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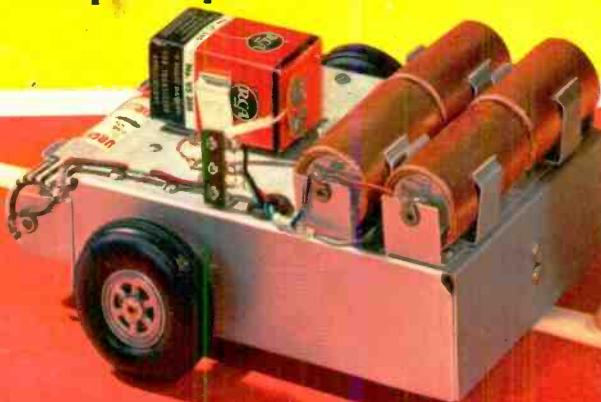
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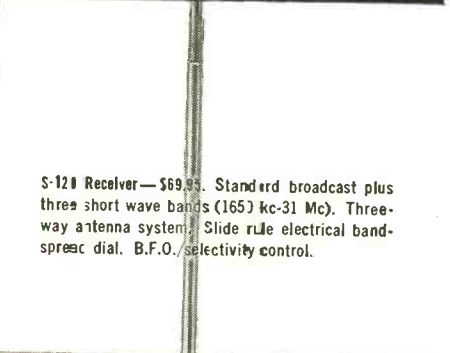
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to Periodical Literature

This month's cover photo by Joe Petrovec

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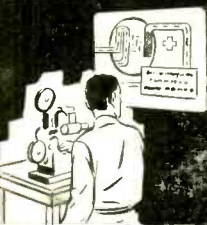
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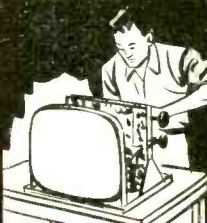
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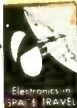
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POP'tronics

NEWS SCOPE



- ◀ 100-LB. SHE E.E.—Out New Mexico way, pretty Joy Arthur asked not what her country could do for her, but what she could do for her country. Joy, a Purdue University graduate, is a project engineer at White Sands Missile Range, and her job takes her to telescope sites spread over an area of 5600 square miles. Joy decided to free her driver for other work by learning how to drive a heavy truck through the mesquite and boulders of America's only overland missile range. It took a lot of spunk, but she completed the heavy-truck training which included maintenance as well as driving skill. Quite an accomplishment for a little Philippine girl who became a citizen less than a year ago!



- ◀ TELESCOPE "RADAR"—LASER light is being tested for radar application by this dual-telescopic device designed at the U.S. Army Signal Research and Development Laboratory, Fort Monmouth, N.J. A pencil-thin beam of ruby-red light is fired at a distant object from one of the telescope tubes, and the reflection is registered in the other. The time it takes for the light to make a round trip gives an exact measure of the target's distance. It has been calculated that a LASER light beam a half inch wide, when properly focused, will spread less than two feet in a mile. Working in conjunction with standard radar devices, LASER light may well improve radar detection capabilities on earth as well as in the far reaches of outer space.



- ◀ HIGHWAY BIG BROTHER keeps an eye on motorists traveling along the busy John C. Lodge Freeway in Detroit. The General Electric closed-circuit television system helps the Michigan State Highway Department provide safer, faster, more convenient traffic flow on the six-lane route. Shown in the photo is the central control room where monitors display 14 camera images, providing the observer with a continuous view of a critical three-mile stretch of the Lodge Freeway. Prompt action is taken when congestion, emergencies, and stoppages occur. Speed limits can be reduced, lanes closed, and entrance ramps shut off—all from the operator's chair in front of the TV panel. In addition, the closed-circuit TV provides information on motorist behavior and reaction in high-speed traffic situations that may well influence future multi-lane freeway construction.



- ◀ POOL-SIDE ROMEOS will be on the lookout for these pretty lassies come summer. Why? Obviously, the attraction will be the new Toshiba 6-transistor superheterodyne which the Transistor World Corp. plans to market this year. The set is water-resistant and floats like a cork. The radio's screw-together case and silicon-coated speaker cone will help provide good listening in the water or out.

(Continued on page 8)

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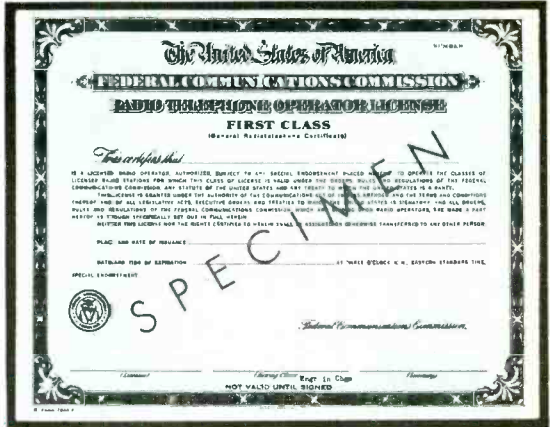
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The streamlined Grantham course is designed specifically to prepare you to pass certain FCC examinations. All of the instruction is presented with the FCC examinations in mind. If your main objective is an FCC license and a thorough understanding of basic electronics, you want a course that is right to the point — not a course which is "padded" to extend the length of time you're in school. The study of higher mathematics or receiver repair work is fine if your plans for the future include them, but they are not necessary to obtain an FCC license.

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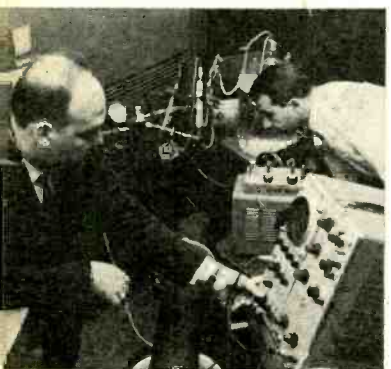
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NEWS SCOPE

Continued

◀ **LISTENING COMPUTER**—The ultimate in computers may very well be a machine that accepts oral commands, types out corporation balance sheets, evaluates census data, types letters to delinquent accounts, and performs many more still unthought of services. An experimental, but successful, voice recognition machine was demonstrated recently by its inventor, William C. Dersch, an IBM engineer. Tabbed the "Shoebbox" because of its size, the device does arithmetic on an adding machine at voice command. Shoebbox recognizes 10 digits spoken naturally to it, as well as six control words instructing it to perform such arithmetic as plus, minus and total. When told, "seven plus three plus six plus nine plus five, sub-total," Shoebbox converts the sounds to electrical pulses and programs the adding machine which prints out "30."

◀ **SILENT SENTRY** is a highly portable transistorized radar that reaches out through darkness, fog, and smoke to pick up and locate enemy soldiers and vehicles. A joint effort of the U. S. Army and the Sperry Gyroscope Co., it is the lightest ground surveillance radar yet produced. Although a two-man team normally operates the Silent Sentry, it can, if necessary, be set up and operated by one man. The use of batteries (providing silent operation) gives added security against detection; however, an engine-driven generator may be used when tactical conditions permit. A well-trained operator can not only distinguish men from moving vehicles but can also tell whether a man is walking or crawling by interpreting the tone in the headset. The Silent Sentry may replace the K-9 Corps and take canned dog food off the Quartermaster's inventory.

◀ **RAIN, RAIN, GO AWAY!** But before it does, New York University scientists will have recorded the size and number of drops, regardless of whether the precipitation is a slight drizzle or a heavy downpour. The data collected is automatically placed on punched tapes and eventually fed to a computer. From sorted and stored data, weathermen will learn more about how rain is formed, be able to perfect new radar water particle detection equipment, obtain new insights into soil erosion, and even help engineers design supersonic aircraft and jet engines with protection against rain damage.

◀ **HAIL THE QUEEN**—The first Miss Amateur Radio, Miss Marilyn Meyers, WV6RXU, has been selected and will reign over the 1962 Southwestern Division of the American Radio Relay League Convention to be held at the Disneyland Hotel in June. Queen Marilyn, who resides in Pasadena, is 21 years old, a graduate of Pasadena City College, and a former secretary of the San Gabriel Ramona Radio Club. Her Majesty became interested in amateur radio through mutual friends and received her ticket about nine months ago. Now let's see if Florida can come up with a W4 queen.

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Washington Correspondent

Latest Flash on Tone Signals

A QUICK and easy way for a *progressive* Class D Citizens Band radio licensee to get himself ordered right off the air by the FCC is to follow the latest fad and equip his CB station with a do-it-yourself electronic signaling circuit which does nothing but send out a tone or whistle signal, thereby adding distinction to his station. Since this fad seems to be becoming standard operating procedure in some CB areas, a number of licensees were prompted to check its legality. They discovered that the use of identifying tone signals does *not* have the blessing of the Commission.

The FCC is trying to get "the word" out to CB'ers before the electronic signaler causes a national crisis in the Citizens Radio Service of the same magnitude as that stemming from the original misconception by thousands that the CB service was to be a poor man's "ham" band. Specifically, the Commission is advising its licensees that "the use of tones, whistles, bird calls, etc., for no purpose, or for no purpose other than to attract the attention of persons hearing them, is not authorized for Class D Citizens stations."

According to the agency, there is a perfectly *valid* place in the Class D service for tone signals or signaling devices used to establish and maintain voice communications between stations. But these tone signals are not to be used to let anybody who might be tuned to the channel you're using know that your station is transmitting. An example of a permissible arrangement, the FCC says, "is the transmission of a tone of a particular frequency (i.e., subaudible) to turn on the loudspeaker of a *receiver which is designed to respond only to that specific tone,*" in order to "provide relief from hearing unwanted voice communications addressed to other stations."

Field inspectors of the FCC are on the
(Continued on page 14)

THE TURNER 254C

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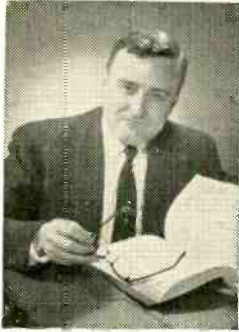
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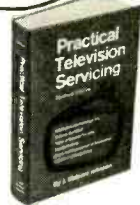
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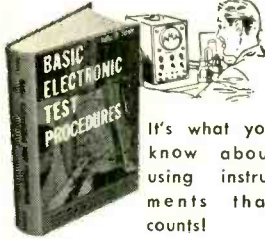
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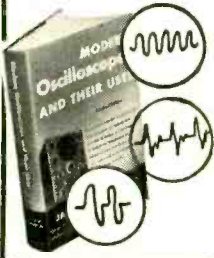
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FCC Report

(Continued from page 10)

lookout for abuses of the tone signaling feature, so if you're wired in for a signaller at the moment, get unwired—unless you're sure your tone signal setup is permissible.

Spectrum Space. In the ground swell of opinion reaching Washington with respect to the crowded condition on the two-way communication frequencies, CB'ers are being called on to take a real stand.

Manufacturers of mobile radio equipment, of all types, are pointing out that there is no reasonable place to turn for communication growth other than the television frequencies which are unused in many areas of the country, and little used in other sections. And the users of the two-way equipment for business, industry, and public safety purposes are becoming willing partners in the request for additional frequency space for their needs.

Citizens Band licensees are going on record at the Commission and in the halls of Congress in growing numbers in support of better overall frequency spectrum management by the government—to ease the current situation in which the military has a lock on a substantial portion of the spectrum and television allocations have sewed up most of the remainder of the frequencies.

Look for increased efforts by communications people in the coming year to dispel the opinion being planted by current v.h.f. TV broadcasters that television needs both the 12 v.h.f. TV channels and the 70 u.h.f. channels which are now lying dormant in most parts of the nation.

The FCC is attempting to boost the use of u.h.f. television through "deintermixing" television areas, that is, setting up u.h.f. "islands" so that the u.h.f. stations will not have to compete with v.h.f. stations. The big point expected to be pushed by the two-way communications users who urgently need additional frequency space is that the current TV deintermixture proposals—as well as longer range plans to move all of television to the u.h.f. spectrum—are based on the premise that the country will receive more and better television than before.

The proposals are to be geared so that the individual TV set owner will not be affected by the transition from v.h.f. to u.h.f. Since the plan would be put into effect over a long enough period of time, all existing v.h.f. receivers will have become obsolete by the time the program is completely u.h.f.

The first real drive by the communications industry to let the general public know that it needs frequency space for the good of the country has begun.

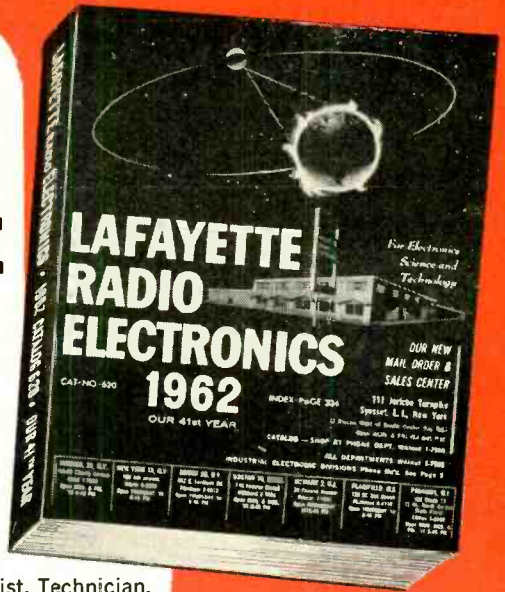
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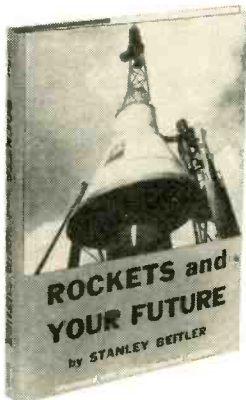
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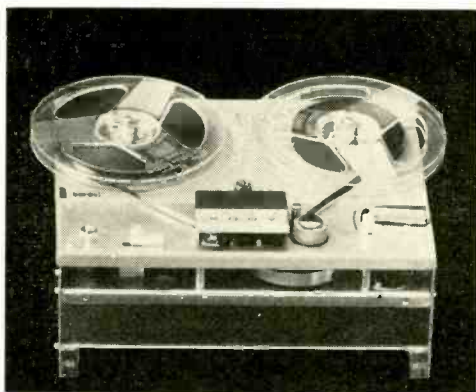
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(Continued on page 19)

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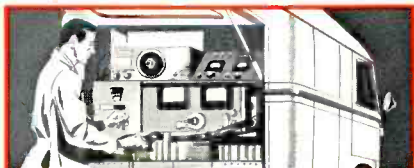
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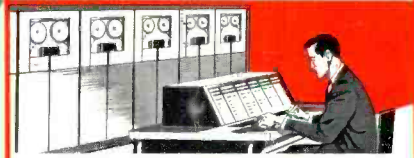
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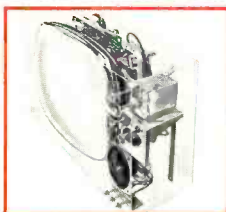
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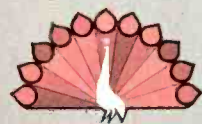


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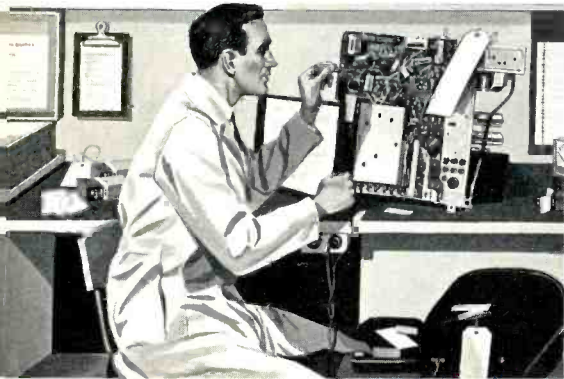
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A	Advanced Electronic Technology (T-3)	High School grad. with Algebra, Physics or Science	Day 2 1/4 yrs. Eve 6 3/4 yrs. (N.Y.) 4 1/2 yrs. (L.A.)
B	Television and General Electronics (V-7)	2 yrs. High School with Algebra, Physics or Science	Day 1 1/2 yrs. Eve. 4 1/2 yrs. (N.Y.) 3 yrs. (L.A.)
C	Radio and Television Servicing (V-3)	2 yrs. High School with Algebra, Physics or Science	Day 9 mos. Eve. 2 1/4 yrs. (N.Y.) 1 1/2 yrs. (L.A.)
D	Transistors	Radio background	Eve 3 mos.
E	Electronic Drafting (V-11 V-12)	2 yrs. High School with Algebra, Physics or Science	Eve. Basic: 1 yr. Advanced: 2 yrs.
F	Color Television	Television background	Eve 3 mos.
G	Radio Telegraph Operating (V-5)	2 yrs. High School with Algebra, Physics or Science	Day 9 mos. Eve. 2 1/4 yrs. (N.Y.) 1 1/2 yrs. (L.A.)
H	Computer Programming (C-1)	College Graduate or Industry sponsored	Eve 24 weeks Sat 30 weeks
I	Technical Writing (V-10)	High School Graduate	Day 9 mos. (L.A.) Eve. 2 1/4 yrs. (L.A.) 3 mos. (N.Y.)
J	Automation Electronics V 14	Background in Radio Receivers and Transistors	Eve 9 mos. (N.Y.) Sat. 44 weeks (N.Y.)
K	Digital Computers	Electronics background	Eve. 3 mos. (L.A.)
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(Continued from page 16)

age, with your request. Supreme also will provide, at a nominal charge, data on individual radio or TV sets.

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HOW TO AVOID LAWSUITS IN TV—RADIO—APPLIANCE SALES AND SERVICE

by Leo T. Parker

Written by an attorney with long experience in litigations associated with sales and servicing, this book should be of great interest to anyone in the TV, radio, or appliance field. It's designed to cover the legal problems of servicemen who must enter the premises of the customer to make repairs, as well as those who repair the customer's property on their own premises. The various obligations, guarantees, and legal conditions involved in both procedures are discussed—including breach-of-contract law, legal rights, and methods of guaranteeing service contracts.

Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York, N.Y. 72 pages. Soft cover, \$1.00.



INDUSTRIAL ELECTRONICS MADE EASY

by Tom Jaski

Intended as a guide for technicians interested in entering or already working in the field of industrial electronics, this book tells what industrial electronics is and analyzes the servicing problems connected with it. Induction, dielectric, microwave, and super-sonic generators are covered, and methods of using transducers, control systems, and servos are explained. There are descriptions of readout and display devices, and the final chapter discusses the techniques and instruments used in industrial electronics maintenance.

Published by Gernsback Library, Inc., 154 W. 14th St., New York 11, N.Y. 288 pages. Soft cover, \$3.95. Hard cover, \$5.95.

March, 1962

INDUSTRIAL ELECTRONICS MEASUREMENT AND CONTROL

by Edward Bukstein

This book is divided into two sections: one devoted to measurement techniques (nine chapters), the other to control techniques (seven chapters). In the first section, specific ways of measuring pressure, illumination, color, temperature, etc., are discussed. The second section covers methods for controlling such things as time delay, temperature, welding current, and elevator leveling. Components, circuits, and applications are described and explained in detail.

Published by Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Indiana. 192 pages. Soft cover. \$3.95.



New Literature

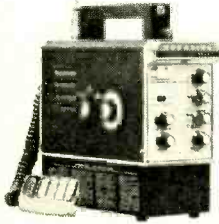
Copies of Joe Palmer's 1962 catalog of "Government surplus components and assemblies" are now available. The catalog, which lists everything from fuses to complete transmitters, can be obtained from Joe Palmer, P.O. Box 6188 CCC, Sacramento, Calif.

A catalog and price list of the "Regohm" voltage regulator line is available for the asking from Dept. VA, Electric Regulator Corp., Norwalk, Conn. These units are said to be smaller, lighter, and lower in cost than other types of regulators having the same capacity. They'll handle a.c. or d.c. output voltages with an accuracy of regulation within 2% (1% on special order) for combined effects of line, load, frequency, and power-factor variations. Ask for Condensed Catalog 5.17-1.

Novel quick-selection charts for equipment designers are featured in a new booklet on RCA vacuum power tubes, rectifier tubes, thyratrons, and ignitrons. Entitled "RCA Power Tubes" (No. PG-101E), the 46-page booklet provides information on over 200 different transmitting, industrial, and special-purpose power tubes. Copies can be obtained from RCA Electron Tube distributors, or by sending 75 cents to Commercial Engineering, Electron Tube Division, Harrison, N.J.

-30-

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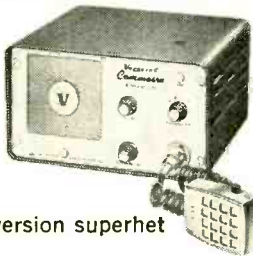


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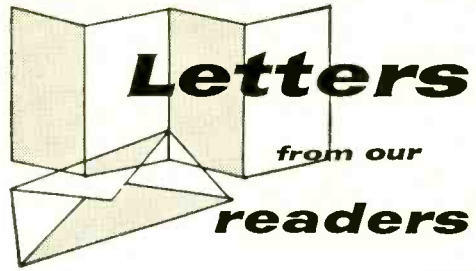
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Improved Salt-Water Cells

■ I built the salt-water powered radio in your October issue, then experimented with various cell electrolytes. By putting a 0-1 ma. meter across the cell, I discovered that ordinary household "Clorox" produced a short-circuit current of from 0.5 to 0.6



ma.; an equivalent amount of salt water in the same cell produced only 0.2 ma. The set sounds louder with the Clorox, too.

HARRY RICHARDS, WN8AUQ
Dayton, Ohio

■ I read your article on the salt-water powered transistor radio in the October 1961 issue. Though I haven't built the set itself yet, I have experimented with several kinds of cells. In the process of doing so, I found that substituting a zinc electrode for the aluminum one gives a higher output.

ROBERT JARVIS
Mansfield, Pa.

Congratulations on your improved cells, gentlemen. We hope, Bob, that you will soon get busy and build the radio, too. Don't throw Clorox in your version of the cell, though; you might generate enough power to put the electric company out of business.

Cheers for the Senators

■ I was very gratified (as I'm sure many other people were) to read in the November 1961 FCC Report about the bill proposed by Senators Barry Goldwater and Andrew Schoepel which would provide for reciprocity in amateur radio licensing. Personally, I see no reason why a person who has the qualifications should not be able to get a ticket just because he isn't a U.S. citizen. Anyone who is determined to transmit information detrimental to U.S. security will do so whether he has a license or not. If passed, the bill would allow visitors from foreign countries to stay in closer touch with folks at home, promote better inter-

are you standing still in electronics while this man advances?

