860 kc., heard in S. America from 2110 with a Spanish request program and some time checks. There is an ID at 2134.

Brazil—The following listing represents changes in Japanese language programming from Brazil: *R. Clube de Marilia*, 3255 kc., at 1800-1900; *Bauru R. Clube*, 3275 kc., at 1800-1915; *R. Presidente Prudente*, 3335 kc., at 0700-

NNRC Dinner

The Annual Dinner of the Newark News Radio Club will be held on Saturday, October 13, at "The Cabin In The Sky," Atlantic Highlands, N. J. You do not have to be a club member to attend. Tickets (at $5.00 each) may be obtained from your Short-Wave Editor.

0730; *R. Brasil,* 4755 kc., at 0400-0500 and 1515-1545; *R. Emissora de Piratininga,* 6025 kc., at 0330-0500 and 1800-1900; *R. Emissora de Paranaense,* 9545 kc., at 0550-0700; and *R. 9th of July,* 9620 kc., at 0415-0500, 1000-1100, and 1700-1730.

Bulgaria—Sofia broadcasts Eng. to Africa at 1130-1155 on 15,330 and 17,800 kc. and at 1505-1530 on 11,850 and 15,330 kc.; to the United Kingdom at 1630-1700 on 9700 and 6070 kc. and at 1430-1500 on 9700 kc.; to N.A. at 2000-2030 and 2300-2330 on 9700 kc. There is a daily concert to N.A. and the United Kingdom at 1835-1900 on 9700 kc.

Chile—When conditions prevent reception of *R. Australia* on 11,740 kc. around 1100, a

Bruce Alan Coleman, WPE2GNX, of Westfield, N. J., tells us that he does his DX'ing with a Hallicrafters S-38EB and "great patience." Now 13, Bruce became interested in short-wave radio about a year and a half ago. His QSL card total is up to 29.

check of the frequency may turn up *R. Nuevo Mundo,* Santiago. It has been heard only once in the mid-west with opening in Spanish at 0100.

Colombia—HJFN, *R. Neiva,* Neiva, has moved from 4855 to 4869 kc., where it is noted from 2253 to 2357 s/off with Latin American music. Reception on the new channel suffers from severe teletype QRM.

Cuba—Havana has been noted broadcasting to N.A. at 2200-0100 on 11,840 kc., a new channel which replaces 5990 kc., and is dual to 11,875 kc. Also noted on 11,962 kc. at 1245 with music, 1253 with ID and address. Another possible new channel is 11,920 kc., noted from 0130 with talks in Spanish.

Czechoslovakia—Prague has changed the times of the N.A. xmsn to 2000-2055 and 2330-0030 on 7345, 9550, 9795, 11,990, and 15,285 kc. (15,285 kc. being replaced by 11,745 kc. at 2330). The Eng. xmsn to New Zealand, Australia, Japan, and the Far East has been changed to 0300-0355 on 21,450, 15,285, 15,245, and 11,725 kc.

Finland—The new schedule from Pori reads as follows: Eng. to N.A. at 1000-1130 on Mondays and Fridays on 9555, 11,805, 15,190 kc.

Germany (East)—*R. Berlin International,* 9560 kc., has changed the Eng. xmsn times to N.A. from 1930 and 2100 to 2000 and 2130. A German program follows the 2000 Eng. newscast.

Ghana—The latest Eng. schedule from Accra reads: 6070 kc. at 1630-1715 and 9545 kc. at 1000-1045, 1200-1245, 1500-1545, and 1630-1715 to W. Africa; 11,800 kc. at 1330-1415 to Sudan and Ethiopia, and at 1550-1635 to Europe; 15,287 kc. at 1500-1545 and 17,740 kc. at 1000-1045 to S. Africa; and 21,545 kc. at 0915-1045 to E. Africa.