*Find out why—and do something about it—if you have
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LET'S LOOK AT THE FACTS. There's something wonderful about knowing how a circuit works or what a filter capacitor does. If you've ever fixed a TV set, built a radio or used a voltmeter, you've tasted the thrills of electronics.

This excitement may have led you to a job in electronics. But the glamour fades if you are stuck in the same job year after year. You'll be bored with routine and unhappy about prospects for future earnings. You'll discover, as have many men, that simply working in electronics does not assure a good future.

If electronics is the "field of opportunity," how is this possible? No question about it, electronics offers many opportunities, *but only to qualified men.* In any career field, it is how much you know that counts. This is particularly true in the fast moving field of electronics. The man without thorough technical education doesn't advance. Even men with intensive military technical training find their careers can be limited in civilian electronics.

ADVANCED TECHNICAL KNOWLEDGE IS THE KEY to success in electronics. If you have a practical knowledge of current engineering developments, if you understand "why" as well as "how," you have what employers want and pay for. With such qualifications, you can expect to move ahead.

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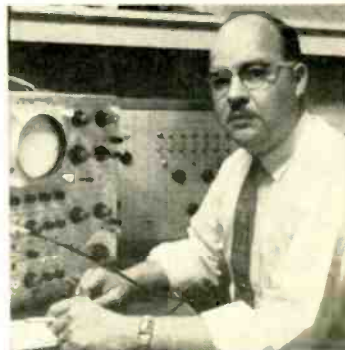
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CREI graduate Mearle Martin, Jr. has progressed from Junior Technician to licensed Senior Engineer. He is now Field Support Manager, Marketing Division of Tektronix, Inc., Portland, Oregon.

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Letters

(Continued from page 20)

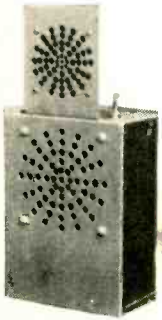
national relations, and give our hams freedom to operate in more foreign countries.

B. A. ZARSKI
Milwaukee, Wis.

Any other opinions from our readers on this interesting bill?

Electronic Do-Re-Mi

■ I recently completed the "Electronic Do-Re-Mi" described by Martin H. Patrick in your October 1961 issue, and thoroughly enjoyed putting the little "gimmick" together. Not being able to obtain a 16-ohm speaker, I used an 8-ohm unit with a 15-ohm resistor in series—with good results. Mr. Patrick stated that the unit should produce from one to six musical tones, depending on the setting of potentiometer R2. Believe it or not, my version puts forth nine (the first four in the "low bass" region)! Incidentally, the most frustrating thing about this gadget is the comment it



draws when demonstrated to the adult female . . . "Is THAT all it does?"

ALFRED W. GLASSNER
Pasadena, Texas

Thanks for your letter, and for enclosing a picture of your fine-looking unit, reader Glassner. The reactions of some of the adult females around our office to the Electronic Do-Re-Mi were a bit more violent. One of them nearly demolished Mr. Patrick's model after we "played" it a few times too many.

The "10-8" De Luxe

■ I'd like to bring to your attention the fact that, in the introduction to "The '10-8' De Luxe" (January, 1962), you indicated that "10-8" means "in service." In your list of "10" signals on page 44, though, you say that "10-8" means "Repeat, conditions bad." Which meaning is correct?

DAVE WELCH
Culver City, Calif.

The first meaning is correct, Dave. And our faces are red because we didn't catch the second one.

Chicago Experimenter's Club?


■ I've been reading your magazine for many years, and have always been on the lookout for any mention of an electronics club in the Chicago area. I'd like to join such a club or, if there is none in existence, to form one. If any experimenters



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Letters

(Continued from page 22)

in the area would like to meet people with similar interests, I'd appreciate hearing from them.

JAMES T. BATES
5241 West 23rd Place
Cicero 50, Ill.

3-Way Intercom

■ Your "3-Way Intercom" project (May 1961 issue) sounds good. Are the 2N1502 power transistors and the Centralab 1448 spring-return switch readily obtainable?

HAROLD NOLTE
Leipsic, Ohio

The power transistors and the 1448 switch are available from most large radio supply houses. Both are listed, for example, in the industrial catalog of Allied Radio, 100 N. Western Ave., Chicago, 80, Ill. If you don't see them listed in your favorite parts dealer's catalog, write and ask for them. Chances are they either will be in stock or your dealer will be able to get them for you.

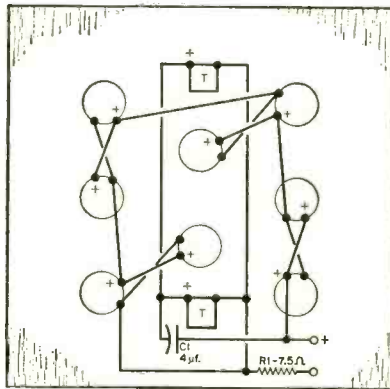
Stereo Sixteen Plus Four

■ Am I right in assuming that there is an error in the wiring diagram for the "Stereo Sixteen Plus

Four" speaker system which appears on page 46 of your January issue? It seems as if no sound at all would be produced if the speakers were hooked up as shown. I also think resistor R1 should be 7.5 rather than 8 ohms.

RONALD WILLOUGHBY
Dallas, Texas

You're quite right, reader Willoughby. The lead between one end of resistor R1 and the "plus"



terminal should be removed and R1 should be 7.5 ohms, as in the corrected diagram shown here. The two square boxes labeled "T," incidentally, represent the two tweeters.

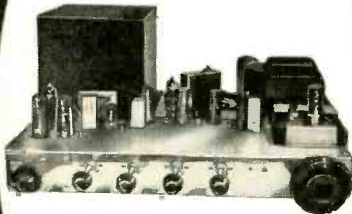
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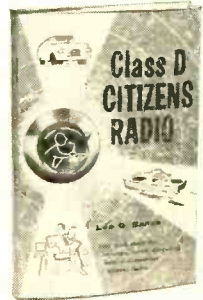
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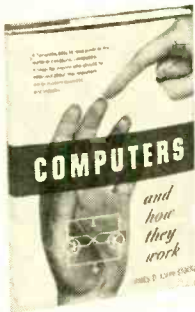
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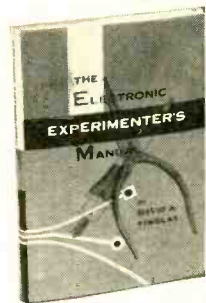
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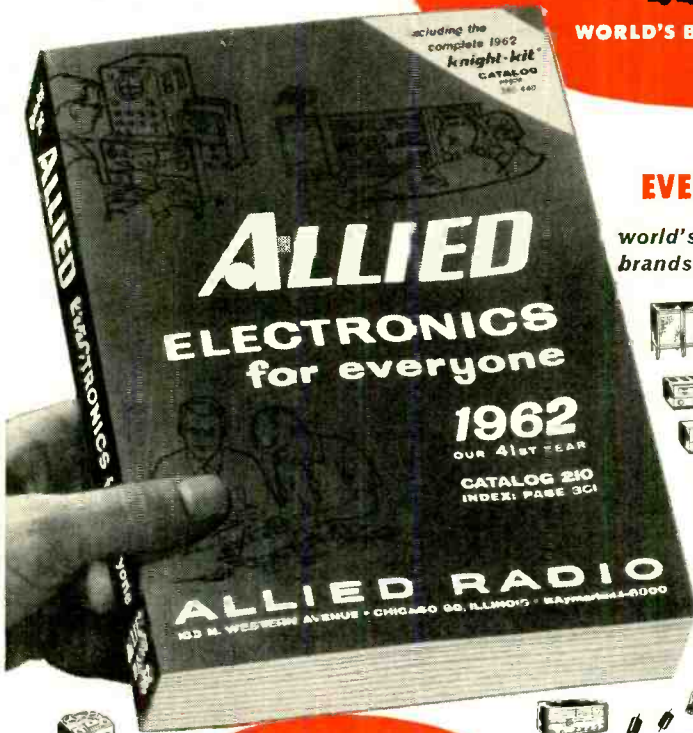
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Showcase

(Continued from page 26)

tape. Price: \$59.95 in kit form; \$89.95 factory-assembled.

Produced in two models, *General Electric's* new VR-1000 stereo cartridge is ideal for professional turntables or high-quality changers. Both models have a frequency response within 3 db from 20 to 20,000 cycles and a nominal channel separation of 25 db at 1000 cycles. The VR-1000-5 is equipped with a 0.5-mil diamond stylus for professional and automatic turntables and lists at \$29.95; the VR-1000-7 has a 0.7-mil stylus for high-quality record changers and lists at \$24.95. . . . From *Harman-Kardon* comes the TA5000X stereo receiver which is an ideal basis for a versatile and handsome home music center. This superb instrument features both an AM and an FM tuner for standard broadcast reception, an integrated stereo adapter for FM stereocasts, and two 25-watt amplifiers complete with control facilities for mono or stereo listening—all on a single chassis. Inputs include magnetic phono, tape head, and auxiliary; outputs consist of tape and a stereo headset jack mounted on the front panel. The TA5000X incorporates 17 tubes and eight diodes and is priced at \$299.95; an optional walnut enclosure sells for \$29.95. . . . A handsome companion to any FM radio, *Heath's* GRA-21-1 stereo adapter is completely self-contained, self-powered, and supplied with a high-quality 6" x 9"

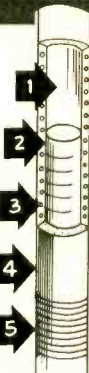


Heath GRA-21-1 stereo adapter

speaker. Designed to match the company's GR-21 FM table radio, the GRA-21-1 provides FM stereo or mono reproduction, using the speakers in the radio and the adapter. Controls include a master volume control for both channels, a tone control which functions independently of that on the radio, and a function switch to select the desired mode of operation or turn the adapter off. Supplied only in kit form, the GRA-21-1 is priced at \$49.95, f.o.b. Benton Harbor, Mich. . . . Another new product by Heath is the AS-81 speaker system. Intended for economy hi-fi/stereo installations or as an inexpensive extension speaker, it boasts a 6" woofer and a 3" tweeter for response from 65 to 14,500 cycles. Its 6½" x 10¾" x 6¾" cabinet is supplied completely assembled; you have only to mount the speakers and connect a few leads. Three models are available: the AS-81U (unfin-

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Optimum coil efficiency begins with air core (1), reinforced by hollow fiberglass cylinder (2). To lower loss, coil (3) is wound only in lower section of antenna — embedded in thousands of parallel glass fibers (4) — that extend full rod length, for high flexural strength. Tapered wrap of fiberglass (5) produces superior impact strength.



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Citizens Band		
30-35 MC		73-1
35-42 MC		73-2
42-50 MC		73-11
10 Meters		73-3
15 Meters		73-4
4 Ft. antenna	\$11.25	

RANGE	STYLE	
20 Meters		73-5
40 Meters		73-6
80 Meters		73-7
6 Ft. antenna	\$15.90	

RANGE	STYLE	
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80 Meters		73-9
Channel 5		73-10
4.58 MC		
8 Ft. antenna	\$18.75	

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Also ask to see and hear the world famous SONY all-transistor battery operated radios and TV

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Please send me more information on the NEW SONY CB-901.

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Showcase

(Continued from page 28)

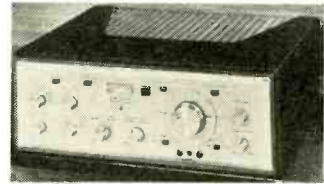
ished) at \$17.50, the AS-81W (walnut) and AS-81M (mahogany) at \$19.95 each.

A low-cost FM stereo adapter from Allied Radio, the *Knight-Kit* KS-10 (supplied in kit form only) can be used with any FM or FM/AM tuner equipped with a multiplex output. The KS-10 is so small that it can be tucked away almost anywhere, and plugging its a.c. power cord into a switched outlet on the amplifier or tuner will turn the KS-10 on and off at the same time. The adapter also has its own on/off switch, noise filter, and separation controls. Price, \$19.95.

... Another new product from Allied is an "all-in-one" stereo FM receiver, the Knight KN-310MC. Housed in a single cabinet are a stereo FM tuner with a transistor/Nuvistor circuit, a 40-watt all-transistor stereo amplifier, and a built-in automatic clock-timer. Add a pair of speakers, and you're all set to receive FM stereo and mono broadcasts. The clock-timer automatically turns the receiver on and off at preset times, and inputs are provided for adding a stereo record changer or tape deck. Power output is 20 watts per channel at less than 1% harmonic distortion. Price, \$254.50.

A portable, transistorized, battery-operated tape recorder from *Norelco* weighs only 8 pounds and operates from six Type "D" flashlight cells. Completely self-contained, the "Continental 100" incorporates its own recording and playback preamplifiers, power amplifier, and speaker. Its low (1 $\frac{1}{2}$ -ips) speed permits up to two hours' playing time on a single 4" reel, and its motor, governor regulated, is independent of battery voltage. Price, \$129.50.

The Model 355 tuner/amplifier system by *H. H. Scott* is an FM stereo tuner, an AM tuner, a stereo control center, and an 80-watt stereo amplifier in one package. The 355 features a "modular" design with each section completely self-powered. (Its stereo power amplifier can actually be placed as much as 50 feet from the main chassis without affecting performance.) Inputs include TV, phono cartridge, and tape deck. Price, \$319.95.



Scott 355 tuner/amplifier

(Continued on page 32)

ANNOUNCING NEW BROWNING 23 S-NINE CB TRANSMITTER



23
S-NINE TRANSMITTER

\$144.00
(with one crystal)

Now with built-in 23 channel selector switch and Standing Wave Indicator!

\$189.00
(with 23 matched crystals installed)

Browning presents a new concept in Citizen's Band radio communications. It's the 23/S-NINE base station transmitter with built-in all-channel selector that lets you transmit on any of the 23 CB channels at the flick of a switch! Also new is the built-in Standing Wave Indicator for perfect matching of transmitter and antenna system for more powerful, long-range transmissions.

Among other outstanding 23/S-NINE features: special audio circuitry with speech clipper and splatter filter for perfect modulation; advanced design power supply with silicon rectifiers for low operating temperatures and maxi-

mum component life; highly efficient output circuitry using Pi network for maximum transfer of energy to antenna.

Order your Browning 23/S-NINE Transmitter now for home or business use.



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- ★ AMPLIFIER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ EXCELLENT BACKGROUND FOR TV
- ★ **SCHOOL INQUIRIES INVITED**
- ★ Sold In 79 Countries

**YOU DON'T HAVE TO SPEND
HUNDREDS OF DOLLARS FOR A RADIO COURSE**

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL. You will learn how to buy 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 principles of the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

You will learn 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 electronics is required. "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.

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The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle "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 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 twenty 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 instruction 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, High Fidelity Guide and a Quiz Book. You receive Membership in the Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

PRINTED CIRCUITRY

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

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

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



Training Electronics Technicians Since 1946

FREE EXTRAS

• SET OF TOOLS

- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
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- 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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- Send "Edu-Kit" C.O.D. I will pay \$26.95 plus postage.
- Rush me FREE descriptive literature concerning "Edu-Kit."

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amateur
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with
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1st choice of
amateurs the
world over!

loaded with features... kit or wired!



ADVENTURER—50 watts CW input through 10 meters. Kit \$54.95 Am. Net	RANGER—75 watts CW input; 65 watts phone—160 through 10 meters. Kit \$229.50 Am. Net	VALIANT—275 watts CW and SSB; 200 watts A.M.—160 through 10 meters. Kit \$349.50 Am. Net
240-181-1... Kit \$54.95 Am. Net	240-161-2... Kit \$229.50 Am. Net	240-104-2... Kit \$349.50 Am. Net
	240 161-1... Wired \$329.50 Am. Net	240-104-2... Wired \$439.50 Am. Net



Complete specifications and schematics on all Johnson transmitters, amplifiers, station accessories, keys and practice sets!

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YOU SAVE MONEY!

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OF HI-FI COMPONENTS
FOR A VERY SPECIAL
GROUP QUOTATION

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DISCOUNT CATALOG A-15

New low prices on tape recorders, amplifiers, tuners, loudspeakers, cartridges, etc.

KEY ELECTRONICS COMPANY
120 LIBERTY STREET
NEW YORK 6, N. Y.

Showcase

(Continued from page 30)

From *Sherwood Electronic Laboratories* comes a three-speaker "bookshelf" system with smooth (± 2 db) response all the way from 45 to 17,500 cycles. Consisting of a 12" woofer, an 8" mid-range, and a specially designed 2½" tweeter, the speaker system has crossovers at 600 and 3500 cycles, both with 12 db-per-octave attenuation. Level controls are provided for optimum mid-range and tweeter balance under all room conditions; prices range from \$119.50 to \$139.50, depending on finish.

Four new high-quality microphones from *Turner* are intended for use in motion-picture studios, television broadcast, and high-fidelity recording applications. Part of the 400 Series, two of the mikes feature adjustable impedance and response; all are pressure-operated, moving-coil dynamics and essentially non-directional. Prices range from \$80.00 to \$130.00.

Viking's Model 86 tape recorder features a special built-in heterodyne filter to permit distortion-free FM stereo recordings. In addition, independent stereo VU meters operate for both record and playback, and switching between the 7½ or 3¾ speeds automatically changes the equalization. Three models are available, all at the same \$297.50 price: the ERQ for half-track stereo or mono record, half- or quarter-track stereo or mono playback; the RMQ for quarter-track stereo or mono record, quarter- or half-track playback; and the ESM for half-track stereo or mono record or playback.



Viking 86 tape recorder

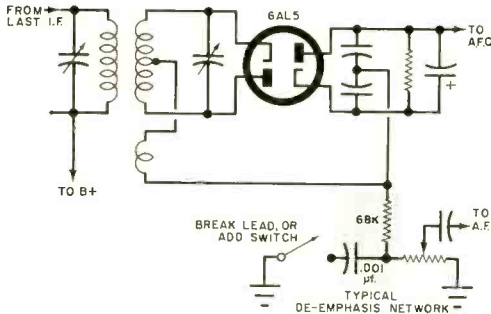
- Argos Products Co., Genoa, Ill.
- Bogen and Rich, Inc., 28 School St., Yonkers, N. Y.
- Benjamin Electronic Sound Corp., 97-03 43rd Ave., Corona 68, N. Y.
- EICO (Electronic Instrument Co., Inc.), 33-00 Northern Blvd., Long Island City 1, N. Y.
- General Electric Co., Radio and Television Div., Electronics Park, Syracuse, N. Y.
- Harman-Kardon, Inc., Plainview, L. I., N. Y.
- Heath Co., Benton Harbor, Mich.
- Knigh (Allied Radio Corp.), 100 N. Western Ave., Chicago 80, Ill.
- Norelco (North American Philips Co., Inc.), 230 Duffy Ave., Hicksville, L. I., N. Y.
- H. H. Scott, Inc., Dept. P, 111 Powdermill Rd., Maynard, Mass.
- Sherwood Electronic Laboratories, Inc., 4300 N. California Ave., Chicago 18, Ill.
- Turner Microphone Co., 901 17th St., N.E., Cedar Rapids, Iowa.
- Viking of Minneapolis, Inc., 9600 Aldrich Ave., S., Minneapolis 20, Minn.

Always say you saw it in—POPULAR ELECTRONICS

Add "Realism" To FM Listening

MOST AM-FM console radios designed before the "hi-fi era" incorporate single-cone 8" - 12" speakers with rather limited high-frequency response. If you own such a set, you can make a startling improvement in its FM reproduction.

The following technique takes advantage of the fact that all FM stations purposely boost (pre-emphasize) the high frequencies in their program material. These frequencies are later attenuated by a de-emphasis network in the FM receiver, so that any high-frequency noise picked up by the receiver is also attenuated. In the older consoles, however, the



de-emphasis can usually be eliminated—feeding more highs into the speaker—with no undesirable effects.

A typical de-emphasis network is shown in the shaded portion of the schematic above (component values may vary from set to set). Used here with a ratio detector, the network is the same as that employed with a Foster-Seeley discriminator.

Regardless of which type of detector happens to be incorporated in your set, it's only necessary to disconnect the capacitor from ground to remove the de-emphasis. An s.p.s.t. switch may be wired in as shown (keep the leads as short as possible), allowing you to restore the de-emphasis when increased high-frequency response is not required.

—Art Trauffer

First with professionals
who know performance

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now with
RF NUVISTOR
STAGE for
matchless range

- Dual Conversion Superhet Circuit
- Sensitivity — .1 for 6 db S/N
- Super Sensitive Stable Squelch
- 60 db Adjacent Channel Rejection
- 70 db Image Rejection
- Better than 3W Power to 52-72 Ohm Antenna
- Advanced Design Noise Limiter

You'll see the new Poly-Comm N — or hear it discussed — wherever pros gather. It's been selected alike by stars of the entertainment world and by farmers, by engineers and boat captains, by outdoorsmen and by families out for fun.

The reasons for this wide appeal are simple: The Poly-Comm N — successor to the 11-G, and incorporating an advanced RF Nuvistor stage — has been engineered to provide the best CB performance on the market, regardless of price. It incorporates the most advanced circuitry for optimum performance in continuous duty. Engineered to withstand shock, vibration, high humidity and other rugged use-conditions, it has the range, power, selectivity, low noise, high rejection, and convenience of operation and maintenance that make it demonstrably superior for every CB application.

Mail Coupon for Important Data
To Guide You in Your CB Investment

Sirs: Please send complete data on the
Poly-Comm N 27 mc transceiver by return mail.

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Intended use _____

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New-Style CB Call-Signs

THE registered serial number appearing on each Citizens Band station license must also be used as the station's call-sign, according to Federal Communications Commission rules. In the past, these serial numbers have been made up of one or two digits and one or two letters, followed by a four-digit serial number (2W5115, for example). But these serial-number call-signs bear no resemblance to call-signs issued in accordance with international agreement. For this reason, the Commission has decided to take all future CB station serial numbers from the international call-sign series available for assignment to stations of the United States. Currently licensed CB stations, however, will continue to use the call-serial numbers they now have.

As of July 1, 1961, for Class A stations, and as of January 1, 1962, for Class B, C and D stations, the call-signs assigned to stations licensed in the Citizens Radio Service are to consist of three letters followed by four digits and, as before, the

digits are to be assigned in numerical order from 0001 to 9999. Examples of such call-signs are KCB4526 and KJA2345.

The first letter of each prefix in the new call-signs is the letter "K," which indicates a U.S. licensed station. The next two letters have various uses for FCC record and enforcement purposes. Serial numbers beginning with KAA through KAF are to be assigned in sequence to Class A stations and may be reassigned to the same stations, indefinitely, upon proper application for renewal or modification. Such continuity, however, is not possible in the case of Class B, C or D stations, where the large number of applications and licenses has forced the Commission to adopt streamlined administrative procedures in order to handle the workload. This means that "modified," "reinstated," or "renewed" Class B, Class C, or Class D licenses will each carry a new call-sign. The serial number (call-sign) previously issued will be superseded and may no longer be used to identify the station.

During the calendar year 1962, all new Class B station licenses will have the prefix KAG; all Class C licenses, the prefix KAH; and Class D station licenses in the various Radio Inspection Districts, the prefixes KBA through KJE.

-30-

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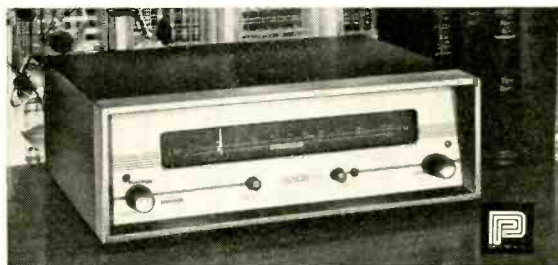
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Rev. Enoch P. Sanford



Thanks to N.T.S. I have a business of my own right in my home. I am still in the Air Force but 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.



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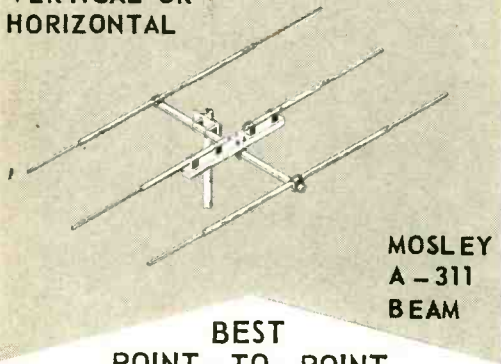


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Tips

(Continued from page 37)

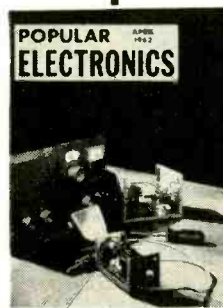
be equipped with a switch for this purpose, here's an easy way to remedy the situation. Get a pair of jacks of the same type used for the converter's input and output connections. Then fasten them together, back to back, with a set of spacers. Now wire the jacks in parallel. When you want to "cut out" the converter, just disconnect it and plug the receiver and antenna cables into the jacks.—Larry F. Dillinger, K4WSA

TEST CLIP FOR TIGHT SPOTS

Standard alligator clips don't work well in the crowded circuitry of transistor radios and other miniature equipment. Ideal substitutes, however, are the pointed pin-curl clips employed in beauty shops and available in most drugstores. They're narrow enough to fit almost anywhere, and have a good, strong spring. Solder a length of wire to the inside of one of the "tabs" used to open the clip and you're in business.

—Bob Culter

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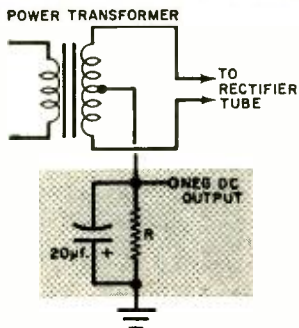
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Tips and Techniques

TRANSISTOR POWER SUPPLY

You won't have to provide a separate power supply for a *pnp*-transistorized device if

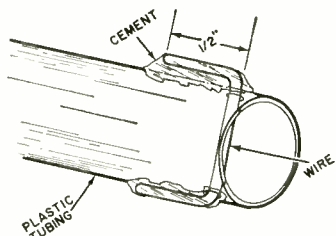


you're adding it to a piece of equipment possessing a center-tapped power transformer. Just insert the circuit shown in the shaded portion of the diagram in series with the grounded center-tap lead. The output voltage yielded will be negative with respect to ground, as required, and its amount will depend on the load on the transformer and the value of resistor *R*. You'll have to experiment to determine the latter value, but for the average receiver, a 100-ohm resistor should yield about 5 volts. The voltage rating of the 20- μ f. electrolytic capacitor should be consistent with the output voltage.

—Robert B. Kuehn

IMPROVED ALIGNMENT TOOL

An alignment tool can be quickly improvised from a length of plastic tubing and a



short piece of solid hook-up wire. Drill holes through the tubing as shown and insert the wire, leaving about $\frac{1}{2}$ " of surplus on each side of the tubing. Then bend back the wire ends and cement them in place. The exact tubing diameter and hole placement depend on the dimensions of the component to be adjusted.

—Hartwell M. Hughes

TEMPORARY WIRE CONNECTOR

A standard, solderless, spring-type banana plug such as the Lafayette PJ-14 can be easily modified to act as a temporary wire connector. The setscrew holding the metal

plug is removed; then the plug is turned around and slipped inside the plastic shell. With the screw reinstalled, leads can be pushed between the shell and the tip of the plug, where they will be tightly gripped. As many as six ordinary-sized wire or component leads can be inserted at once, but it might be necessary to wedge in very small wires with larger ones.

—James Wilson

RECORD-CHANGER STANDS

Servicing record changers can be made a good deal easier by putting together a pair of wooden



stands. The stands can be fastened to the changer by means of screws passed through the latter's mounting holes. Note that the changer can be supported either on its side (as illustrated) or in an operating position.

Dimensions are up to you but, to get good stability, make each "foot" at least four inches long.

—H. Leeper

BANANA PLUG SPlice

Many experimenters have standardized their test leads by attaching a banana plug to both ends of each one. It's a good idea, because the hollow end of a standard alligator clip can be easily slipped over one of the plugs. It's not so easy, however, to connect a pair of standard test leads in series unless you have a supply of banana plug splices like the one pictured here. (H. H. Smith No. 245 or equivalent). If the



local parts dealer doesn't have a stock of these little-known items, you can probably obtain them from your favorite mail-order house.

—William E. Bentley

CONVERTER BYPASS

If you're planning on using a converter in series with your receiver antenna, you'll need some way to bypass the former for normal reception. Should the converter not

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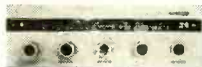
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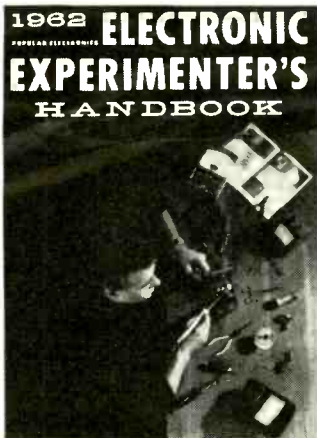
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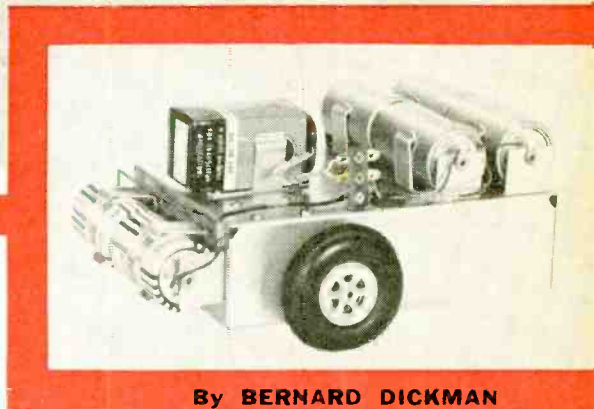
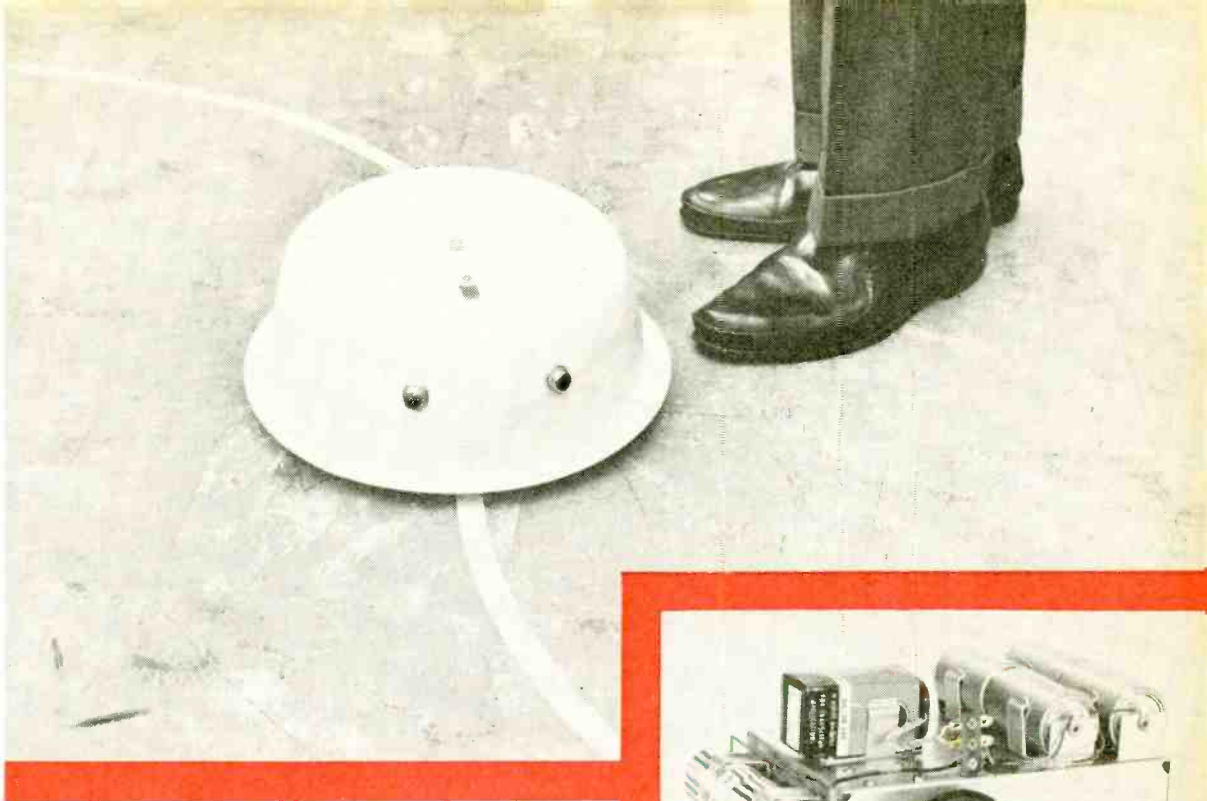
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Emily...

By **BERNARD DICKMAN**

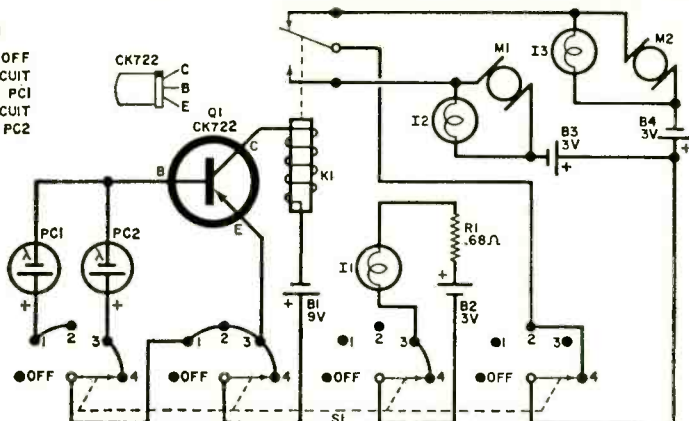
The Robot with a One Track Mind

THE strange-looking object following the white line is named "Emily." She may look like a dishpan with eyes, but this "Electro-Mechanical Inebriated Ladybug" is actually an electronic robot of the simplest type. Though equipped with only one "sense organ" (a photocell), two "muscles" (a pair of motors), and a very rudimentary "brain" (a transistor and relay), she's capable of some extremely intelligent (if slightly inebriated) behavior.

The ladies of our own species are often *said* to have "one-track minds." In Emily's case, however, this is literally true. Set her down on a white line and she'll doggedly follow it, regardless of how many times it twists and turns. Though her weaving gait suggests that she's a little "under the influence," she always reaches the end. This isn't all Emily can do, though; blink a flashlight beam at her and she'll follow *you* to the ends of the earth.

COVER STORY

SWITCH POSITION	FUNCTION
OFF	ALL POWER OFF
1	TEST PCI CIRCUIT
2	OPERATE WITH PCI
3	TEST PC2 CIRCUIT
4	OPERATE WITH PC2



Emily's uncomplicated circuit can be further simplified if optional photocell PC1 is omitted. Positions 1 and 2 of S1 would not be needed, and a 3-position switch could be used.

PARTS LIST

B1—9-volt battery (RCA VS 305 or equivalent)
 B2, B3, B4—3-volt battery; 2 flashlight cells in series (Burgess Type 2 or equivalent)
 I1—2.2-volt, prefocused-type flashlight lamp (G.E. Type 222 or equivalent)
 I2*, I3*—Pilot lamp (G.E. Type 48, or equivalent)
 K1—Sensitive relay; 8000-ohm, 0.7-ma. coil; s.p.d.t. contacts (Sigma 26F-8000-CDS/S1L or equivalent)
 M1, M2—Miniature d.c. motor (supplied with gear train kit—see "Hobby-Shop Items" listed below)
 PC1*, PC2—Selenium photocell (International Rectifier B2M or equivalent)
 Q1—CK722 transistor

R1—0.68-ohm, 1/2-watt resistor
 S1—4-pole, 5-position rotary switch (4-pole, 3-position switch if PC1 is not used—see text)
 1—2" x 7" x 5" aluminum chassis (Bud AC-402 or equivalent)
 1*—1 1/4" x 2 3/4" x 2 5/8" miniature aluminum chassis (Bud CB-1623 or equivalent)
 1—Socket for I1 (Dialco 505 or equivalent)
 3—Battery holders—for B2, B3, and B4 (Keystone 186 or equivalent)
 1—Battery holder—for B1 (Keystone 96 or equivalent)
 Misc.—Terminal strips, wire, hardware, plastic dishpan*, pilot lamp assemblies for I2 and I3 (if used), etc.
 *Optional—see text

Hobby-Shop Items

2—Wilson No. 3000 motor and gear train kits—see text
 2—2 1/2"-diameter, airplane-type wheels (VECO No. 321 or equivalent)
 1—1"-diameter, airplane-type wheel

1—6"-length of stiff wire (diameter to match hub of 1" wheel above)
 Misc.—Epoxy-resin glue (Duro E-POX-E or equivalent) or "heatless" solder (Craftsman Metal-Mend or equivalent)

How Emily Works. Emily's uncanny behavior is made possible by a very simple electronic circuit. With switch S1 in position 4, as shown in the schematic diagram, photocell PC2 is connected to the base circuit of transistor Q1. Also, power is fed to the transistor, exciter lamp (I1), and motors M1 and M2 from batteries B1, B2, B3, and B4, respectively.

Exciter lamp I1, a 2.2-volt flashlight bulb, is powered from 3-volt battery B2 and provides illumination for photocell PC2. Though resistor R1 drops the battery voltage a bit, I1 is still operated slightly in excess of its rating. This is done purposely, since the extra light output is needed to insure positive operation of the photocell.

When PC2 is illuminated, a small volt-

One of the two motor and gear train units which drive rear wheels. Assembled from kits, these units were set for reduction ratios of 216 to 1.



age is generated which biases $Q1$'s base. This causes the collector-emitter resistance of the transistor to drop to a low value, allowing current to pass from $B1$ through $K1$'s coil. The energized coil then pulls down the relay armature.

Motors $M1$ and $M2$, each of which turns one of Emily's rear wheels, are controlled through the relay's contacts. When the relay coil is not energized, power is fed to $M2$; when it is energized, power is fed to $M1$. The two motors are never powered simultaneously.

Photocell $PC2$ and exciter lamp $I1$ are mounted on the $M1$, or right, side of the chassis, near the front, as shown in the photos. The lamp, which is of the pre-focused type, is pointed down. If it passes over a white surface, light is reflected back into the photocell and motor $M1$ is switched on; if the surface is dark, $M1$ is shut off and power is fed to $M2$.

When Emily is placed over a white line on a dark floor, the left-rear wheel (driven by $M2$) will rotate. Pivoting on her single front wheel, she will turn toward the right until $I1$ passes over the line, reflecting light into $PC2$ and activating $K1$. This, of course, switches power from $M2$ to $M1$, and Emily will turn toward her left until $I1$ is moved away from the white line and power is switched back to $M2$.

The process is then repeated as described above—the net result being that the robot follows a mildly “drunken” course along the line. Indicator lamps $I2$

and $I3$ (optional), wired in parallel with $M1$ and $M2$, respectively, are Emily's “eyes”; they blink on and off as she changes direction.

Position 3 of $S1$ is used for test purposes. With the switch set in this position, photocell $PC2$, the transistor, and exciter-lamp circuits are left unchanged—but power for the motors is cut. In this way, the operation of the white-line tracking circuits can be checked without running the motors.

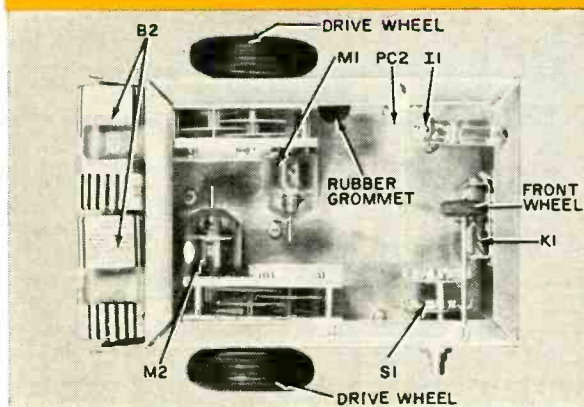
With $S1$ in *position 2*, photocell $PC1$ is connected to $Q1$'s base circuit in place of $PC2$. This optional photocell is mounted on top of Emily's cover and enables the robot to follow, by means similar to those discussed earlier, a flashlight beam in a darkened room. Power is also fed to the transistor and motor circuits, but exciter lamp $I1$, not needed in this application, is shut off.

Position 1 of $S1$ is used for testing the light-beam following circuit. With $S1$ in this position, everything is connected as above, except that the motor circuit is shut off. To cut off all of Emily's power, $S1$ is placed in the “off” position.

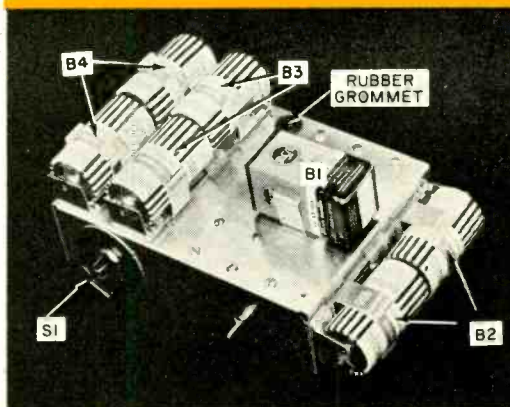
If the light-beam-following feature is not desired, $PC1$ is not needed—nor are switch positions 1 and 2. In this case, Emily may be wired to use a 4-pole, 3-position switch.

Putting Emily Together. Begin by assembling the two Wilson No. 3000 motor and gear train kits which will supply the robot's motive power. Following the in-

View of robot's underside with all major components installed. Terminals of $K1$ should be prewired, since they are difficult to reach once relay is in place.



Batteries which power the motors, exciter lamp, and transistor circuit dominate top view. Battery leads are run through the rubber grommet.



structions supplied with the kits, set up each unit for a reduction ratio of 216 to 1.

These kits are available in most hobby shops; but you can also get them by mail (write Wilson's of Cleveland, 6502 N.W. 16th St., P.O. Box 8995, Fort Lauderdale, Fla., enclosing \$4.00 for each kit). You'll find that more gears are included than you will need, but it's more economical to purchase the kits than to buy the required components individually.

With the power units assembled, the main construction job can begin. Parts placement is not critical, except where specified, but the photographs should be followed as closely as possible.

Mount the power units under the chassis as shown. Each one should be positioned so that its output shaft passes through the chassis lip at a point about 2" from the *B2* end of the chassis. Use sheet-metal screws wherever there isn't enough clearance to install a nut for a machine screw.

Relay *K1* is installed under the chassis on the end opposite *B2*. Place it far enough from switch *S1* so you won't have difficulty wiring the switch terminals. The terminals of the relay itself are difficult to reach once the unit is fastened in place, so solder leads of the proper length to each one before installation.

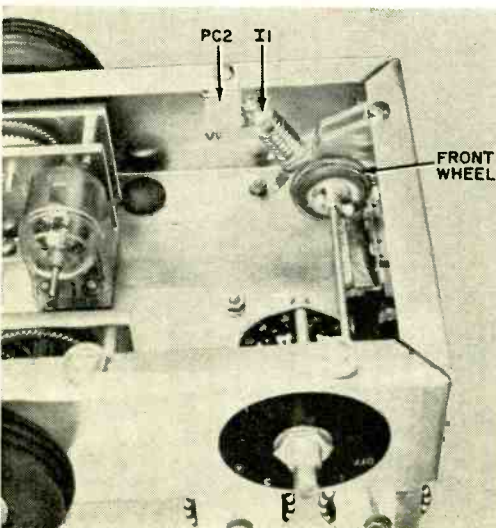
The bracket for *I1*'s holder is fastened to the lip of the *K1* end of the chassis and positioned 1" from the corner as

shown. Before installing *I1* in the holder, wrap the bulb with tape so that only its tip is left unmasked. Then, with *I1* in place, bend the bracket down so that the tip of *I1* projects only about $\frac{3}{16}$ " out from the chassis. Photocell *PC2*, its right-angled mounting bracket carefully bent out straight, is also fastened to the chassis lip and placed so that it centers on, and almost touches, *I2*.

The leads of transistor *Q1* are soldered to a 3-lug terminal strip fastened under one of the mounting nuts for *B3*'s holder. Dropping resistor *R1* (not visible in the photographs) is mounted on a 2-lug terminal strip which is located under *PC2* and fastened to another of the mounting nuts for *B3*'s holder. Other terminal strips found to be necessary as you proceed with the wiring can be installed as you go along.

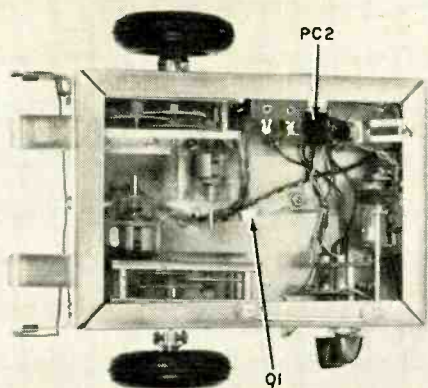
Holders for batteries *B1*, *B2*, *B3*, and *B4* are mounted as shown in the photos and need no special comment. The leads from these batteries, and from the pilot lights and photocell (if used) on Emily's cover, pass to the underside of the chassis through a $\frac{3}{8}$ " rubber grommet placed as shown.