Israel—A reader in Jerusalem sent in this new schedule: Tel Aviv, on 9009 kc., operates to South America at 2315-2330 in Yiddish; to S. Africa at 1100-1130 in Yiddish and at 1130-1200 in English; to Europe at 1315-1345 in Persian, at 1345-1400 in Ladino, at 1400-1415 in Rumanian, at 1415-1430 in Hungarian, at 1430-1445 in Hebrew, at 1445-1515 in French, at 1515-1545 in Eng.; to W. Africa at 1600-1630 in Eng., and at 1630-1645 in French. Tel Aviv also operates on 7189 kc. (with 20 kw.) and 9725 kc. (with 7500 watts) in Arabic at 0030-0115, 0615-0715, and 1030-1615. The 9009-kc. outlet is rated at 50 kw.

Japan—The new schedule for the General Services of *R. Japan* has been adjusted to: 1000-1030 and 1100-1130 on 11,815, 11,855, and 11,725 kc.; 2000-2030. 2100-2130, 2200-2230, 2300-2330, and 0000-0030 on 15,105, 15,195, and 17,755 kc.; 0100-0130, 0200-0230, 0300-0330, 0400-0430, and 0500-0530 on 11,725, 11,855, and 15,195 kc.; 0600-0630, 0700-0730, 0800-0830, and 0900-0930 on 11,725, 11,815, and 11,855 kc.

Liberia—The current operating schedule from ELWA, Monrovia, reads as follows: Tuesdays only to N.A. at 1956-2230 on 11,825 and 9660 kc. and to S. America at 1657-1945 on 15,155 kc. Other xmsns, all reportedly in Eng. (but this has not been confirmed by your Short-Wave Editor): to Nigeria at 2345-0300 and 0555-0830 on 11,975 kc. and at 0842-1330 on 11,790 kc.; to local areas at 0112-0430 on 4770 kc.; to the Congo at 1027-1300 on 15,155 kc.; to W. Africa at 0112-0430 on 3225 kc. and at 1357-1730 on 4770 kc.; to the Near East at 1309-1430 on 15,155 kc.; to Liberia at 0742-1745 on 3225 kc.; and to N. Africa at 1433-1630 on 15,155 kc. They are all listed as being on the air Monday through Saturday.

Malaya—ZLH10, *R. Malaya* (Blue Network), Singapore, 7200 kc., is noted in Western Canada in Eng. from 0030 on Mondays and Thursdays only.

Netherlands—Hilversum now beams Eng. to N.A. and Europe at 1630-1720 on 9715 kc. (new), dual to 11,730 kc. (also dual to 6020 kc. to Europe).

Norway—*Norsk Rikskringkasting,* Oslo, sends this new schedule: to S. America, Mid and S. Atlantic areas at 1800-1930 on 17,825, 15,175, 11,850, and 6130 kc.; to N.A., N. Atlantic, and Caribbean areas at 2000-2130 and to N. Atlantic, Western N.A., Pacific areas, and E. Africa at 2300-0030 on 15,175, 11,850, 9610, and 6130 kc. "Norway This Week" is broadcast in Eng. during the last half hour on Sunday in each of the xmsns listed. *R. Norway* also suggests that listeners who are troubled by jamming try for the medium-wave outlet on 1578 kc.; the broadcast-band fellows report hearing it at times.

Peru—A new station is OAX7Z, *R. Juliaca*, Juliaca, 5780 kc. It has been noted at 1830-1907 with music and time checks but no commercials, all-Spanish. Other rarely reported stations heard (in Brazil) are: OAX8V, *R. Eco*, Iquitos, 5010 kc., also new and testing irregularly from about 2332 to 0000 s/off; OAX6B, *R. Landa*, Arequipa, 6038 kc., at 2341-0006; OAX1A, *R. Delcar*, Chiclayo, 6700 kc., at 2254 with music and many ads. All of these stations were noted using Spanish only.

Poland—While not beamed to N.A., Eng.-language xmsns from Warsaw can be found at 1530-1600 on 7285 and 9675 kc. and at 1630-1700 on 7125, 9540, and 11,365 kc.