This all but completes the mechanical work on the chassis except for the installation of the wheels. The small front wheel is mounted on a length of steel wire, the diameter of which matches its hub. As can be seen in the close-up photograph of this assembly, the wire is bent

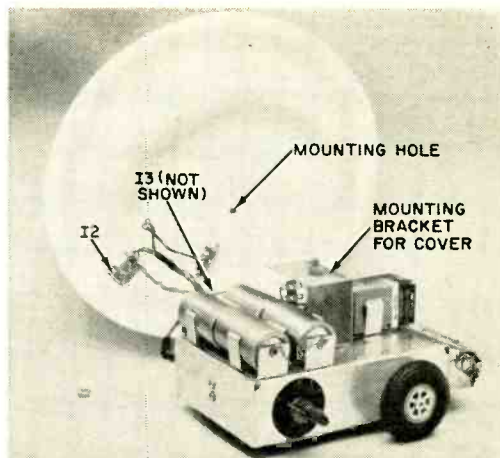


Mounting of *PC2*, *I1*, and front wheel can be seen clearly at left. Terminal strip for resistor *R1* will be fastened under nut directly below *I1*. Rear wheels with setscrew pulleys glued on are shown below, as is spare shaft used for centering the hubs. Either epoxy resin or "heatless" solder can be used for gluing.





This under-the-chassis view shows the completed wiring. A 3-lug terminal strip is mounted for Q1; connections to PC2 are made via a 2-lug strip.



Completed robot with dish-pan cover in background. All the components and wiring associated with the cover are optional (see text).

at a right angle and fastened at two points on the chassis lip with screws and washers.

The driving wheels are mounted on the gearbox output shafts by means of set-screw pulleys (one is supplied with each Wilson kit). These pulleys must be glued to the wheels; either epoxy-resin glue or "heatless" auto body solder will work well (see Parts List).

The hubs of the wheels used in the model were larger in diameter than the 3/32" pulley hubs. In order to center the pulley hubs on the wheel hubs properly, spare 3/32" shafts from the kits were slipped through the latter. In each case the diameter of the shaft, where it passed through the wheel, was built up with masking tape to match the diameter of the hub. The pulley was then slipped over the protruding end of the shaft and glued in place. When the glue dried, the spare shafts were removed and the wheels mounted on the gearbox shafts.

The design for the robot's cover can be as fanciful and imaginative as you wish to make it. The cover used here was made out of a yellow plastic dishpan about 12 3/4" in diameter and 4" high. A 1 1/4" x 2 3/4" x 2 5/8" miniature aluminum chassis, its two short ends bolted to Emily and the dishpan, respectively, serves as the mounting bracket.

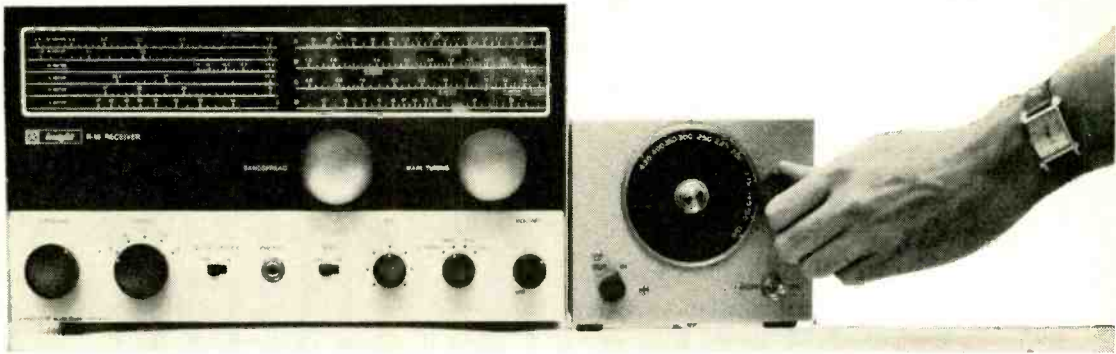
Photocell PC1 and the pilot lamp assemblies for I1 and I2 are mounted on the cover. A terminal strip installed under PC1's mounting nut connects the short leads of the photocell to the longer ones required to reach the chassis. The photocell and the two pilot lamps, as explained earlier, are optional.

Emily's wiring is not at all critical. All connections are made in normal point-to-point fashion, and no special attention need be paid to lead dress. Just be sure to use a heat sink when soldering Q1's leads and to observe carefully the polarity of battery B1—otherwise, the transistor might be damaged.

Testing and Operation. Install batteries B1, B2, B3, and B4 and, if PC1 is used, set switch S1 at position 1. Shine a flashlight on photocell PC1 and check to see that relay K1 pulls in. When you block the light beam with your hand, the relay should return to its normal position.

With PC1 illuminated, turn S1 to position 2. This should start motor M1 and illuminate I2. Be sure that the rotation of the wheel is in the proper direction (clockwise when viewed from the side). If the rotation is wrong, reverse either the motor leads or the polarity of battery B3.

Next, shield PC1 from the light. This should switch power from M1 and I2 to
(Continued on page 95)



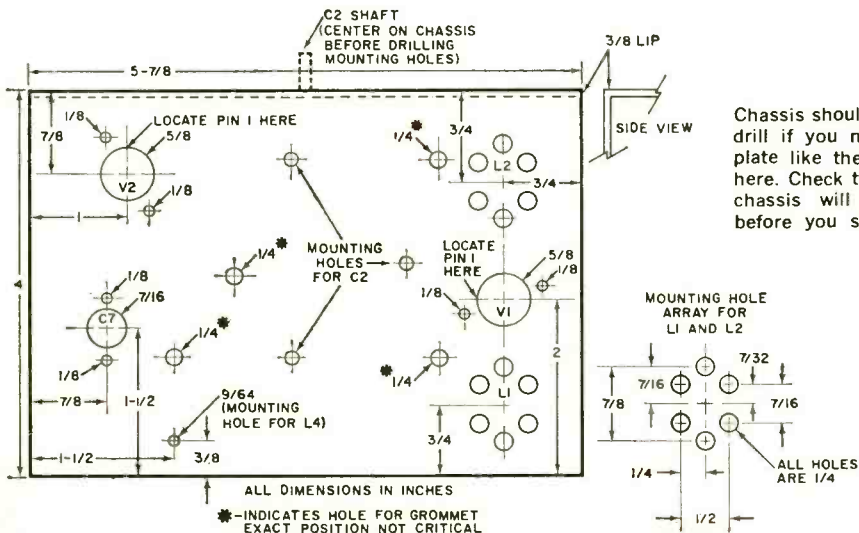
EVER LISTEN to the low-frequency "aircraft" band between 140 and 430 kc.? Chances are this portion of the spectrum is as unfamiliar to you as next week's DX'ing. Yet it's packed with aircraft beacon signals, tower-to-plane landing instructions, and continuous weather reports.

Since this band is seldom included on communications receivers, a special receiver or converter is usually required to pick it up. With the two-tube converter pictured here, you can easily adapt your communications receiver or even a good broadcast set to cover the 140-430 kc. range. Furthermore, the converter won't prevent you from picking up stations in the receiver's normal tuning range, since a switch on the converter's front panel enables you to bypass the converter and

run your antenna directly to the communications set.

Construction. The converter is housed in a 4" x 5" x 6" utility box; all parts, with the exception of the input and output jacks, are mounted on the front panel of the box and on a simple "L"-shaped chassis. In the model, the chassis is a 4 $\frac{3}{8}$ " x 5 $\frac{7}{8}$ " sheet of aluminum with a $\frac{3}{8}$ " lip bent on one edge for mounting.

If you prefer, small angles could be used in place of the lip to support the chassis. Begin assembly by drilling all holes in the chassis and box, and mounting all parts except power transformer *T1* and filter capacitor *C8*. All wiring, except that for the power supply and the input and output connections, can now be completed. Be sure to connect the terminals of the oscillator coil (*L4*) exactly as



Chassis should be easy to drill if you make a template like the one shown here. Check to make sure chassis will fit in box before you start drilling.

430

and



DOWN

Two-tube converter lets you listen to signals below the broadcast band

By PHILIP E. HATFIELD, W9GFS

Receiving Tube Dept.,
General Electric Co.

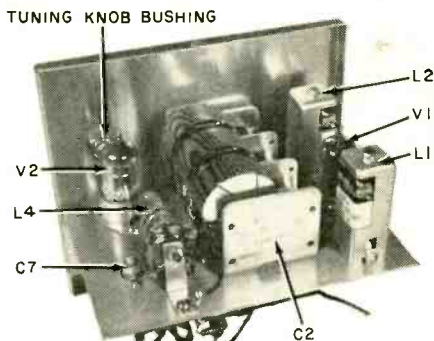
shown in the schematic, and note that both the rotor and the stator of padder capacitor *C7* must be insulated from the chassis.

Power transformer *T1* and filter capacitor *C8* can now be mounted and the power supply wired. The front panel and chassis should be mounted in the case, and the antenna and output leads connected to the antenna binding post (*J1*) and output jack (*J3*), respectively. If a small amount of slack is left in these wires, the unit can be removed from the case without unsoldering the antenna and output connections. (Simply turn the back plate at an angle and slide the whole assembly, back plate dangling, through the front of the box.)

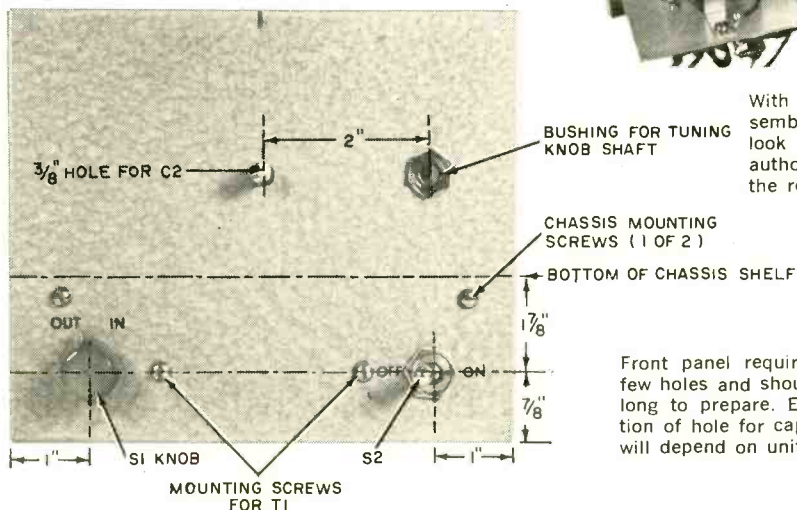
Alignment. With the utility box used here, the converter must be removed

from the cabinet for alignment. Make certain that the power supply is feeding about 100 volts to the tubes, then allow the converter to warm up for approximately ten minutes.

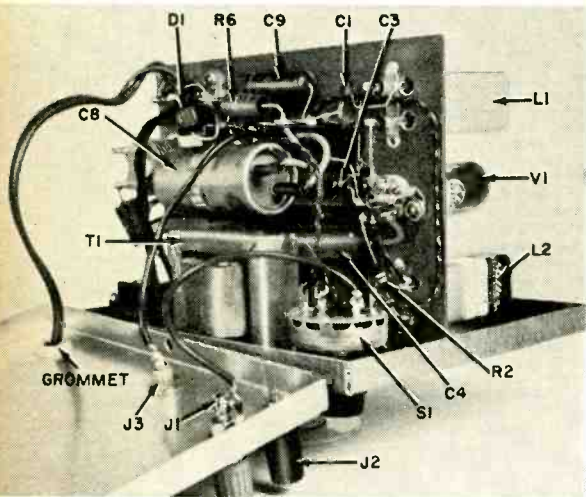
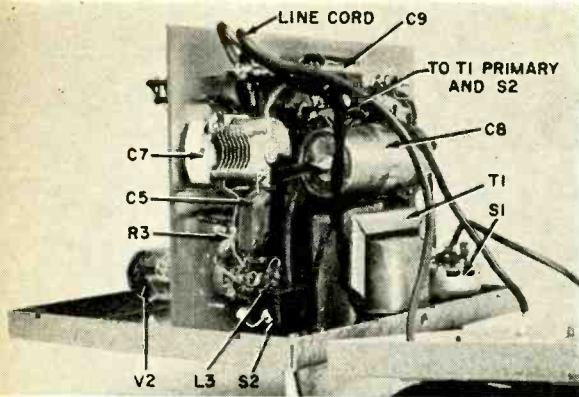
The oscillator should then be adjusted so that it covers the 1640 - 1930 kc. range. This can be done most easily by picking up the signal from the oscillator on an accurately calibrated communica-



With a little care in assembly, your converter can look just as neat as the author's. This photo shows the rear of the instrument.



Front panel requires only a few holes and shouldn't take long to prepare. Exact position of hole for capacitor *C2* will depend on unit selected.



These two views of the underside of the chassis show the location of every major component. Leads to jacks J1 and J3 should be long enough to allow you to rotate the back panel slightly in order to pass it through the utility box.

tions receiver and adjusting the oscillator to cover the proper range.

To align the converter, set the trimmer capacitor on the oscillator section (*C2b*) of the three-gang capacitor at about mid-range, padder *C7* at mid-range, and turn the three-gang capacitor (*C2*) to maximum capacitance. Tune the communications receiver to 1640 kc. and adjust the slug in the oscillator coil (*L4*) until the oscillator is on 1640 kc.

Now turn the three-gang capacitor to minimum capacitance, tune the communications receiver to 1930 kc., and adjust

PARTS LIST

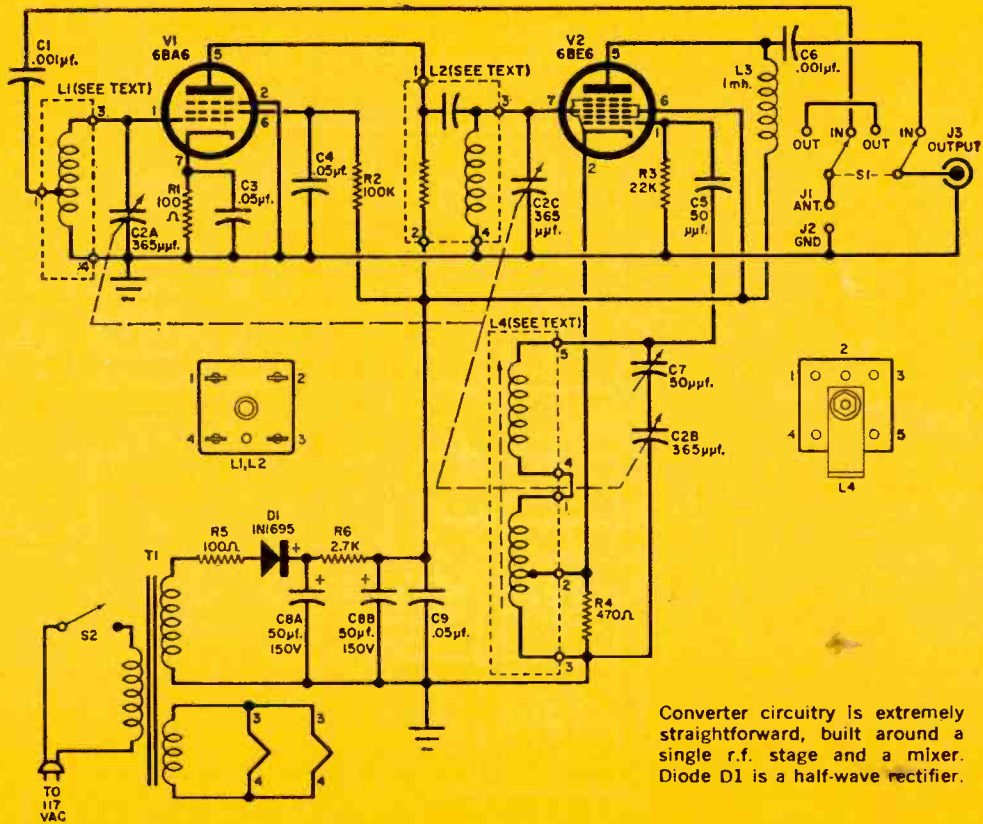
- C1, C6*—0.001- μ f. ceramic capacitor
C2a/C2b/C2c—Three-gang variable capacitor, 365- μ f. per section (Allied Radio 60 H 726 or equivalent)
C3—0.05- μ f., 200-volt paper capacitor
C4, C9—0.05- μ f., 400-volt paper capacitor
C5—50- μ f. mica capacitor
C7—50- μ f. variable capacitor, screwdriver or hex-wrench adjust (Hammarlund APC-50 or equivalent)
C8a/C8b—Dual 50/50- μ f., 150 w.v.d.c. electrolytic capacitor
D1—1N1695 diode
J1, J2—Insulated jacks (one red, one black)
J3—RCA phono jack
L1—140-425 kc. antenna coil (Miller X-121-A, Stancor RTC-8756, or equivalent)
L2—140-425 kc. r.f. coil (Miller X-121-RF, Stancor RTC-8757, or equivalent)
L3—1-mh. r.f. choke
L4—Oscillator coil (Miller 72-OSC, Stancor RTC-8735, or equivalent)
R1, R5—100 ohms
R2—100,000 ohms
R3—22,000 ohms
R4—470 ohms
R6—2700 ohms, 2 watts
S1—2-pole, 2-position, non-shorting, rotary switch (Mallory 3222J or equivalent)
S2—S.p.s.t. toggle switch
T1—Power transformer: primary, 117 volts a.c.; secondaries, 110 volts @ 30 ma. and 6.3 volts @ 0.6 amp. (Olson T-173 or equivalent)
V1—6BA6 tube
V2—6BE6 tube
I—6" x 5" x 4" utility box (LMB U-C 972 or equivalent)
Misc.—Wire, solder, etc.

HOW IT WORKS

The signal from the antenna is fed to the In/Out switch (*S1*) on the converter. When this switch is in the *Out* position, the signal is fed directly to the input of the receiver connected to the converter. When *S1* is in the *In* position, however, the signal travels (via capacitor *C1*) to the grid circuit (*L1/C2a*) of the 6BA6 r.f. amplifier (*V1*), and the receiver is connected to the output of the converter.

the padder capacitor (*C7*) until the oscillator is on 1930 kc. There will be considerable interaction between the slug and padder adjustments, and some "juggling" between the two will be necessary to achieve the proper frequency range.

After the oscillator has been adjusted to cover the required range, run a length of shielded wire from the output jack (*J3*) of the converter to the antenna and ground terminals of the communications receiver. Connect a signal generator to the input of the converter, and



Converter circuitry is extremely straightforward, built around a single r.f. stage and a mixer. Diode D1 is a half-wave rectifier.

The signal fed to tube V1 is amplified and then fed to the tuned circuit (L2/C2c) in the signal grid of the 6BE6 oscillator/mixer (V2). The tuned circuit (L4/C2b and C7) in the oscillator grid of V2 controls the frequency of the local oscillator signal which is produced in V2 and mixed with the incoming signal. The intermediate-frequency signal which results from mixing these two signals appears across the r.f. choke

(L3) in the plate circuit of V2 and is coupled to the associated receiver through capacitor C6.

The r.f. amplifier grid circuit, the mixer signal-grid circuit, and the oscillator-grid circuit are so tracked that the oscillator is always 1500 kc. higher than the incoming signal. This allows signals between 140 and 430 kc. to be tuned in with the converter when the communications receiver or broadcast set is tuned to 1500 kc.

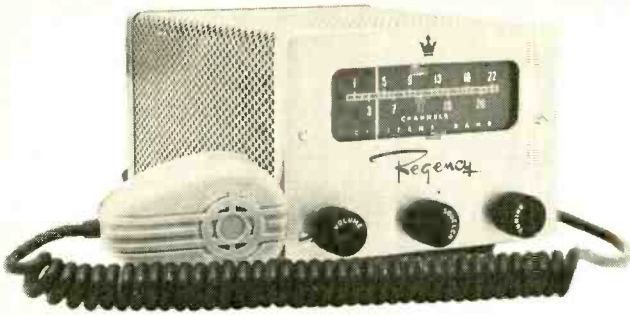
tune the communications receiver to 1500 kc. and the signal generator to 400 kc. Tune in the 400-kc. signal with the converter and adjust the trimmers on C2a and C2c for maximum signal strength.

A calibration curve of frequency-versus-dial settings of the converter can be drawn, or a calibrated scale can be attached to the dial. The dial scale shown on the model was prepared by making a drawing on tracing paper and then using this drawing to make a photographic contact print. The print was trimmed to size, with allowance made for a border

at the edge of the dial to accommodate the rim-drive mechanism. The print was then cemented to the dial, and sprayed with clear lacquer.

Operation. The converter should be used with a transformer-operated receiver, preferably of the communications variety. An a.c./d.c. receiver would introduce a shock hazard, and the loop antenna incorporated in this type of receiver would allow excessive pickup of signals other than those between 140 and 430 kc. Connections between the converter

(Continued on page 96)



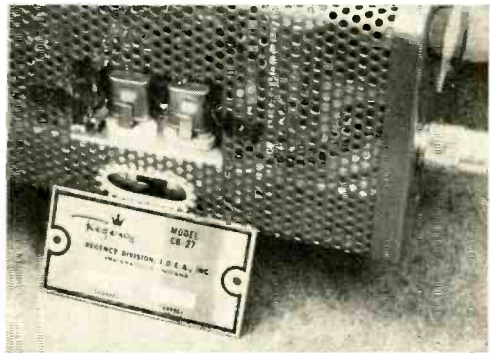
Equipment Report

Regency CB-27 Ranks High

AMONG the hundred different CB transceivers now on the market, there are several that are exceptionally well designed. One is the CB-27 available from Regency (7900 Pendleton Pike, Indianapolis 26, Ind.) and selling for \$124.95. (It is supplied for mobile use as the CBM-27-6 and CBM-27-12.) Small and very compact, the CB-27 incorporates a dual-conversion receiver covering all of the CB channels.

During a 30-day test in the POPULAR ELECTRONICS lab, the CB-27 racked up an excellent performance record. Our one reservation (see "Box Score") is that the operating ease is limited because only two transmit channels are available, and switching between the two is slightly inconvenient. This is a very minor drawback to the single-channel CB user when it is weighed against receiver performance, price, size and talk power.