Portugal—Eng.-language xmsns from Lisbon are beamed to N.A. at 2100 and 2245 on 6025 and 6185 kc.; to Europe at 1315 on 6025 kc.; to Africa at 1315 on 17,895 kc.; and to S. E. Asia at 0815 on 21,495 kc.

Singapore—The British Far Eastern Broadcast Station, Singapore, 15,455 kc., has been noted from 0640 with a discussion program relay from London. An ID is given at 0644.

South Africa—According to a recent radio bulletin, Paradys operates for Africa on 21,690 kc. at 0600-1045; on 15,085 kc. at 1045-1400; on 11,900 kc. at 1230-1500; on 11,865 kc. at 0600-1230; and on 9660 kc. at 1400-1500. English is broadcast on Tuesdays, Thursdays, and Saturdays; on other days Afrikaans is used. There is a French news bulletin at 1305-1310 daily, Monday through Friday. DX'ers needing this country might also try 6095 kc. on Sunday evening around 2335-2358. All reports go to: Chief Engineer, South Africa Broadcasting Corp., Box 8606, Johannesburg.

SHORT-WAVE ABBREVIATIONS

annt—Announcement	N.A.—North America
Eng.—English	QRM—Station interference
ID—Identification	R.—Radio
kc.—Kilocycles	s/off—Sign-off
kw.—Kilowatts	xmsn—Transmission

Sweden—*R. Sweden*, Stockholm, is operating to N.A. as follows: to Eastern N.A. on 11,805 kc. at 2000-2045 in Swedish and at 2045-2145 in Eng., and on 17,840 kc. at 0900-0930 in Eng.; to Western N.A. on 11,805 kc. at 2130-2215 in Swedish, at 2215-2245 in Eng.; to Mexico and Central America on 11,805 kc. in Spanish. The National Program is also broadcast at 0000-0400 on 6065 kc. (Program I), at 0400-0715 on 11,880 kc. (Program I), and at 1200-1630 on 6065 kc. (Program II). These xmsns are non-directional; they can be heard best in Europe, and in certain areas of the Mid-Atlantic and Africa.

Switzerland—The latest Berne schedule reads: to United Kingdom and Ireland at 1345-1500 on 9545 and 7210 kc.; to N.A. at 2030-2145 and 2315-0000 on 6165, 9535, and 11,865 kc.; to Australia, New Zealand, and the Far East at 0400-0515 on 11,865, 15,315, and 21,520 kc.; to S. E. Asia and Japan at 0745-0900 on 9665, 15,315, and 21,520 kc.; to India and Pakistan at 0945-1100 on 11,865, 15,315, and 17,795

Lucky DX'ers recently received one of these special QSL cards from the Swiss Broadcasting Corporation. A limited number were made up to celebrate the official opening of the SBC's new studios at 1 Giacomettistrasse in Berne.

kc.; and to the Middle East at 1145-1300 on 9665 and 11,865 kc. All of the above xmsns are in English.

Surinam—AVROS, *R. Surinam*, Paramaribo, 15,462 kc., is noted with music and commercials at 2003-2105, news at 2100, all-Dutch. An Eng. xmsn is listed for 2030 daily, dual to 4852 kc.

Turkey—English from Ankara is broadcast at 0845-0915 on 17,820 kc. (to Asia), at 1645-1730 on 7285 kc. (to Europe), and at 1815-1900 on 9515 kc. (to N.A.). Foreign-language xmsns from Ankara are scheduled as follows: on 17,820 kc. at 0800-0830 in Peshtu, at 0830-0845 and 1000-1030 in Persian, at 0915-0945 in Urdu, at 1030-1100 in Arabic; on 9745 kc. at 2330-0000 in Arabic; on 9515 kc. at 0600-0700 and 1100-1115 in Turkish, at 1230-1245 in Arabic, and at 1745-1800 in Spanish (to S. America); on 7285 kc. at 1115-1130 in Greek, at 1130-1145 in Serbo-Croatian, at 1145-1200 in Rumanian, at 1200-1215 in Bulgarian, at 1345-1400 in Hungarian, at 1400-1415 in Polish, at 1415-1445 in German, at 1445-1515 in Italian, at 1515-1545 in French, and at 1545-1615 in Turkish.

Windward Islands—A letter from the Windward Islands Broadcasting Service, St. Georges, gives this new schedule: 1030-1230 on 6080, 9520, and 5010 kc. (15,085 kc. has been temporarily discontinued); 1500-1740 on 5010 and 15,085 kc.; and 1745-2115 on 9815 and 3280 kc. There is a special program to the British Isles on 15,240 kc., but no times were listed. Broadcasts are beamed to Jamaica and/or the Eastern Caribbean. Reports go to Mr. R. A. Smith, Technical Director, WIBS, Broadcasting House, St. Georges, Grenada, The West Indies.

Utility—Two coastal stations which may be of interest to our readers are *Hollandia Radio*, Hollandia, Netherlands New Guinea, on 8776 kc., and *Nuku'alofa Radio*, Tonga Islands, on 2182 kc. The former is heard at times in the non-broadcast phone service and is scheduled weekdays only at 1900-2100. The latter maintains radio-phone service with ships at various times between 1240 and 0440 daily and may be quite difficult to log. —30—

SHORT-WAVE CONTRIBUTORS

Paul Gough *(WPE1ASX)*, W. Newton, Mass.
Paul Burns *(WPE1DRB)*, Montpelier, Vt.
Robert Kokko *(WPE1DSI)*, Needham, Mass.
Richard DiLalla *(WPE1DTW)*, Trumbull, Conn.
Ronald Grzelak *(WPE1DWA)*, Willimansett, Mass.
Gene Molter *(WPE1IW)*, Needham, Mass.
Robert Biglands *(WPE2CTS)*, Angola, N.Y.
Edward Light *(WPE2FBT)*, New York, N.Y.
Dave Listort *(WPE2FGX)*, Elmont, N.Y.
Henry Marbach *(WPE2FHU)*, White Plains, N.Y.
Jeffrey Newbro *(WPE2FVZ)*, Great Neck, N.Y.
Dennis Austin *(WPE2FZU)*, Olean, N.Y.
Martin Rosenzweig *(WPE2GOQ)*, Levittown, N.Y.
George Fank *(WPE2GQD)*, N. Valley Stream, N.Y.
Frank Diehl *(WPE2GUJ)*, Buffalo, N.Y.
George Derringer *(WPE2GVZ)*, Newburgh, N.Y.
Nicholas Nicastro *(WPE2HHS)*, Hoboken, N.J.
John Linzmayer *(WPE2HNT)*, S. Amboy, N.J.
Harvey Stern *(WPE2HSO)*, New York, N.Y.
Bill Dickerman *(WPE3BEB)*, Williamsport, Pa.
Frank Raftovich, Jr. *(WPE3BOG)*, Chester, Pa.
J. L. Ekblom *(WPE3BPJ)*, Williamsport, Pa.
Alfred Ioppolo *(WPE3CUG)*, Philadelphia, Pa.
Jack Cunningham *(WPE3DOV)*, Silver Spring, Md.
Gene Pearson *(WPE4AIX)*, Birmingham, Ala.
Grady Ferguson *(WPE4BC)*, Charlotte, N.C.
S/Sgt. R. C. Watts *(WPE4CMR)*, APO, New York, N.Y.
Theodore Lawson, Jr. *(WPE4CXV)*, Nashville, Tenn.
Edward Odom *(WPE4EDQ)*, Mobile, Ala.
James W. Phillips *(WPE4EDV)*, Waverly, Va.
Ernest Childs *(WPE4EMV)*, Charleston, S. C.
Robert Stack *(WPE4ESP)*, Columbia, Tenn.
Billy Akin *(WPE4EUW)*, Columbia, Tenn.