By the way, the Regency CB-27 is one of the few transceivers that has a modulation level control in its speech amplifier circuitry. At maximum setting, the modulation percentage was 110%—which is more than enough to compensate for aging tubes. —30—



Crystals for the two transmitting channels are located behind a removable plate. The slide switch for changing frequency is just below the crystal mounts.



With an RCA Power Line Monitor checking the line voltage and a CESCO Transcheck measuring output, the CB-27 produced 3.2 watts output at 5 watts input.

BOX SCORE

	Excellent	Good	Fair	Poor
Talk Power	✓			
Selectivity	✓			
Sensitivity	✓			
Squelch	✓			
Noise Limiting	✓			
Stability	✓			
Operating Ease			✓	



IMPROVED EXPANDED SCALE VOLTMETER

New circuit will read peak a.c. voltage, or d.c. volts, regardless of lead polarity

By DOROTHY LOUISE ZACHARY

IF you built the "Expanded-Scale Voltmeter" described in the August 1961 issue of POPULAR ELECTRONICS, or if you're still thinking about building one, you'll be interested in this useful modification. As you may recall, the original instrument had three d.c. voltage ranges (0-10, 10-20, and 20-30), each spread out over the full scale of a 4½"-wide panel meter. Overload protection was automatically provided by the zener diodes used in the circuit; these diodes had the effect of "locking" the meter at its maximum scale reading regardless of the amount of overvoltage applied at the input jacks.

The improved expanded-scale voltmeter retains all of the original features, but each of the three d.c. voltage ranges can now be used to read the peak a.c. volts as well. In addition, you

don't have to worry about polarity when using the instrument on d.c. No matter which of the input jacks is positive and which is negative, the meter reads in the proper direction. To get these extra bonuses, you have only to add four diodes, a capacitor and a couple of terminal strips.

About the Circuit. No changes have been made in the circuit of the original meter, shown in the shaded area of the schematic on p. 53. (For a discussion of this circuit, see article mentioned earlier.) The modification involves adding a simple diode-bridge input consisting of diodes *D4-D7* and capacitor *C1*. The new circuit is connected to the old one at the points (marked "X" on the

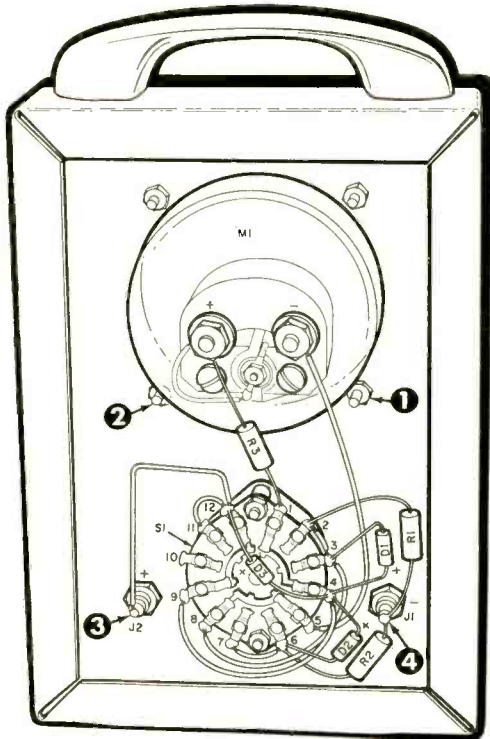
schematic) where input jacks *J1* and *J2* were originally wired in. These jacks are rewired to the diode bridge as shown.

If d.c. is now fed into the meter with *J1* plus and *J2* minus, diodes *D5* and *D6* conduct; diodes *D4* and *D7* do not conduct, since they are reverse-biased. The current then flows from *J2*, through *D6*, to the original negative input lead of the meter. Leaving the meter circuit through the original positive lead, the current passes through *D5* and out jack *J1*.

Should the situation be reversed (with *J1* minus and *J2* plus), diodes *D4* and *D7* would conduct—but diodes *D5* and *D6*, being reverse-biased, would not. In this case the current flows from *J1*, through *D4*, then to the original negative input lead of the meter and out the other lead as before. Passing through diode *D7*, the current finally flows out jack *J2*.

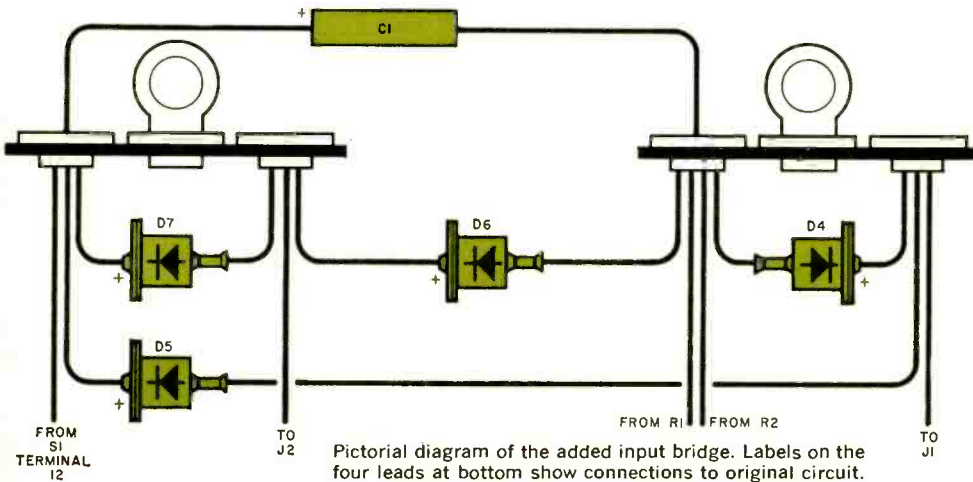
If jacks *J1* and *J2* are connected to an a.c. source, *J1* and *J2* become alternately positive and negative. When *J2* is negative, the current flows as in the first example discussed above; when *J1* is negative, the current flows as in the second example. Since the flow of current through the meter must always be in the same direction, rectification takes place. The net result is that the meter reads peak a.c. volts on each of its ranges. Capacitor *C1* acts as a ripple filter for the rectified a.c.; during d.c. operation, it serves to increase the damping factor of the meter.

Making the Modification. Even if you've already built the expanded-scale volt-

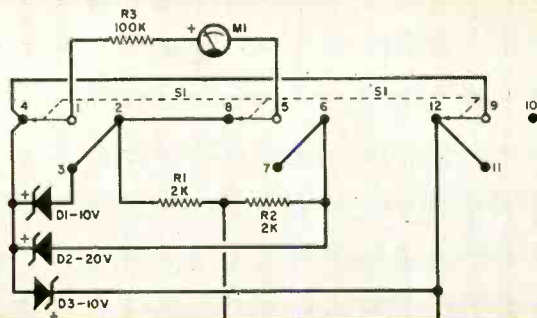


meter, installing the added components is no problem at all. Pictorial diagrams of the original circuit and the new input circuit are included for your convenience, as well as a photograph of the wiring of the author's modified unit.

Begin by removing the nuts from meter *M1*'s two bottom retaining screws. A 2-lug terminal strip is then installed

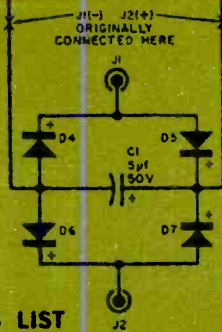


Pictorial diagram of the added input bridge. Labels on the four leads at bottom show connections to original circuit.



New circuit (in color) is added to old one (grey area) at the points formerly connected to jacks J1 and J2.

Pictorial diagram of original meter is shown at left. Begin conversion by installing terminal strips under nuts at points 1 and 2, unsoldering connections at points 3 and 4.

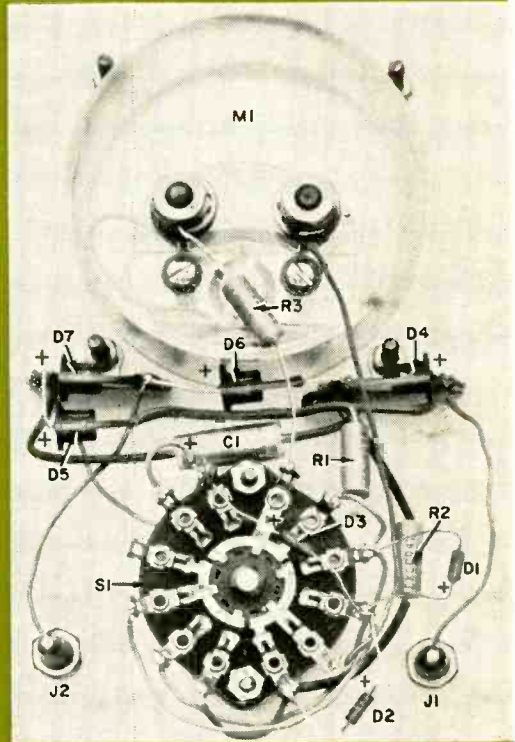


Rear view of converted unit (below) shows wiring clearly. Note that extra components fit with no overcrowding.

COMPLETE PARTS LIST

- C1—5- μ ., 50-volt miniature electrolytic capacitor*
- D1, D3—10-volt zener diode, 1-watt, 5% (Motorola 1N3020B or equivalent)
- D2—20-volt zener diode, 1-watt, 5% (Motorola 1N3027B or equivalent)
- D4, D5, D6, D7—1N91 diode*
- J1, J2—Insulated tip jack
- M1—0-100 d.c. microammeter (Beede Model 230 or equivalent)
- R1, R2—2000-ohm, 1-watt, 1% precision resistor (either deposited-carbon or wire-wound)
- R3—100,000-ohm, 1-watt, 1% precision resistor (either deposited-carbon or wire-wound)
- S1—3-pole, 3-position rotary switch
- 1—2" x 7" x 5" aluminum chassis (Bud AC-402 or equivalent)
- Misc.—Carrying handle, 2-lug terminal strips*, wire, solder, etc.

*Used in modified version only

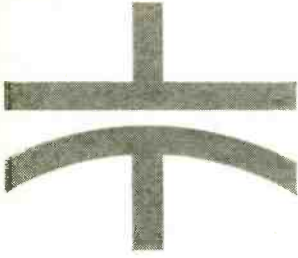


on each screw, and the nuts replaced and tightened down. Disconnect the lead (from S1's terminal 12) running to J2 and the leads (from resistors R1 and R2) running to J1. These leads are connected to the terminal strips as shown in the pictorial diagram of the input circuit.

Still referring to the pictorial, install diodes D4-D7 and capacitor C1 on the terminal strips, then wire in the new leads to J1 and J2. Be sure to use a heat sink when soldering in the diodes (they can easily be ruined by the application

of too much heat) and to observe carefully the polarity of both capacitor C1 and the diodes. The modification is now complete and the instrument is ready for use.

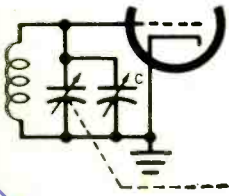
Reading the Meter. The procedure for reading the meter, whether you're measuring a.c. or d.c., is exactly the same as that used with the unmodified version. Just mentally convert M1's 0-100 scale to read 0-10 volts; but add 10 volts to all measurements taken on the 10-20 volt range and 20 volts to all measurements on the 20-30 volt range. -30-



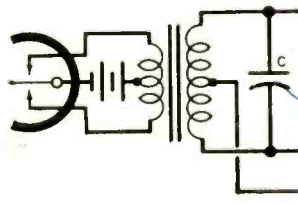
CAPACITOR FUNCTION QUIZ

By **ROBERT P. BALIN**

A "mainstay" of electronics, the capacitor is often identified by the function it performs. Can you match capacitor "C" in the circuits below with the functions listed on the right?



A



B

1 Coupling

2 Bypass

3 Filter

4 Trimmer

5 Decoupling

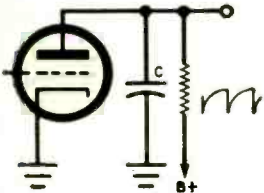
6 Sweep-forming

7 Buffer

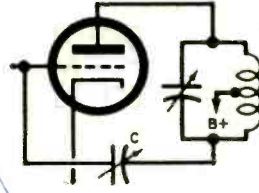
8 Padder

9 Neutralizing

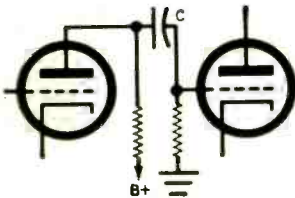
- ✓ E
- ✓ G
- ✓ F
- ✓ A
- ✓ ~~B~~
- ✓ C
- ✓ B
- ✓ H
- ✓ D



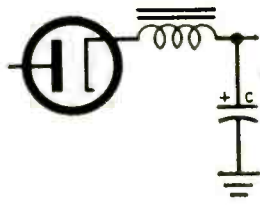
C



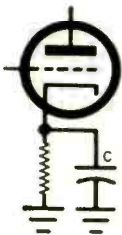
D



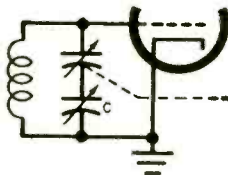
E



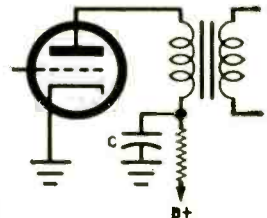
F



G



H



I

(Answers appear on page 101)

**Work out dozens of games
to delight your friends
with this clever panel of
144 random-lighting bulbs**



The Magic Matrix

By LOUIS E. GARNER, JR.

THE "Magic Matrix" is a delightful electronic toy for children and an interesting gaming device for adults. An easy-to-build electronic gadget, it permits the random illumination of any one of a large number of neon bulbs at will, depending on the relative positions of two unmarked rotary switches.

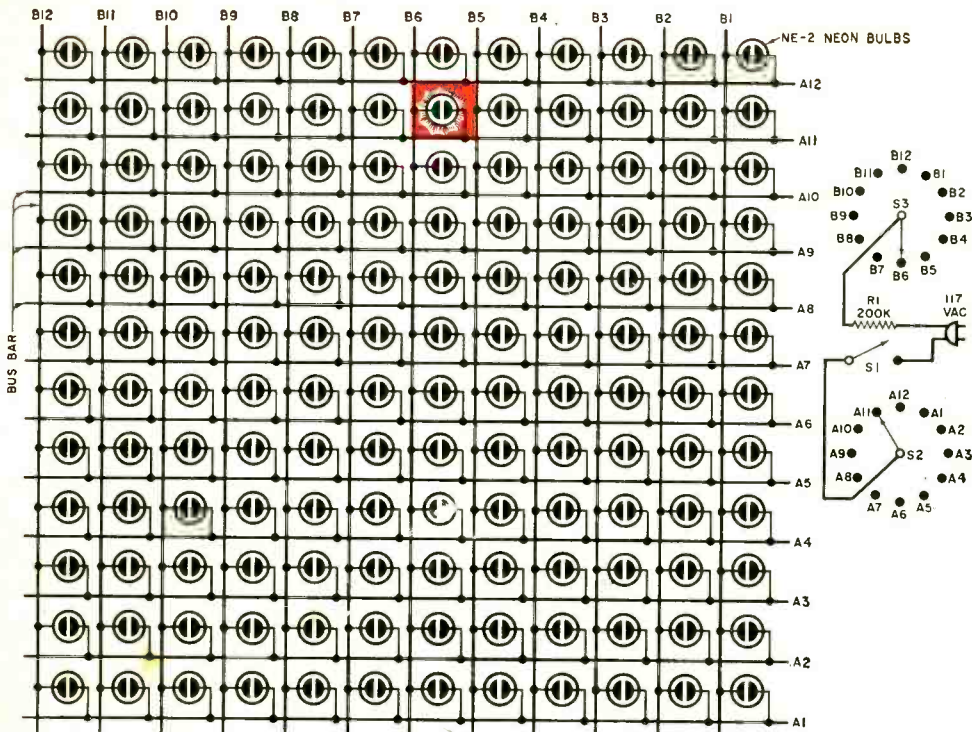
Basically, the Magic Matrix consists of a square 12 x 12 array of low-cost neon lamps. In operation, the manipulation of two rotary switches selects the row and column in which the chosen lamp is located. Then, when the *Push-to-Play* switch is depressed, the selected lamp glows. Since the two switches can rotate freely and continuously, and are unmarked, the chances of guessing

which lamp will glow are comparable to the odds of 143 to 1.

Thus, the Magic Matrix can form the foundation for a large variety of games, including *Electronic Roulette*, *Bingo*, *Rows and Columns*, *Blank the Board*, *Catch the Crook*, and others.

CONSTRUCTION

The size and the operation of the Magic Matrix are determined by the Malloy 12-position single-pole rotary switches (Type 32112J) currently available at most parts distributors and mail order houses for about a dollar per switch. There are a few other types available with 14 and 20 positions, in case you would like a larger matrix, but



Of the 144 neon bulbs, only the shaded one will light for the switch positions shown. Wire bus bars to switch terminals having same markings.

they are priced much higher than the 12-position type.

Either NE-2 or NE-51 neon lamps may be used as indicating devices—one lamp for each position, or 144 lamps, in the 12 x 12 Magic Matrix. Type NE-2 lamps were used by the author because they are less expensive and come equipped with flexible wire leads which are easily soldered to connecting bus bars.

The playing board is made from a piece of perforated Masonite prepunched with holes on half-inch centers. Cut the board large enough to provide a mounting space for all the neon bulbs, as well as extra space for mounting the push-button *Push-to-Play* switch, *S1*, and the two rotary selector switches, *S2* and *S3*.

Using a tapered reamer, enlarge the small holes in the playing area sufficiently to provide a snug fit for the neon bulbs. Enlarge other holes (outside the playing area) for the line cord and for mounting the three switches.

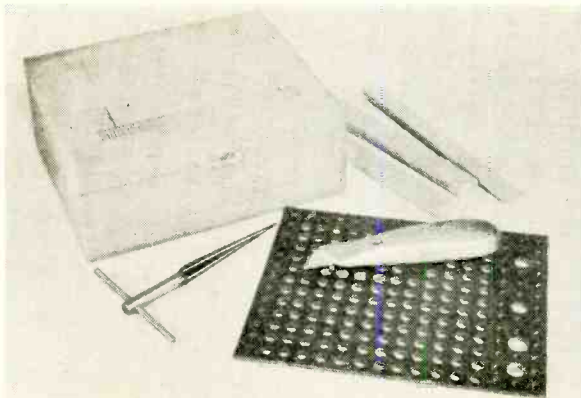
PARTS LIST

- R1*—220,000-ohm, 1/2-watt resistor
- S1*—S.p.s.t. normally-open push-button switch (Switchcraft #951 or equivalent)
- S2, S3*—1-pole, 12-position non-shorting rotary switch (Mallory 321121)
- 144—Type NE-2 neon bulb
- Misc.—Wooden cigar box; two knobs; line cord; 12-lug terminal strips; perforated 3/4" thick Masonite (to fit box); cement; rubber grommet, wood strips, etc.

Next, paint the board on its smooth side with white enamel or aluminum paint. When the paint has dried, the neon bulbs are seated in the mounting holes, and are cemented in place with Duco cement or some similar general-purpose household cement (such as General Cement Type 32-2A).

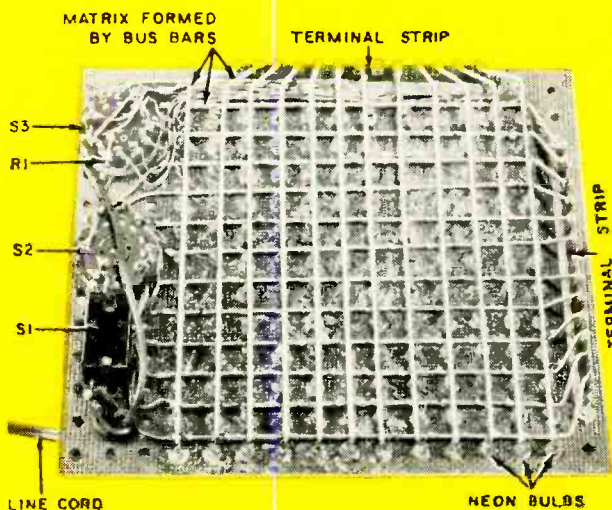
The neon lamps' leads (or terminals) are soldered to horizontal and vertical bus bars. Refer to the schematic diagram when making lamp connections. As each lamp is connected to a row and column bus bar, put a check mark on the lamp symbol in the schematic diagram.

Each bus bar is made up of #12 tinned copper wire, straightened and mounted on terminal strips so that each is in-



Non-electronic parts and tools required to build the Magic Matrix are a wooden cigar box, $\frac{1}{4}$ "-thick perforated board, wood strips, reamer, and razor.

After the terminal strips and switches are installed, the neon bulbs are seated in their openings and cemented in place; keep cement off the leads.



When wiring is completed (left), unit's matrix resembles that of a complex computer. Cigar box (below) makes neat-looking housing.



sulated from all others, with the vertical array of bus bars insulated from the horizontal array. This is accomplished by mounting one bus bar array one inch above the other set. One bus bar is provided for *each* row and column in the matrix . . . 12 horizontal and 12 vertical bars in a 12 x 12 array.

Connect one end of each horizontal bar to a different terminal on rotary switch *S2*. Similarly, each vertical bus bar is connected to corresponding terminals on rotary switch *S3*. Thus, the positions of the two rotary switches determines to which pair of horizontal and vertical bus bars voltage is applied when the *Push-to-Play* switch, *S1*, is depressed.

Switch *S1* is a s.p.s.t. normally-open

push-button switch in series with one side of the line cord. Series resistor *R1* is connected to the other side of the line cord and its resistance serves to limit the current through the selected neon bulb. *Round, unmarked* knobs should be installed on switches *S2* and *S3*.

To check the operation of the completed board, insert the line plug into a standard a.c. or d.c. wall receptacle and depress *S1*. One of the neon bulbs in the matrix should glow. *With S1 depressed*, rotate *S2* and *S3* through their full rotation; one switch should "move" the
(Continued on page 106)

On the Citizens Band



with **DICK STRIPPEL**, 2W1452

CB Editor

THE TWO teen-agers who stole mobile CB radios in Wenatchee, Wash., recently, didn't realize that tracking down such mobile sets is child's play to Citizens Banders. The transceivers disappeared from the Belmont Radio and Music Shop on a Saturday afternoon. When the owner of the store, Merle (Beany) Lanphere, noticed they were gone, he turned on his own set, tuned it to the channel he knew the stolen sets used, and waited. Almost immediately he heard the two boys on the air.

Using a directional antenna, Lanphere tried to determine their location by the signal they were transmitting. Then, with the help of some six other members of the Apple Valley Citizens Band Association, he went looking for the sets.