Bruce Churchill *(WPE4EVD)*, Pensacola, Fla.
Delmar Ihle, Jr. *(WPE4EWT)*, Memphis, Tenn.
Pat Griffin *(WPE4EXS)*, Tuscaloosa, Ala.
Pat Dyer *(WPE5ABW)*, San Antonio, Texas
William Bing *(WPE5AG)*, New Orleans, La.
John Frazier *(WPE5AUU)*, Tyler, Texas
James Coston *(WPE5CEP)*, Winfield, Texas
Larry Altman *(WPE5CGR)*, Hedley, Texas
William Kraus *(WPE5CGT)*, Albuquerque, N.M.
Ted Drew *(WPE6CMS)*, Arcadia, Calif.
Greg Kordes *(WPE6DDT)*, Anaheim, Calif.
Charles Matterer *(WPE6DGA)*, San Leandro, Calif.
Steve Coombes *(WPE6DIE)*, Arcadia, Calif.
David Ryan *(WPE6DKU)*, El Segundo, Calif.
John Langdell *(WPE6DLH)*, San Francisco, Calif.
Robert Kipp *(WPE8BBL)*, Detroit, Mich.
Gary Cook *(WPE6DJW)*, Lansing, Mich.
Thomas Ebeling *(WPE8DOA)*, Wheeling, W.Va.
John Udvari *(WPE8EDM)*, Akron, Ohio
Dennis Marquart *(WPE8ELK)*, Sandusky, Ohio
Mike Kander *(WPE8MS)*, Dayton, Ohio
Robin Fisher *(WPE8OG)*, Beach City, Ohio
Richard Powers *(WPE8WH)*, Detroit, Mich.
Stanley Head, Jr. *(WPE8YC)*, Huntington, W.Va.
Don Griffith *(WPE9CGF)*, Evansville, Ind.
Jan Jackson *(WPE9CVB)*, Spring Green, Wis.
Dan Hillyer *(WPE9DBN)*, Streator, Ill.
Kenneth Shafer *(WPE9DCK)*, Whitestown, Ind.
Dennis Streveler *(WPE9DFJ)*, Hammond, Ind.
Lawrence Baron *(WPE9DKF)*, Skokie, Ill.
Daniel Lyon *(WPE9DMJ)*, Lincolnwood, Ill.
J. P. Arendt *(WPE9DN)*, Aurora, Ill.
Daniel Weinstein *(WPE9DST)*, Madison, Wis.
Franklin Bayuk *(WPE9DUJ)*, Greenwood, Wis.
Michael Peters *(WPE9EEC)*, Burnett, Wis.
Eddie Coven *(WPE9EGJ)*, Hammond, Ind.
William Foley *(WPE9EKH)*, Depauw, Ind.
Robert Frey *(WPE9IP)*, Niles, Ill.
John Beaver, Sr. *(WPEØAE)*, Pueblo, Colo.
Bill Holscher *(WPEØATE)*, Webster Grove, Mo.
Ron Moore *(WPEØCCV)*, El Dorado, Kansas
Jack Perolo *(PY2PE1C)*, Sao Paulo, Brazil
Gregg Calkin *(VE1PE3L)*, Saint John, N.B.
Brad Watson *(VE3PE1HJ)*, Port Credit, Ont.
Halid Carim *(VE3PE1L4)*, Ottawa, Ont.
Richard Laviolette *(VE7PE2M)*, Richmond, B.C.
Eddie Burchfield, Mississippi City, Miss.
Stanley Cohen, Philadelphia, Pa.
S. G. Kellerman, San Pedro, Calif.
Bentley La Montagne, N. Babylon, N.Y.
John McDermott, Franklin Lakes, N.J.
Daniel Rosenne, Jerusalem, Israel
Nils Young, Dayton, Ohio

Across the Ham Bands

(*Continued from page 77*)

The length of the stub can be calculated from the formula: $L = 2420/F$, where L is the length in inches, and F is the interfering frequency in megacycles. For an interfering frequency of 50 mc., for example, the length would be 48.4 inches.

For best results, cut the stub slightly "long," connect it to the TV set, and trim off $\frac{1}{4}$" pieces from the end until you reach a point of minimum interference. A word of caution, though. Don't trim a six-meter stub too short, or you may spoil reception on Channel 2.

News and Views

Greg Rolfe, WNØBNX, 1859 Flandrau, St. Paul 9, Minn., has been tickling the 40-meter ionosphere for a month with his Heathkit DX-40 transmitter. The DX-40 feeds a 40-meter dipole 20" high, which, in turn, feeds most of its power into a nearby rain gutter; nevertheless, Greg has worked 15 states. A Hallicrafters S-38E receiver processes incoming signals. . . . **Don Ward, WN4AAL,** 206 Linden St., Arden, N.C., uses a Globe Scout 680-A transmitter, a doublet antenna, and a National NC-57 receiver on the 80-, 40-, and 15-meter Novice bands. Don will sked anyone who needs a North Carolina contact or who wants to be nominated for the RCC (Ragchewer's Club)—he QSL's 100%, incidentally. And, if you have the August, 1960, issue of P. E. available, Don recommends the transmit-receive switch we described in that issue—at least six of his friends also use it. . . . **Bob Tucker, KN1VWN,** 80 Fairbanks Ave., Wellesley Hills, Mass., keeps the 2-meter Novice phone band hot in his area with a Heathkit "Twoer" transceiver, and a 7-element beam on an Alliance "Tenna Rotor." In three months he made over 200 contacts in three states. By the time you read this, Bob will also be operating CW on the other Novice bands.

Richard Nadelson, WA2MJF, 688 Longacre Ave., Woodmere, N.Y., has exchanged the "N" in his call letters for an "A," but he wants the world to know that he worked 40 states and 25 countries as a Novice. The scene of the battle was 15 meters; the weapons, an EICO 720 transmitter, a 3-element, 15-meter beam, and a Hallicrafters SX-111 receiver. . . . Just as Chip, K9IGR, was about to give **Frank Cantwell,** 622 Monroe St., River Forest, Ill., his Novice code test, the code oscillator gurgled off into silence. Un-

POPULAR ELECTRONICS
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Ad Index

daunted, Chip went over to the grand piano and gave the test on it. Frank's new call letters are **WN9CTP**—who says piano lessons are a waste of time? . . . . **George M. Churpek, K8VPX,** RD #1, Huron, Ohio, is another General who started his radio career as a POPULAR ELECTRONICS registered SWL (WPE8BUQ), then got his Novice license, and finally his General ticket. As a General, George still uses his Heathkit DX-40 transmitter and Hallicrafters S-108. He works some phone but still prefers CW; a 20-wpm ARRL code-proficiency certificate proves that he can copy it. Check with George for a sked or if you need help with either code or theory.

David Johnson, KN7RMV, 2715 S.E. Kelly St., Portland, Ore., can give lessons to many more-experienced hams in the art of getting out. In 4½ months, he has worked 46 states —all confirmed—16 contacts in Japan, two in Okinawa, one in Puerto Rico, two on Midway Island, and one in New Zealand! Puerto Rico, Midway, and one of the Japan stations were worked on 40 meters—the rest on 15 meters. A Globe Scout Deluxe running 75 watts, a 40-meter dipole, and a 15-meter vertical antenna, plus a Hammarlund HQ-145XC receiver and good operating are the secret ingredients Dave uses. . . . **Ted Leonberger, KN3RCI,** Rt. #2, Rockwood, Pa., was a railroad telegrapher for 15 years, which probably didn't hurt when he took the Novice code test. Ted prefers 80 meters and has worked 28 states and two Canadians on this band. He transmits on a Hallicrafters HT-40K transmitter, assembled from a kit, feeding a 5-band "trap" antenna about 45′ high. A National NC-109 does his receiving.