"All it took was one call on the rig," said Lanphere, whose call letters are 14W1288, "and I had a crew out to run them down. It lasted about an hour and a half as the boys only talked at intervals and kept moving around."

The club members would listen on the same channel the boys were using, then switch to another channel to talk among themselves. After getting several "fixes," they converged on the boys, accompanied by a police car. Although the thieves escaped at this point, it was the beginning of the end, for several of the club members recognized them.

"Those Citizens Band radios proved to be good detectives," declared Lanphere, who handles both Polycomms and Osborne equipment in his store. He and his CB associates have had plenty of practice tracking down signals as part of Civil Defense drills.

Needless to say, the boys were apprehended a short time afterward and the missing CB sets recovered.

Avoid QRM. Need a rest from the babble of interference on some CB channels? If you're a serious fleet operator, or just someone who wants to get a message

through without hair-pulling QRM, try one of the even-numbered channels. For some reason, CB'ers seem to gravitate to the odd-numbered channels. With the possible exceptions of 4 and 20, the even-numbered channels are remarkably clear, even in the New York City area. B-C-N-U on channel 14?

Alarming Views. During the past several months, a number of clubs and individuals have taken it upon themselves to write to their Congressmen complaining about CB regulations. These people seem to take the stand that the FCC is an impersonal agency, while their representatives in Congress are there to work for them.

When examined logically, this view is not only ridiculous, but has an undermining effect on our governmental structure. A comparative case on a local scale would be the person who writes to his city councilman because he receives a traffic ticket or objects to parking meters. In some localities this may work—because the actions of the police force are governed by politicians with reelection in mind.

(Continued on page 100)

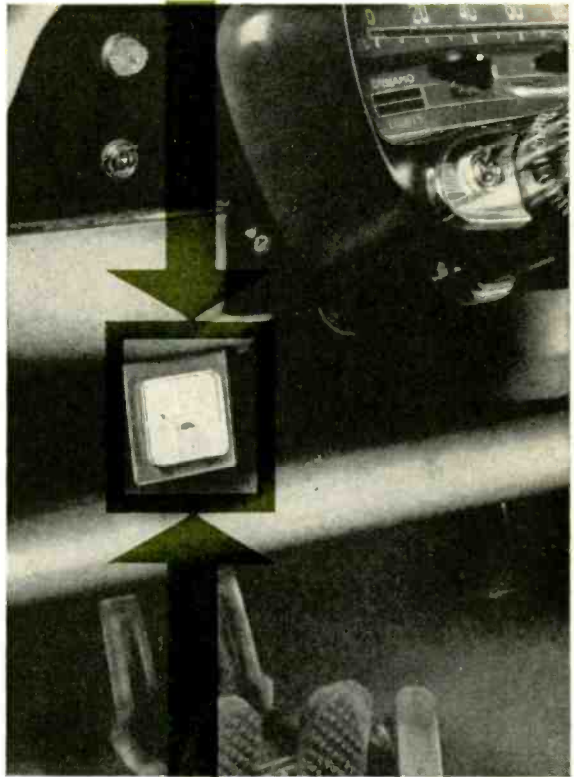


"Well, man, I hear like Citizens Bands are the thing now."

IDIOT LIGHTS OUT ...METERS IN

No way to keep tabs on your car's exact engine temperature? Then dump those "idiot lights" and replace them with this all-electronic temperature gauge!

By
CHARLES CARINGELLA
W6NJV



AS you no doubt know, the temperature gauge is one "standard equipment" item that is missing from a good many cars. In fact, a colored light is often the only indication that there's trouble brewing somewhere in the auto's cooling system. And all too often, its warning comes too late.

While canvassing the auto parts houses in search of a suitable temperature gauge for his automobile, the author decided that he wanted a more versatile instrument than the types commonly available. An *electronic* temperature gauge was his solution.

The model shown was designed to operate as "universally" as possible. It will work on either a 6- or 12-volt, positive- or negative-ground system with simple circuit modifications. In addition, it can

be constructed for less than \$10.00—cheap "insurance" against costly auto engine repairs from almost anyone's point of view. And it can be duplicated by virtually anyone without the need for test equipment or tricky adjustments.

There are several advantages in using an *electronic* temperature gauge. First, a single-conductor lead of any length can be run from the sensing unit to the meter assembly. Secondly, its response time is much faster than that of many other gauges—bourdon-tube types, for example. Last of all, any number of sensing units can be switched; this feature should be of value to auto enthusiasts and race-car drivers who would like to monitor cylinder-head and oil temperature as well as water temperature.

The model was carefully temperature-

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temperature rises, and decreases as its temperature falls.

The thermistor is inserted into one leg of a bridge circuit—see the schematic diagram. At some temperature, the resistance of the thermistor is equal to the resistance of resistor *R1*, which is in the opposite leg of the bridge. In this condition, the bridge is balanced and no current flows through the meter.

Whenever the thermistor is heated, however, its resistance drops, causing current to flow through the meter. In order to read temperature rather than current, the meter scale is calibrated directly in degrees Fahrenheit.

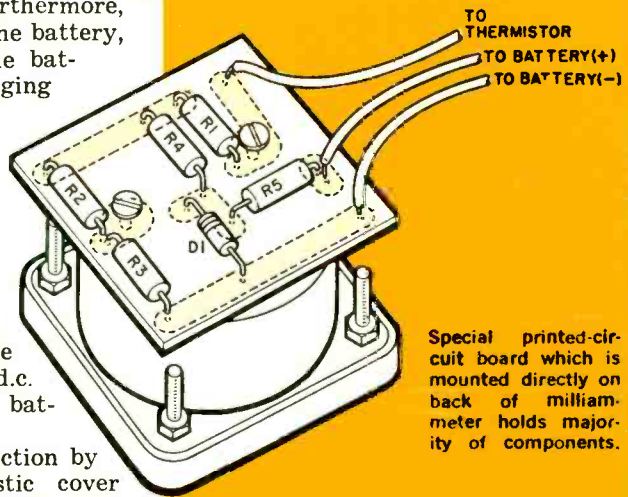
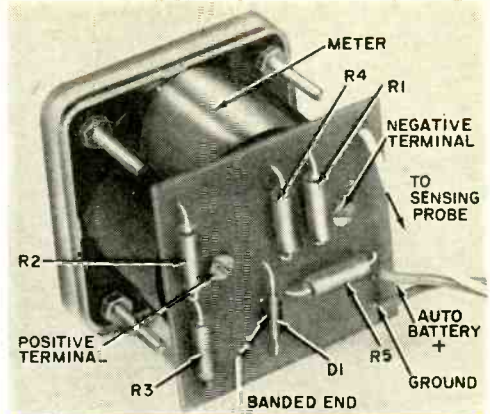
The circuit is powered by the automobile battery. Unfortunately, battery voltage is not always constant; furthermore, since the generator is across the battery, its output voltage exceeds the battery voltage during the charging period, and the output of the generator will vary with engine speed.

These voltage fluctuations would naturally disturb the overall accuracy of the instrument, had they not been eliminated with zener diode *DI*, which keeps the voltage applied to the bridge at a constant 5.6 volts d.c. regardless of what the actual battery voltage might be.

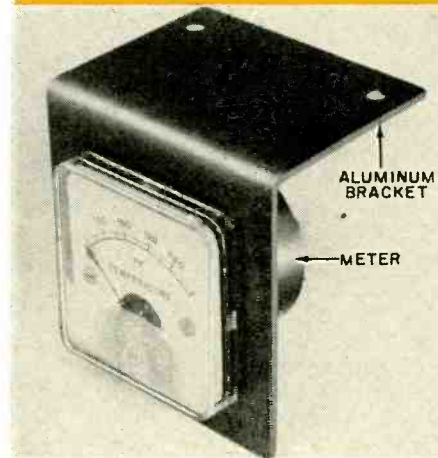
Construction. Begin construction by carefully removing the plastic cover from the front of the meter. (The cover is held by two snaps on either side and can be pried off with a small knife.) Remove the two screws which hold the meter face (see photo), and carefully slide the face out from under the pointer. (The pointer is extremely delicate, so hands off!)

Cut out the new meter face, including the two holes for the screws. Apply a thin layer of rubber cement to the front of the old meter face and also to the rear of the new one. Join the two together, being careful to align the two screw holes in the process. Then mount

Entire meter assembly can be inserted into a small right-angle aluminum bracket and bolted to underside of automobile dashboard, as pictured at right.

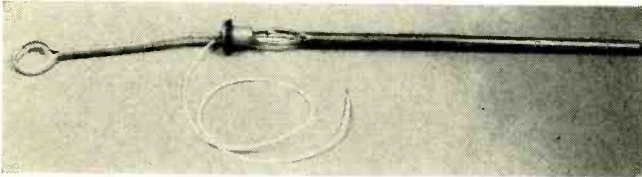
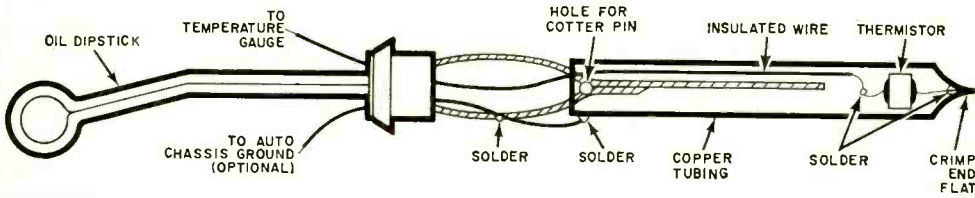


Special printed-circuit board which is mounted directly on back of milliammeter holds majority of components.





Disc-type thermistor isn't much larger than the head of an ordinary household match, yet it functions as the "sensing unit" for the electronic temperature gauge.



Thermistor can be mounted either in a modified oil dip stick (above) for measuring oil temperature, or in a simple housing (below) for monitoring temperature of cylinder head. See text for details.

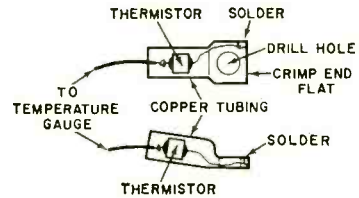
the new meter face on the meter movement once again and snap the plastic cover back in place.

The entire circuit, except for the thermistor sensing probe, is constructed on a printed-circuit board.* (If you wish, a piece of perforated phenolic board can be used in place of the printed-circuit board, with the components mounted exactly as shown. A similar point-to-point wiring arrangement can then be used on the underside of the board.)

The hookup shown in the schematic diagram is for the conventional negative-ground system. If your automobile employs a positive-ground system, reverse the zener diode connection so that the banded end is connected to ground, and reverse the meter connections so that the positive terminal is connected to the junction of resistor *R1* and thermistor *RT1*.

It was decided to monitor the oil temperature, since the author's car is air-cooled rather than water-cooled, and oil temperature is probably a better all-around indication of an engine's cooling efficiency. Accordingly, the thermistor is mounted in a special housing on the oil dip stick and soldered into the end of a piece of copper tubing which is slipped over the dip stick.

*The printed-circuit board is available for \$1.00, postpaid, from SESCO, Box 7388, Alta Loma, Calif.



One end of the thermistor should be soldered to the copper case, and the other end connected to the lead running to the electronic assembly. A separate ground lead to the auto chassis will probably be required, although the contact between the dip stick and the engine block may be good enough to make such a lead unnecessary. Since the original oil-level markings will have been covered up, it will be necessary to scratch new ones on the outside of the copper tubing.

If it is desired to monitor cylinder-head temperature, a simple housing can be made. The thermistor is mounted in a short piece of copper tubing, with the tubing crimped at one end and flattened along with one of the thermistor leads. The flattened end is drilled so that it can be bolted to the cylinder head.

Take care not to overheat the zener diode when soldering it to the board, and be certain to connect the electronic temperature gauge to the ignition switch so that the gauge is in operation only when the automobile is running.

ELECTRONICS SCHOOLS PART 2

Want a career in electronics but find that you're unable to attend school full-time? The solution to your problem is a correspondence school. You can suit yourself as to how, when, and where you study, because . . .



They'll teach you **ELECTRONICS** at home

By JOHN D. and IRENE LENK

GETTING AHEAD in electronics makes some type of formal electronics training almost a necessity. But whether you decide to take this training at home from a correspondence school—or away from home at a residence school—depends on individual circumstances and preferences. Since “home-study” schools have proven extremely popular over the years, let's look more closely at how these schools operate.

Almost all correspondence schools divide their home-study courses into a number of individual lessons. In actual practice, each lesson is a separate booklet devoted to a specific subject—modulation, time constants, electron tubes, and so on. In fact, by carefully grouping the training material, a student can easily build up a reference library in which almost any subject can be readily located.

Usually, each booklet opens with an introduction and then goes into the subject in detail. Each booklet ordinarily includes all necessary

Electronic kits form a part of many correspondence school courses. Kits help you to become familiar with many basic circuits and give you an opportunity to build and test a wide variety of electronic equipment. All will prove very useful to you, especially the test instrument kits which you will probably need later in your professional career.



diagrams and exercises, as well as a summary of the material covered. Sometimes, too, each booklet contains a glossary of new terms to be learned in that particular lesson.

The average electronics home-study course will have 60, 80, or even more lessons, depending upon the particular electronics field covered. In each case, the first 40 or so lessons will cover basic electronics and elementary mathematics. The remaining lessons will be devoted to a particular subject—TV servicing, FCC license preparation, etc., or perhaps even to specialized subjects such as TV cameras, servomechanisms, and computer logic.

In the case of a Technical Institute or Advanced Trade School, a home-study course will probably be divided into 80 or 100 lessons. In addition, each lesson will be broader in scope and quite a bit more "meaty" than those from an "ordinary" correspondence school.

How Long Will It Take? As with most home-study schooling, the time required to complete any given course is pretty much up to you. A good rule of thumb, however, is one lesson per week, or 8 to 10 hours per lesson—whichever fits your situation. Thus, a full 100-lesson course from an Advanced Trade School or Technical Institute will take you the better part of two years to complete.

Some schools impose a time limit (usu-

ally about three years) for completion of their courses. They reason that either the course is too difficult or that you're not applying yourself if you can't complete a "1½-" or "2-year" course in three years.

Even so, most schools recognize that each student is an individual, with individual capabilities and circumstances. However, a student who regularly turns in one lesson every two or three weeks is considered a much better prospect than one who intermittently keeps up with a one-a-week average schedule and then falls badly behind. In other words, if you can show steady progress and are doing good work, most schools will allow you to take additional time.

Will I Get Any "Extras"? At one extreme, you might receive nothing but basic lesson material and the corresponding examinations. At the other extreme, you could receive the parts for a 21-inch TV set (which you can assemble and fit into your own cabinet) along with a fairly complete set of test equipment in kit form (which you can also build and later use in your work). Generally, the more you receive in the way of "extras," the more you will pay.

Some schools supplement their basic lesson material with such training devices as motion picture films. The counterpart of classroom lectures, such films are loaned to you during the course,

along with a hand-operated silent projector and a viewing screen. This type of extra training aid is the exception, however—in most cases, the “extras” consist of slide rules, reference books, electronics dictionaries, tips on turning your new-found skills into spare-time cash, and so on.

As far as kits are concerned, some home-study schools supply them and some do not. Those schools which don't furnish kits—about 50% or more—offer several reasons for their stand. They feel that the prime purpose of kit construction is for the student to acquire mechanical skills, to become familiar with the physical appearance of electronics parts, and to “learn by doing.” Students of the advanced schools (particularly the Technical Institutes) are ordinarily already working in electronics or have at least been exposed to basic shop practices, so kits might serve only to slow them down. Other schools state flatly that they omit kits to reduce the cost of training.

If you decide that kits are a necessary part of your home-study course, you'll find that there is a vast difference in both their quantity and quality. In general, the shorter courses supply fewer kits, and the less expensive courses supply kits of lower quality. But this isn't always so. Some schools have gone “all-out” in their kit programs, particularly those

which provide test equipment in the form of kits. Such schools assume that you will make use of test instruments in your professional career.

What Will I Need? If you select a non-kit type of home-study course, you can get by with a minimum of equipment. About all you'll need is a few pencils, possibly a slide rule, a ream or two of scratch paper, and (if worse comes to worst) several gallons of black coffee!

The situation is a little different if your study course includes kits. First, you'll need adequate work space (a conventional workbench is best) and a source of electric power. Most kits require 117 volts a.c. (at least for the soldering gun), even though they may be battery-operated. This may seem a minor point, but some schools have reported cases where students in remote areas or foreign countries have had to skip key portions of their training because of inadequate or otherwise unsuitable power sources!

Next comes the problem of tools and test equipment. Some schools supply common hand tools, some make tool kits available at reduced cost, and some expect you to dig up your own. Tools present no great problem, since most are inexpensive and readily available. Unfortunately, this isn't true of test equipment, at least as far as cost is concerned. And since a number of schools specify that

ADVANTAGES OF HOME STUDY

You set your own pace. You neither fall behind, nor are you held back by a “class average” schedule.

You can repeat the study material. In residence-school training, you receive a class lecture or a demonstration only once. If you miss it or fail to understand it, you've more or less had it. With home study, you can read the lessons any number of times. And you can keep the lesson material after you have completed the course.

You receive more personal attention. No other student shares the time of your instructors with you. An instructor at a residence school can answer just so many questions after each lecture or demonstration. A home-study instructor answers all of your questions, and in writing. Thus, you retain the answers for future use.

You have less problems with temporary interruptions in study. You can't interrupt in-residence training more than a day or two without missing vital lectures and demonstrations (or examinations). Therefore, no matter what the reason, residence schools cannot tolerate your being absent for any length of time. They must drop you, or put you back. Home-study courses can be far more lenient in this respect.

The hidden factor of personal application. By its very nature, home study develops your ability to analyze and extract information, as well as to strengthen your sense of responsibility and initiative. Electronics technicians, even though they do not intend working for themselves, must be “self starters.” Anyone who can satisfactorily complete a home-study course in electronics need have no worry about his initiative.

you must have certain items of test equipment to complete kit training, this is a point to watch when selecting a home-study course.

What About Exams? The majority of home-study courses in electronics provide an examination with each lesson. One exception is where the lessons are supplied in groups of two, three, or five, in which case there will be an examination for each group. A very small number of schools require examinations at periodic intervals during the course as well as a final examination.

Those Technical Institutes which grant an A.S.E.E. degree for home study require that you sit for a final exam at the school or for a "proctored" exam somewhere nearer your home. (A proctored examination is one supervised by a representative of the school or by an instructor so designated.)

It's not that the Technical Institutes don't trust you; in fact, they won't even allow you to take the final exam until they feel you're qualified! However, the accrediting agency (usually the State Board of Education) will not permit the institutes to grant an A.S.E.E. degree without a supervised final exam.

Home-study course examinations are almost always "open-book." But since the lessons and examinations are written in such a way that you can't "match up" the questions and answers, you must do

more than merely memorize facts. In short, you must understand the principles you have learned to get the right answers; simply memorizing facts isn't enough!

When the course includes kits, most schools require that you also submit examination papers on various stages of kit construction. In this way, your instructor can check your practical knowledge and tell whether you are developing the necessary manual skills.

For example, assume that you have constructed a simple ohmmeter kit. You might then be asked to make up a network of resistors, to measure the resistance at various test points in the network, and to write up the test results. By carefully studying your answers, the instructor can tell: (1) if the ohmmeter was constructed properly, (2) if the resistor network was arranged as indicated, and (3) if you performed the tests correctly. If you've "goofed" somewhere along the line, you'll hear about it. So it's not just a matter of putting home-study kits together and making them work.

And If I Fail? At this point you may be wondering, "What happens if I flunk one or more of the exams?" Although each of the schools has its own particular procedure for "problem" students, it usually goes something like this.

Your instructor sends you a new exam-

DISADVANTAGES OF HOME STUDY

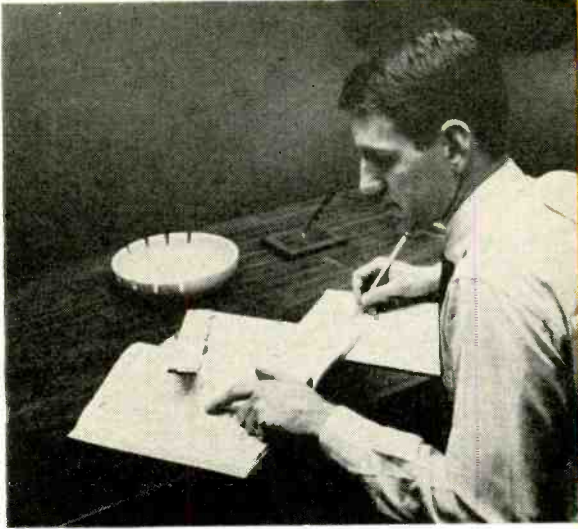
The lack of training and supervision in manual skills. A professional electronics technician must be able to assemble, wire, and solder electronic equipment in a workmanlike manner. The only way you can learn this is by actually doing it. Unless you have worked in the field, you'll likely need training and supervision to acquire the skills. Even with a home-study course that supplies kits, there is no instructor to inspect your practical shop work in person. It's true that home kit experiments and test results will tell the instructor that you have wired a particular kit correctly, but they won't show if you have produced a good wiring job.

The lack of personal contact with instructors. There are some people who must be shown how a thing is done, or how it works, to fully grasp a new subject. Once they understand the subject, they have no trouble in remem-

bering, or in putting the knowledge to work. If you are one of those people, home study may prove difficult.

The lack of practical experience in specialized fields. Some specialized electronics fields require on-the-job type training before a technician is qualified to fill a position—such as operator of a radar set or a TV camera. Until a person has actually operated these devices, no amount of theoretical study will enable him to make full use of them.

Lack of academic credit. As of this writing, it is not possible to obtain a B.S.E.E. degree solely through home-study training. Also, it is quite difficult to obtain an A.S.E.E. degree without some resident work. If a degree is your immediate goal, you may as well plan on spending months, if not years, at resident training.



Periodic examinations are the rule for most home-study courses. The majority of these exams are "open-book" and are designed to gauge your knowledge of electronic principles rather than specific facts. When completed, the exams are mailed to your school's home office where your instructor carefully checks them and grades you on your progress.

ination paper (the schools have several dozen examinations for each lesson), and a letter explaining why you failed. He will then recommend that you re-study the lesson, and he may point out certain areas on which to concentrate. If you fail this second examination, the instructor will again supply you with a new one and sufficient written comment to point out your weaknesses.

A third failure will bring one or two things. Some schools will permit you to take the examination any number of times, although you'll receive no additional lessons until you pass. Other schools set a limit on the number of failures. If you exceed the limit, they tactfully request that you drop the course. If you're in the early stages of training, the schools will quite often refund all or most of your money; if you're toward the end of the course, they will pro-rate the refund.

Personal Contact. In any type of home-study course, there is the obvious drawback of the student not having personal contact with his instructors in the classroom. This situation is particularly critical in the study of electronics, or at least far more critical than with comparable studies—say accounting or law.

All of the schools recognize this drawback, and each school has developed its own methods for bridging the "in-person" gap. In general, the methods boil

down to (1) clear, straightforward lesson material, and (2) personal attention for each student.

The lesson material is written and illustrated in such a manner that the average student should be able to grasp the subject *without further help* from an instructor. Naturally, the schools aren't going to force you to "go it alone," but they do try to prepare their material so that you can digest it without the aid of an instructor.

Most texts are written in two steps: first, by an expert in the particular field the lesson covers, then by an editorial specialist to make sure that the lesson is clear and readily understandable. All of the material is heavily supplemented with drawings, diagrams, and photographs to clarify or stress particular points.

Each examination sent in by a student is personally evaluated, corrected, and graded by individual instructors who are experts in their particular fields. Incorrect answers are noted, and special comments are made, showing the proper approach to the problem. The instructors rarely give you the correct answers; instead, they make you "dig" to find the

(Continued on page 101)

Which of these correspondence schools will you choose to help you get ahead in electronics?



MAJOR CORRESPONDENCE SCHOOLS OFFERING ELECTRONICS COURSES

American School
Drexel Ave. at 58th St.
Chicago 36, Ill.

**American Institute of Engineering
and Technology**
1135 W. Fullerton Ave.
Chicago 14, Ill.

Business Electronics
420 Market St.
San Francisco 11, Calif.

Capitol Radio Engineering Institute
3224 Sixteenth St., N.W.
Washington 10, D.C.

Central Technical Institute
1644 Wyandotte St.
Kansas City 8, Mo.

Christy Trades School
3214 W. Lawrence Ave.
Chicago 25, Ill.

Cleveland Institute of Electronics
1776 E. 17th St.
Cleveland 14, Ohio

Commercial Trades Institute
1400 W. Greenleaf Ave.
Chicago 26, Ill.

Coyne Electrical School
1501 W. Congress Pkwy.
Chicago 7, Ill.

DeVry Technical Institute
4141 Belmont Ave.
Chicago 41, Ill.

Grantham School of Electronics
1505 N. Western Ave.
Hollywood 27, Calif.

Industrial Training Institute
2150 Lawrence Ave.
Chicago 25, Ill.

International Correspondence Schools
Scranton 15, Pa.

Motorola Training Institute
4501 W. Augusta Blvd.
Chicago 51, Ill.

National Radio Institute
3939 Wisconsin Ave., N.W.
Washington 16, D.C.

National Technical Schools
4000 S. Figueroa St.
Los Angeles 37, Calif.

**Pacific International College of
Arts & Sciences**
5719-M Santa Monica Blvd.
Hollywood 38, Calif.

Phileo Technological Center
P. O. Box 4730
Philadelphia 34, Pa.

RCA Institutes
350 W. 4th St.
New York 14, N.Y.

Radio Television Training of America
52 E. 19th St.
New York 3, N.Y.

RTS Electronics Division
815 E. Rosecrans Ave.
Los Angeles 59, Calif.

DeVry Tech of Canada, Ltd.
970 Lawrence Ave., W.
Toronto 19, Ont.

ICS Canadian, Ltd.
7475 Sherbrooke St., W.
Montreal 28, Que.

WHO SAYS you have to fashion a room around a speaker rather than a speaker around a room? Looking over the justly famous "Sweet Sixteen" speaker system (see POPULAR ELECTRONICS, January, 1961, p. 55, and April, 1961, p. 55), this author came up with the idea of building a multiple-speaker setup to fit his wall space.

In the author's case, it was desirable to place a center-channel speaker halfway between two stereo speakers which were spaced approximately ten feet apart. However, the space between these two enclosures was occupied by a six-foot-long radiator. Directly above the radiator was a double window, which left a nine-inch section between the top of the Venetian blind and the ceiling as the only space available.

The "Sweet Sixteen" system suggested that small speakers could be mounted in a line, occupying a space "n" speakers long and only one speaker high. The result: a veritable "line" of sound from a magnificent little enclosure appropriately dubbed the "Soundliner."

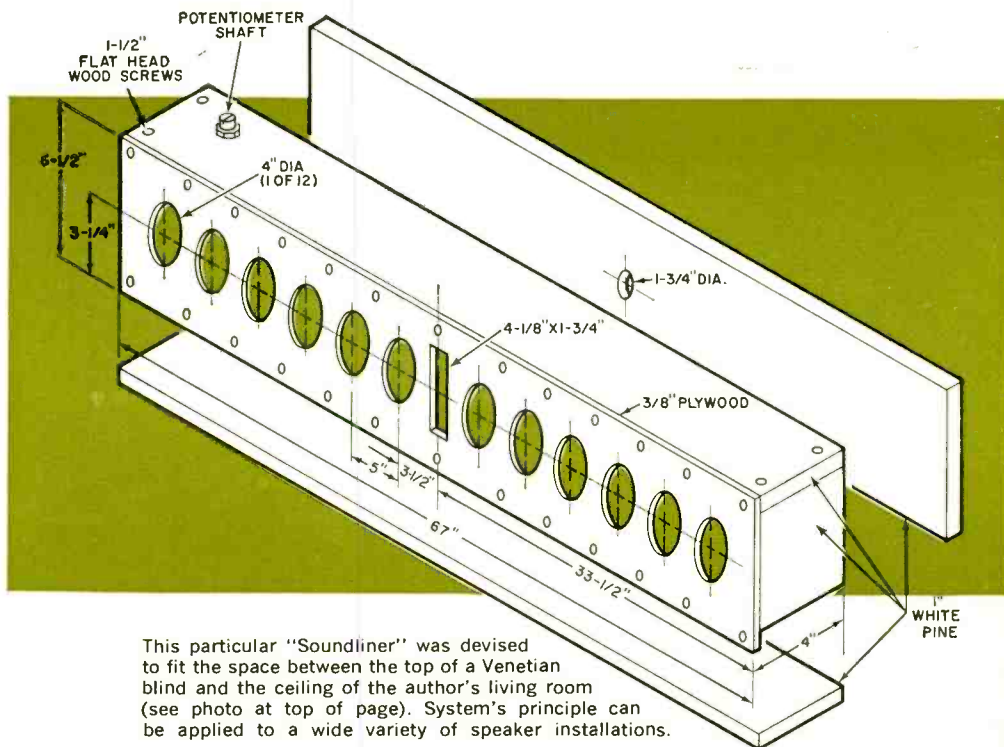
Details of the multiple-speaker "Soundliner" appear below, but the exact nature



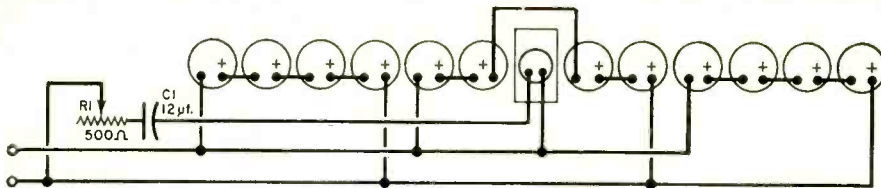
THE SOUNDLINER

**Adaptable speaker enclosure is
low in cost, high in performance**

By JOHN P. BOSTON



This particular "Soundliner" was devised to fit the space between the top of a Venetian blind and the ceiling of the author's living room (see photo at top of page). System's principle can be applied to a wide variety of speaker installations.



Wiring diagram for "Soundliner" system. This particular configuration presents an impedance of approximately 4 ohms, but almost any other common impedance is possible.

of the enclosure will naturally vary from installation to installation. The author used 1" pine for the top, back, bottom, and ends of the enclosure, with 3/8" plywood for the front. Inexpensive, replacement-type speakers were purchased from Olson Electronics—the 5" units cost only 99¢ apiece, while the tweeter (an Olson S-307) sells for \$8.95. The entire enclosure was lined with inexpensive acoustical padding.

If you intend to use your "Soundliner" as a center-channel speaker and your stereo amplifier doesn't have a center-channel outlet, you can either add the proper resistive networks or purchase a special center-channel output trans-

former. An Olson T-296 third-channel output transformer was utilized here.

Although the author was primarily interested in adding a center channel to a stereo system, the "Soundliner" is applicable to almost any setting. Since it is based on the same principles as the "Sweet Sixteen," its sound is extremely good. What's more, its adaptability and economy should appeal to almost any audio fan—whether for public address, added coverage, low-cost hi-fi/stereo, or—you name it! Since the number of speakers and the length of the enclosure can be selected to suit the space available, the "Soundliner" is a "natural" almost anywhere!

-30-

CROSSWORD PUZZLE

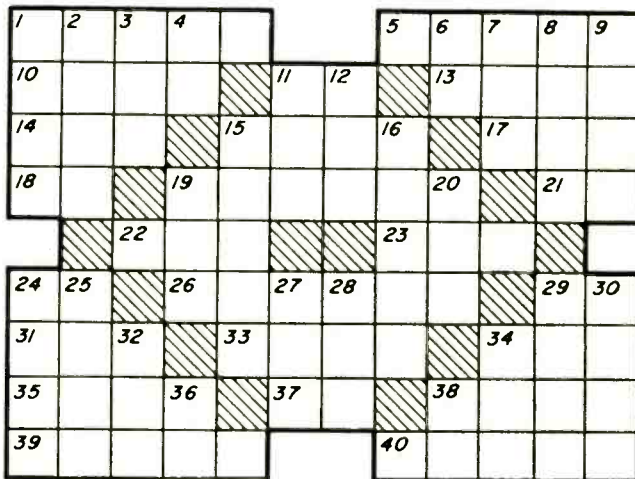
By Margaret Le Fevre

ACROSS

- 1 Electromechanical man.
- 5 White -----
- 10 March days.
- 11 Pronoun.
- 13 Norse goddess.
- 14 Obtain.
- 15 To trim.
- 17 Circuit used in s.w. receivers: abbrev.
- 18 Selenium rectifier: symbol.
- 19 Transceiver manufacturer.
- 21 Shilling: abbrev.
- 22 Heater or filament: schematic abbrev.
- 23 To discard.
- 24 ----- tube.
- 26 Amateur license class.
- 29 Table of Operations: Army abbrev.
- 31 Solder -----
- 33 Reckless.
- 34 Fire residue.
- 35 Island.
- 37 Normally open: schematic abbrev.
- 38 1/16 of an ounce.
- 39 C.W. or -----
- 40 Long-distance "hounds."

DOWN

- 1 Ham equipment: pl.
- 2 River in Germany.
- 3 Wager.
- 4 Osmium: symbol.



- 6 Preposition.
- 7 Man's name.
- 8 Incoming -----: (pl.) abbrev.
- 9 ----- and everyone.
- 11 Vase-like vessel.
- 12 Morse code for "help."
- 15 ----- code.
- 16 Birds do it.
- 19 Separates seeds from fibers.
- 20 ----- point.
- 24 Alligator -----.

- 25 ----- order.
- 27 Type of truck.
- 28 ----- tope.
- 29 Eastern king.
- 30 ----- Law.
- 32 ----- bar thermistor.
- 34 To be: pl.
- 36 Printer's measure.
- 38 SWL talk for long distance.

(Answers on page 108)

BACK in the February 1956 issue of **POPULAR ELECTRONICS**, the author described an easy-to-build electronic "banjo"—an instrument resembling a conventional banjo in appearance, but with a unique tone quality of its own. In those days, power transistors were fairly expensive and not very plentiful. The circuit, therefore, was designed around a small-signal transistor capable of handling only a few milliamperes. Adequate speaker volume could be obtained only by operating at moderately high voltages, and an expensive and relatively

sistor drives its main load, the PM loudspeaker, directly. Transformer *T1*, its secondary connected in parallel with the voice coil of the loudspeaker, is used to provide the collector-to-base feedback needed to start and sustain oscillation.

The rate of oscillation is determined mainly by the values of base feedback capacitor *C1* and base bias resistances *R1* and *R2*. Varying the value of any of these three components would change the "pitch" of the signal produced but, in this circuit, only *R1* is variable. Power for the oscillator is supplied by battery



ELECTRONIC BANJO . . . REVISITED

A more modern version of the musical instrument familiar to our readers of a few years ago, this unit provides more volume with a less-expensive battery

By LOUIS E. GARNER, Jr.

short-lived 22½-volt battery had to be used as a power source.

Today, power transistors are common and inexpensive. Handling large currents, they can deliver fair amounts of power at low voltages. And so, with the new components available, a redesign of the electronic banjo seemed like a good idea. The result was an instrument using a popular *pnp* power transistor and an inexpensive 6-volt battery. The new banjo has a tone range and quality comparable to the original version, but with somewhat greater volume.

About the Circuit. Transistor *Q1* functions as a blocking oscillator. The tran-

B1 and controlled by push-button switch *S1*.

Construction. Although the circuit is completely new, the body of the original banjo was retained intact. It's made from an 8" x 1½" round aluminum cake pan and an 18"-length of 1"-diameter aluminum tubing. A 1" hole is punched in the side of the cake pan and the tubing is pushed through it so that about an inch projects into the pan. A 1" pipe clamp is then fitted around the tubing and secured to the pan with a pair of machine screws.

To prevent the tubing from rotating, secure it to the pipe clamp with a small

sheet-metal screw. The far end of this 18" aluminum arm is closed off with a standard snap-on cap. Mount push-button switch *S1* about three inches from the end of the arm and run its leads through the arm and into the cake pan.

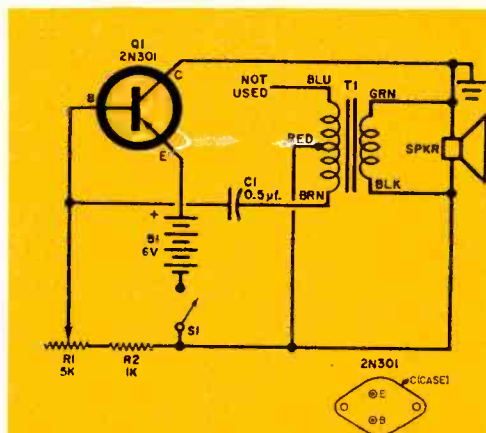
Holes are drilled in the pan for mounting the pitch control (*R1*), the battery holder, the loudspeaker, transformer *T1*, and a 5- or 6-terminal "tie point" strip. In the author's model, a pattern of small holes was punched for the loudspeaker "grille." A large round or square hole could be cut, however, and covered by a piece of grille cloth glued to the inside of the pan. The back of the pan is closed later with a round piece of 1/4" Masonite which is secured to the rear of the loudspeaker with a pair of machine screws. The parts layout used in the author's model is shown in the photograph. Parts placement is not critical, however, and the locations may be shifted to suit your own preference.

When all the mechanical work is completed—but before the parts are mounted and wired—the body should be painted and, if desired, decorated. Use two coats of good-quality enamel, applying them with brush or spray. When the second coat is dry, the decorations may be applied. Decals representing musical notes were used by the author. If you decide to use decals, protect them with two or three coats of clear lacquer.

After all the parts are mounted on the pan, attach transistor *Q1* to the loudspeaker's output-transformer mounting bracket; use one of the two holes provided in the bracket. A lockwasher-type ground lug, which serves as the collector terminal, is placed under the nut.

The wiring is quite simple and lead dress is not critical. Note that the only parts of the circuit connected to the "chassis," or ground, are *Q1*'s collector, *T1*'s green lead, and one of the loudspeaker terminals. The transistor's base and emitter connections are made by soldering the leads directly to the pins. To avoid heat damage, use a hot, well-tinned soldering iron and complete the connections as quickly as possible.

When the wiring is completed, double-check for errors before installing battery *B1*. When you do install it, be sure to observe the proper polarity—a dab of red nail polish can be used to identify



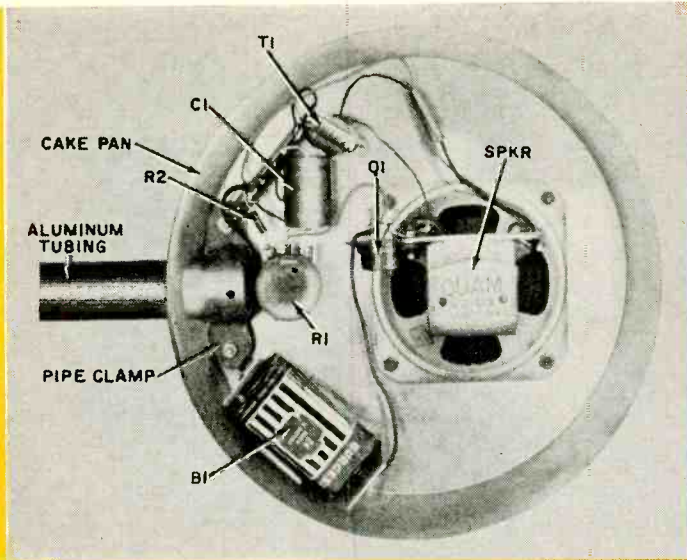
PARTS LIST

- B1*—6-volt battery (Burgess Z4 or equivalent)
- C1*—0.5- μ f., 150-volt paper capacitor
- Q1*—2N301 transistor
- R1*—5000-ohm potentiometer
- R2*—1000-ohm, 1/2-watt resistor
- S1*—S.p.s.t. push-button switch
- T1*—Output transformer; primary, 500 ohms CT; secondary, 8 ohms (Argonne AR-164)
- 1—8" diameter, 1 1/2" high aluminum cake pan
- 1—18" length of 1" o.d. aluminum tubing
- Misc.—Holder for *B1*, 1" pipe clamp, 1" tubing end cap, Masonite for back, bar or lever knob, terminal strip, decals, paint, hardware, wire, solder, etc.

the positive terminal permanently. Finish the banjo by attaching the Masonite back and mounting a long bar or lever knob on the shaft of pitch control potentiometer *R1*.

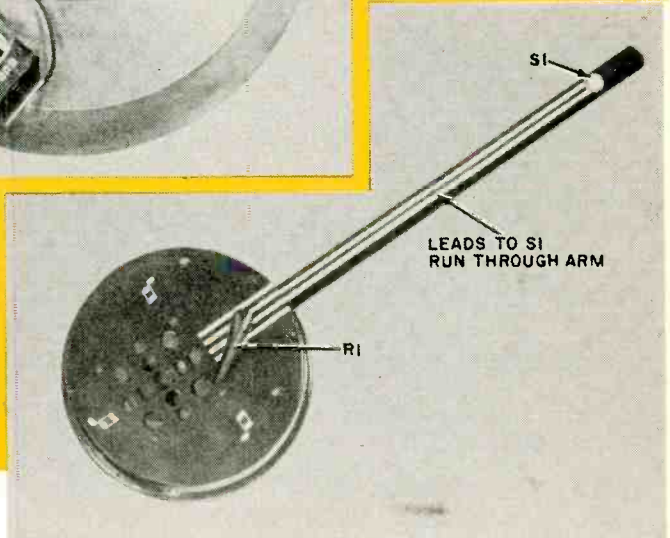
Operation. The instrument is held, much like a conventional banjo, in both hands. A note is sounded by positioning *R1*'s lever knob and depressing *S1*. The switch is held closed long enough to sound a sixteenth, quarter, half, or full note as desired. Potentiometer *R1* is then repositioned for the next note.

With practice, *R1*'s proper position for each musical note can be determined by "feel." At the beginning, however, you may wish to mark the various positions. You can do this directly on the banjo's body with water color paint—the markings may be wiped off with a damp cloth after you've learned the settings. Alternatively, a cardboard or paper "calibra-



Uncluttered parts layout reflects simplicity of circuit (see schematic on opposite page). Speaker frame is used as common grounding point.

A bit of paint and a few decals disguise the humble origins of the banjo body. Use long bar or lever knob on shaft of R1.



tion chart" might be taped on. Using your piano, or a pitch pipe, as a guide, try to determine positions for each of the eight notes in an octave. You might call on a musically inclined friend to help with the calibration if you find it difficult.

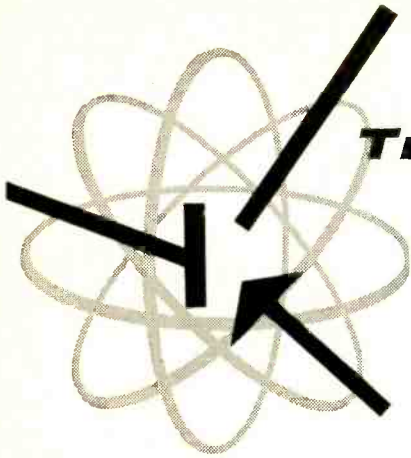
As mentioned previously, the instrument's tone is not like that of a string banjo. It resembles, rather, that of a code practice oscillator rich in harmonics. Although but one note can be sounded at a time, several special effects become possible as skill is acquired. For example, if R1 is shifted in position while S1 is held depressed, it is possible to "slide" from one note to another. A practiced operator can almost make the instrument "talk."

With the specified values of C1, R1, and R2, the lowest frequency produced by the banjo is 400 cycles and the range

is about two octaves. These characteristics will vary considerably from unit to unit, however, depending on component tolerances.

The banjo's basic range may be shifted in frequency by changing C1. A larger value here will lower operating frequencies while a smaller one will raise them. The final value of this capacitor can be determined experimentally to suit personal tastes but the 0.5 μ f. unit specified should work quite well.

The range may be extended to cover three octaves or more by reducing the value of R2. In the author's model, changing R2 to a 330-ohm resistor did the job. Conversely, increasing R2's value will compress the range. Again, it's necessary to experiment to get the range you want, but don't reduce the value to less than 300 ohms or you may damage the transistor.



Transistor Topics

By **LOU GARNER**
Semiconductor Editor

NO ONE WOULD DENY that electronics is a richly rewarding hobby. But, like most hobbies, it generally pays its "rewards" in intangibles rather than cold cash . . . the *joy* of creating a new instrument from individual components, the *skill* acquired in working with tools, the *knowledge* gained in studying new circuits, the *pleasure* of using the completed instrument, and the *pride* in showing the project to family, friends, and neighbors.

Once in a while, though, an individual will find that his hobby can pay more material rewards. Reader Ralph E. Riggs III, KN3NCQ (10304 Julep Ave., Silver Spring, Md.), for example, recently won a \$100.00 U. S. Savings Bond in recognition of his skill in assembling a transistorized keying monitor. (See Fig. 1.)