If you know something about basic electricity and electronics, and would like to try your hand at writing a column for fun and experience, contact **Richard D. Roll, WPE2ALE,** President, North American Shortwave Association, 265 Stillwell, Hamburg, N.Y. You'll probably end up as a contributing editor of the "NASA" bulletin. . . . **Bobby Webb, WN5CAC,** 2003 W. Capitol St., Jackson, Miss., uses the Hallicrafters twins—an HT-40 transmitter and an SX-140 receiver—tied to a dipole antenna 30′ high. Bob didn't tell us which bands he operates on, but he has worked 19 states, 16 confirmed.

Ronnie Long, K7NUQ, 2835 E. Lincoln St., Idaho Falls, Idaho, worked five countries with a home-brew 35-watter. He now works all bands (6 through 80 meters), and will sked anyone needing an Idaho contact. . . . **Tony Anderson, WV6YDX,** 210 South Montague Ave., Fullerton, Calif., likes to rag-chew on 40 meters with his Heathkit DX-40 transmitter exciting a 40-meter dipole. Tony receives on a Heathkit AR-3 aided by a QF-1 Q-multiplier. Although he prefers a good chat to DX-chasing, Tony has worked 14 states in two months on the air.

Would *you* like to be represented in "News and Views?" If so, write and tell us about your ham activities. Send your letters to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana. Until next month, 73,

Herb, W9EGQ

ELECTRONICS MARKET PLACE

RATE 60¢ per word. Minimum 10 words prepaid. October issue closes August 6th. Send order and remittance to Martin Lincoln, POPULAR ELECTRONICS, 1 Park Ave., New York 16, N. Y.

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TRANSFIRE Transistor electronic ignition. Saves gas, tune-ups. Points, plugs last to 100,000 miles. Top performance, improved starting. Parts, Complete systems, Kits, from $34.95. Literature. Palmer Electronics, 40E, Carlisle, Massachusetts.

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WPE-CB-QSL cards—Brownie-W3CJI—3110A Lehigh, Allentown, Pa. Catalogue with samples 25¢.

CB WPE QSL Cards, Finest Quality, Multicolor, 10¢ For Samples. Radio Press, Box 24, Pittstown, New Jersey.

INVESTIGATORS, write for free brochure on latest subminiature electronic listening devices. Dept. 9A, Ace Electronics 11500 NW 7th Ave., Miami 50, Fla.

CONVERT any television to sensitive, big-screen oscilloscope. Only minor changes required. No electronic experience necessary. Illustrated plans, $2.00. Relco Industries, Box 19563, Houston 18, Texas.

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TRANSISTOR Ignition Coil and construction manual. Special $8.50. Anderson Engineering, Wrentham, Mass.

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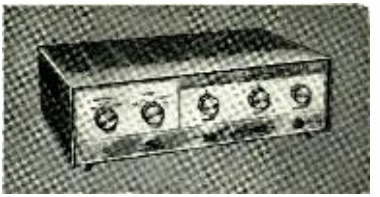

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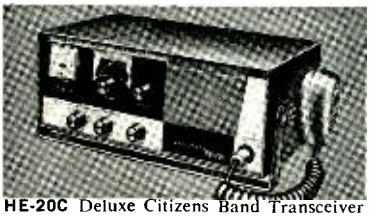

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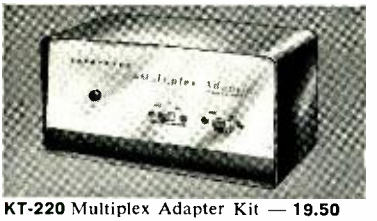

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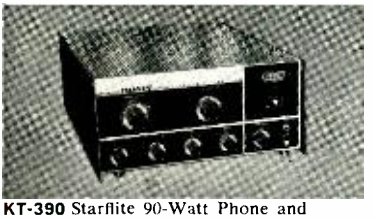

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