The award was presented late last year by Nathan F. Coffey, an electronics engineer with the National Institutes of Health. It represented top prize in the Rock Creek Amateur Radio Association's annual "build-it-yourself" competition among Novices in Montgomery County, Md. Significantly, Ralph's prize-winning project was adapted directly from a circuit described in POP'tronics by Contributing Editor Herb Brier in the November 1960 issue (p. 93).

In addition to the monetary award,

KN3NCQ received a few extra "intangible" awards in the way of favorable publicity and public recognition—including write-ups in several newspapers and an interview on station WHFS-FM. Congratulations, Ralph! And a "Hats Off" to the Rock Creek Club for their efforts in encouraging new hobbyists. Finally, kudos to Herb Brier for providing the necessary "spark" in his column.

Readers' Circuits. Barry Burnside's (34726 Palomares Rd., Hayward, Calif.) recently submitted the *wireless broadcaster* circuit shown in Fig. 2, together with the suggestion that other readers might wish to experiment with this simple hookup. Suitable for use with a high-output crystal microphone or phono cartridge, the unit operates near the upper end of the AM broadcast band. It is designed for use with a moderately long (5' to 8') external antenna and, like most other low-power designs, it has a rather limited range.

Referring to the schematic diagram, a *pnp* transistor, *Q1*, is used as a modified common-base r.f. oscillator. The r.f.

Fig. 1. Ralph E. Riggs III is the proud recipient of a \$100 Savings Bond awarded by the Rock Creek Amateur Radio Association. Ralph, KN3NCQ, won the prize in a "build-it-yourself" contest by constructing the transistorized keying monitor shown here.



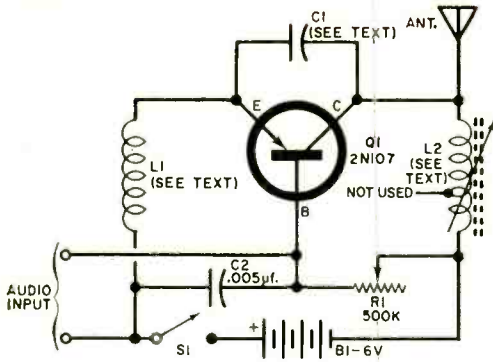


Fig. 2. Wireless broadcaster circuit submitted by reader Barry Burnside employs a single transistor and works with a crystal mike or phono cartridge.

choke, $L1$, serves as the emitter load, while a ferrite Loopstick antenna coil ($L2$) serves as the collector load. Feedback necessary to start and maintain oscillation is furnished through capacitor $C1$, and base bias is supplied through potentiometer $R1$, which is bypassed for r.f. by capacitor $C2$. A 6-volt battery, $B1$, controlled by a s.p.s.t. switch, $S1$, supplies the operating power. The audio signal used for modulation is applied between $Q1$'s base and circuit "ground."

A duplicate circuit can be assembled on almost any available chassis—a small metal one, a plastic box, or simply perforated fiberboard. Neither layout nor lead dress should be critical. Coil $L1$ is a standard 2.5-mh. r.f. choke, $L2$ is a Meissner 14-9015, Lafayette MS-11, or similar unit. Capacitor $C1$ is a small mica or ceramic unit, with its final value determined experimentally; some builders may prefer to use an adjustable padding capacitor—30 $\mu\text{f.}$ should work.

The other capacitor, $C2$, can be a paper or ceramic bypass unit; its working voltage is not critical. Any standard 500,000-ohm potentiometer is suitable for $R1$. Power switch $S1$ can be a toggle or slide type, or, if preferred, a rotary unit ganged to $R1$. Finally, the power pack can be made up of four penlight or flashlight cells in series or a single six-volt unit, such as a Burgess Z4.

Once the wiring is completed and checked for errors, the battery should be installed and the instrument adjusted; be sure to set $R1$ at its maximum resistance position and turn $L2$'s core all the way in *before* flipping $S1$ "on." The com-

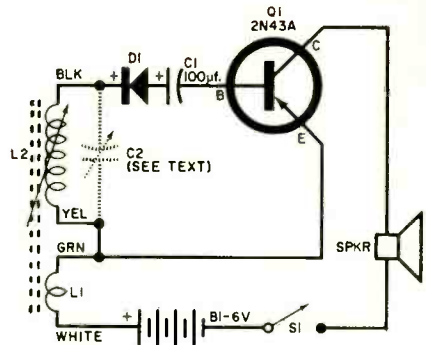


Fig. 3. Darkroom timer designed by Norman Huffnagle delivers audible "clicks" at regular intervals ranging from $\frac{1}{2}$ to 20 seconds.

pleted unit should be placed near a standard AM receiver and $R1$ adjusted *gradually* while the set is tuned. When a signal is picked up, $C1$ and $R1$ should be adjusted for best operation; $L2$ can be readjusted to shift the operating frequency. You'll find that the signal can be identified more easily if a microphone (or phonograph pickup) is used to supply audio modulation as the receiver is tuned.

Reader Norman Huffnagle (2717 Carpenter Ave., Des Moines 11, Iowa) works in a photographic darkroom where total darkness must be maintained at all times. Norman's solution to this problem was an *audio timer* that provides "clicks" at intervals ranging from one-half to twenty seconds.

As you can see from Fig. 3, a single *pnp* transistor, $Q1$, is used in the common-emitter arrangement as a modified Hartley oscillator. Feedback needed to start and maintain oscillation is provided by a ferrite core antenna coil, $L1/L2$.

A large coupling capacitor ($C1$), series diode ($D1$), and strong feedback signal (supplied by $L2$) combine to produce "blocking action" at a low repetition rate. The net result is a series of current pulses through the speaker voice coil serving as $Q1$'s collector load, developing clearly audible "clicks" at predetermined intervals. Operating power is supplied by a 6-volt power pack, $B1$, controlled by s.p.s.t. switch $S1$.

Standard components are used throughout. Coil $L1/L2$ is a Meissner 14-1071 antenna coil; $C1$ is a 100- $\mu\text{f.}$, 6-volt electrolytic capacitor; and $S1$ is

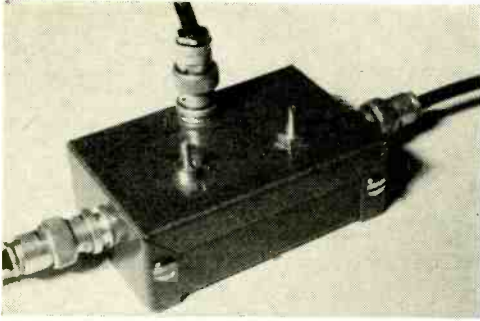


Fig. 4. Novel solid-state amplifier by Denro Labs has a high input impedance, a low output impedance, and a resultant power gain of between 30 and 40 db.

a s.p.s.t. toggle or slide switch. Norman indicates that almost any diode can be used for *D1* if it has a forward resistance of about 20 ohms and a reverse resistance of about 5000 ohms; he himself employed a Honeywell 2N539A transistor, using the collector as the positive and the emitter as a negative lead, with the base not connected.

The speaker in the original model is a 2" PM unit with a 3.2-ohm voice coil, but larger speakers can be used as long as the voice coil impedance doesn't exceed 16 ohms. The power supply is made up of four flashlight cells connected in series.

With the wiring completed and batteries installed, closing *S1* should produce a "click" in the speaker. Afterwards, the pulse rate can be pre-adjusted, using a watch or clock with a sweep second hand. Adjustment of *L1/L2's* ferrite core controls the pulse rate; for widely spaced pulses, it may be necessary to insert a short piece of iron in the coil in addition to the ferrite core—a nail or ferrous wood screw should do the trick. If difficulty is encountered in obtaining operation, try connecting a 365- μ f. variable capacitor across *L2* (*C2* in Fig. 3).

High-Impedance Amplifier. Since we are accustomed to thinking of semiconductors as low-impedance devices, we were somewhat surprised to learn that a small manufacturer had introduced a solid-state amplifier with an input impedance of (hold your breath) 20,000 megohms! An investigation seemed in order.

We found that the amplifier is produced by Denro Labs, 2801 15th St.

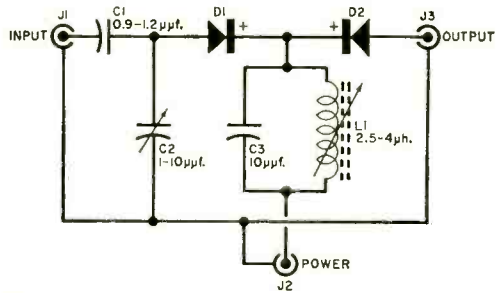


Fig. 5. The simplicity of the solid-state amplifier is evident from its schematic diagram. Actual input impedance is on the order of 20,000 megohms.

N.W., Washington 9, D. C. Available as a factory-assembled unit (Fig. 4) for \$87.00 each or in kit form for \$29.00, the instrument is not an "amplifier" in the conventional sense of the word. Rather, it is an isolation circuit utilizing special diodes. Although the actual voltage gain is less than unity, it achieves its power gain of 30 to 40 db due to the difference between input and output impedances. (Output impedance is approximately 1 megohm.)

The primary application of the instrument (Model 514, or Model 514-K in kit form) is as a high-impedance preamplifier for test instruments and research work. See the schematic diagram in Fig. 5. Diode *D1* is a special-purpose silicon type available only from the manufacturer, while *D2* is a germanium unit such as the 1N60.

In operation, *D1* is self-biased by a high-frequency power source through a series/parallel resonant circuit (*L1*, *C3*, *C2*, *D1*). The tuned circuit is tuned below or above resonance on the linear portion of its response curve, thus applying several times the power-supply voltage to the anodes of *D1* and *D2*. This voltage, rectified to its peak value, self-biases the diodes.

When an input signal is applied, *D1's* d.c. level is shifted, changing its internal capacity and shifting the operating point of the resonant circuit. This results in a change in the voltage applied to *D2*, developing the output signal. The amplifier is essentially flat from 3 to 200,000 cycles. Operating power (applied to *J2*) is obtained from a low-noise r.f. (25-30

(Continued on page 97)



Short-Wave Report

By **HANK BENNETT**
W2PNA/WPE2FT

WHAT ARE THE FACTS ABOUT RADIO SWAN?

FOR MANY MONTHS a station identifying as *Radio Swan* has been heard on 1160 and 6000 kilocycles. Reportedly operated by an independent steamship company, *Radio Swan* has been on the air as an anti-Castro station, and its location was assumed to be Swan Island, a small Caribbean island off the coast of Honduras. Recently, however, there has been some doubt as to whether *Radio Swan* was actually on Swan Island. Repeated telephone calls made to the steamship company have gone unanswered.

Expert DX'ers, with well-equipped monitoring stations and an uncanny ability to determine approximate station location from the propagation effects of the signal, were convinced that *Radio Swan* was on Swan Island, or at least in that general area. But there were some who felt that it might be on Navassa Island (see map below), an island much closer to Cuba. One definite fact is that

Radio Swan now has either gone off the air, or been replaced and renamed as . . .

Radio America. This station, not to be confused with the *Voice of America*, is also operating on 1160 and 6000 kilocycles but with considerably stronger signals than its predecessor, *Radio Swan*, especially on the medium-wave outlet. Your Short-Wave Editor has heard *Radio America* broadcasting in English during the early evening, and reports filtering in from the New York-Washington area claim reception of the station's signals even at noon, EST, on 1160 kc. It is possible that this could be the station reported by *Radio Sweden* as being in the Navassa Island area (see Short-Wave Report, November, 1961, page 130).

Some DX'ers believe that *Radio America* may be located within the Continental United States, possibly in the Florida Keys. (The station's mailing address is P. O. Box 352, Miami, Florida.) How-

What has happened to the anti-Castro *Radio Swan*, presumably located on Swan Island? And what is its connection with *Radio America*, currently reported as operating nearer to Cuba in the Navassa Island area?





Jim Tice, WPE8DPE, Hilliard, Ohio, does his DX'ing with a Knight "Span-Master" receiver and a 50' long-wire antenna. To date, he has 31 countries logged, 17 verifications.

ever, reports from a Miami DX'er regarding the signal on 1160 kc., would seem to indicate that the station is not in that area although it is heard well during daylight hours.

Still another group of DX'ers are of the opinion that the station is mobile, probably aboard ship, in the western Atlantic-Caribbean waters. This is not too remote a possibility, for a "generator-type" of signal has definitely been noted at times. Such a type of operation would,

perhaps, explain why the signals have been heard during the middle of the day in areas where reception would not normally be likely.

Do any of our readers have anything really definite to report about *Radio America*?

Voice of America. The United States Information Agency has announced the awarding of a contract for a mobile relay station which will be operated by the *Voice of America* and have a total power range of 200 kilowatts. The entire unit is to be designed and constructed so that a wide variety of methods of transporting it will be possible—ranging from tractor-trailer trucks to airplanes. To be built by the Alpha Corporation, a division of Collins Radio, the station is

(Continued on page 109)

MEDIUM-WAVE STATIONS YOU CAN HEAR

During the present period of low sunspot activity, the medium waves are stirring up considerable interest among DX'ers. The following stations have already been logged by WPE4DMX, and other sources confirm the fact that reception of these, and other medium-wave stations, is possible at this time.

FREQUENCY (kc.)	STATION	TIMES (EST)	PROGRAMS
644	Antigua, Leeward Islands	1815-2137	Eng. news and music
655	V. of Aruba, Aruba	1830-1845	Eng. news and weather
675	YND, Union Radio, Nicaragua	1900-2330	Spanish news and music
693	TIHB, R. Reloj, Costa Rica	2130-2300	News, music, frequent Spanish ID's
720	YVQR, Cumana, Venezuela	1900-2300	Spanish music and news
820	HJCY, La Vos Del Rio, Cali, Colombia	2000-0000	Spanish music and news
830	Belize, British Honduras	1830-2230	News relay from London, and music
854	OAX4A, Lima, Peru	1800-0000	Spanish music, news, frequent ID's
860	R. Caribe, Dom. Republic	1900-0100	Spanish, with some Eng. records
865	HRUC, R. Centro, Honduras	1900-0000	Spanish music and news
865	R. Curom, Willemstad, Curacao	1830-1900	Eng. talks and music
1040	TGXA, Guatemala City	1900-0100	Spanish music and news
1045	St. Georges, Windward Is.	1830-1930	Eng. news and music
1080	4VA, R. Commerce, Haiti	1930-2300	French talks and music
1120	YVMF, Maracaibo, Venezuela	1900-0000	Spanish music and news
1157	Radio Moscow, USSR	1930-2130	Eng. news, music, other programs
1175	YSCB, Voz Del Pacifico, El Salvador	1800-0100	Spanish news, some Eng. recordings

Other DX'ers have logged a French-speaking station on 830 kc.; this is very likely Radio Lucia in St. Lucia, Leeward Islands. Station HCJB, Quito, Ecuador, has been logged on 700 kc. by DX'ers living within 300 miles of WLW, Cincinnati. And there are many others that can be tuned if you have enough patience. In fact, you'll stand an even chance of logging and verifying stations located in countries which have no short-wave broadcasting stations.



Across the Ham Bands

By
HERB S. BRIER
W9EGQ

REVIEWING THE HX-11 TRANSMITTER

THIS MONTH we'd like to talk about a new Heathkit c.w. transmitter, the HX-11. This new kit is a direct descendant of the venerable AT-1, but what great differences there are between the old and the new—all in favor of the latter. Housed in a 13" x 8 $\frac{3}{4}$ " x 7" metal cabinet attractively finished in the standard Heathkit green and grey colors, the assembled HX-11 weighs 16 pounds. It's rated at 50 watts input on the five ham bands between 3.5 and 29.7 mc.

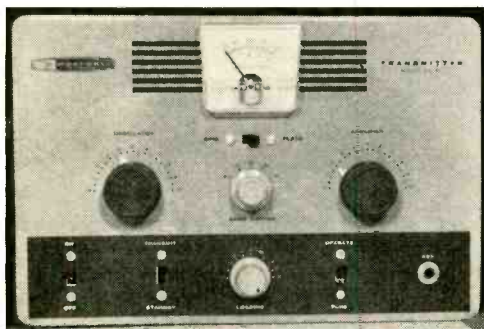
Technical Data. A 6CL6 crystal-controlled oscillator and frequency multiplier drives a 6DQ6A r.f. power amplifier, which is neutralized for stability. The pi-network tank circuit, which has variable output loading, feeds the transmitter's signal to the antenna via a built-in low-pass filter; to reduce possible harmonic-type television interference, the filter has a cutoff frequency of about 34 mc. The transmitter is keyed in the cathode circuits of the oscillator and amplifier tubes—a method which is both simple and effective. And with the use of a suitable input adapter, an external, self-powered VFO may be plugged into the HX-11's crystal socket.

A dual-range, full-vision milliammeter

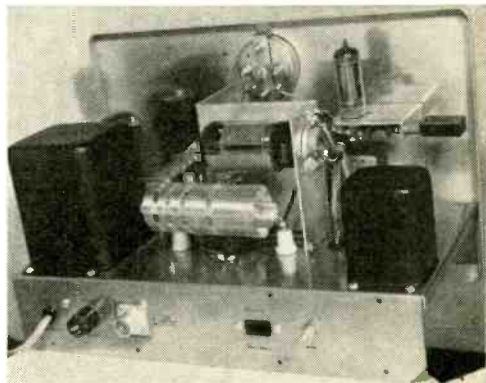
located in the upper center of the HX-11's front panel measures the 6DQ6A tube's grid and plate currents. Also located on the panel are the bandswitch; the oscillator tuning, amplifier tuning, and output loading capacitors; the "a.c.," "meter," "tune-operate," and "transmit-standby" switches; and the key jack. The crystal socket, located in the side of the cabinet, is shielded by an easily removed cover.

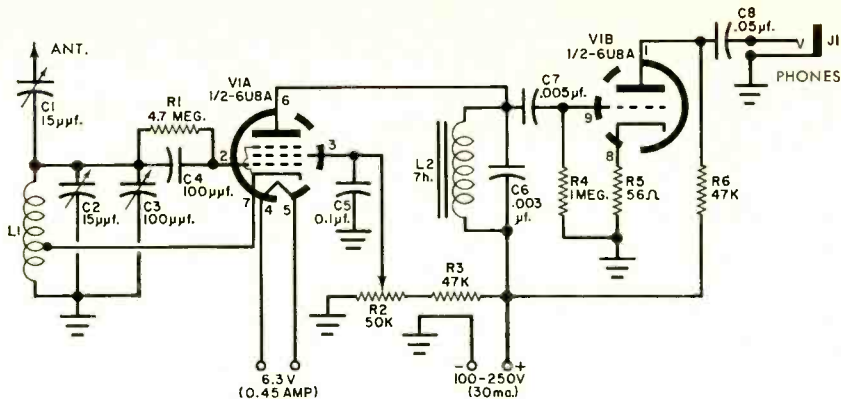
In the "tune" position of the "tune-operate" switch, the oscillator circuit alone is energized, permitting the oscillator to be tuned or the transmitting frequency to be checked without turning on the amplifier. The "transmit-standby" switch controls the d.c. voltages to the transmitter and the a.c. voltage to an accessory socket located on the back of the chassis. A relay for automatically switching the station antenna between the receiver and the transmitter may be powered from the accessory socket.

Assembling the HX-11. It took us approximately 15 hours (spread out over five evenings) to assemble the HX-11 kit. The 29-page instruction manual puts the job in the "falling off a log" category for any constructor willing to follow clear,



Heathkit HX-11 transmitter (above) takes about 15 hours to build. Rear view of chassis is at right.





Circuit for one-tube regenerative receiver (above) is housed in small utility box (right).

step-by-step instructions illustrated by excellent pictures. Part of the first evening was spent in identifying and separating the smaller components, such as fixed capacitors, resistors, and mounting hardware—this procedure definitely reduces time lost in searching for a specified component.

Twenty minutes after the last connection was soldered, the HX-11 was delivering r.f. power to a dummy load. On

80, 40, 20, and 15 meters, its power output was 35 watts or better when loaded to the rated 50 watts input; on 10 meters, where the amplifier tube operates as a frequency doubler (usual in two-stage transmitters), the output is a bit under 20 watts.

When operated in its cabinet, the HX-11 is remarkably free of TVI. This is powerful evidence of the effectiveness of its internal low-pass filter and the shielding of the metal cabinet. The filter, however, is necessarily designed to work into a specified load impedance (50 to 75 ohms). As a result, the transmitter doesn't "load" into a random-length, end-fed antenna very well unless an antenna coupler is used. (One such unit was described in this column in the August 1961 issue.) You won't need a coupler, of course, with any antenna employing 50- to 75-ohm transmission line.

Emitting a pure T9X tone and keying well when active crystals are used, the Heathkit HX-11 transmitter easily meets all of its design specifications, and can be recommended to any ham desiring an excellent 50-watt c.w. transmitter. Available in kit form only, it can be obtained from the Heath Company, Benton Harbor, Mich., for \$43.50.

Novice Station of the Month

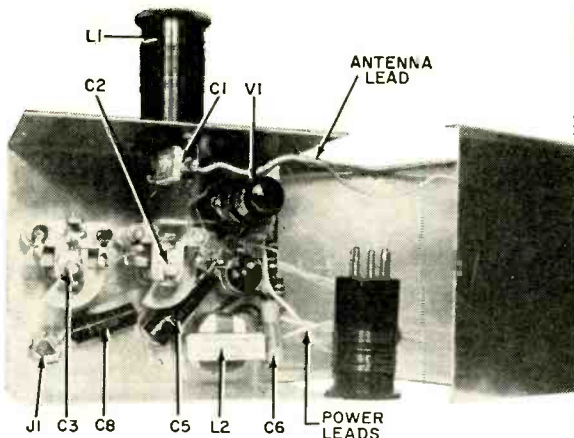
This shot of E. "Jack" Fisher (KN3QZA, Box 214, Emlenton, Pa.) and his rig wins this month's Novice photo contest. Jack uses a Heathkit DX-20 transmitter and a National NC-109 receiver, both of which perform well on the 15-, 40-, and 80-meter Novice bands. In two months he has worked 175 stations.

Jack will receive a 1-year free subscription to P.E. for his photo. If you'd like to try for a similar award, send us a picture of your station—preferably with you at the controls, and include some information about yourself, your equipment, and your activities. Maybe you'll be one of the lucky winners. Entries should be sent to Herb S. Brier, c/o POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana.



ONE-TUBE REGEN RECEIVER

Many an old-time ham has been heard to say, "Well, I don't know but what the regenerative receiver I had when I first got on the air didn't do as good a job as the super-special receiver I have now—at least I heard an awful lot of DX on it."



PARTS LIST

- C1—15- μ f. trimmer capacitor
- C2—15- μ f. midget variable capacitor (Bud MC-1850 or equivalent)
- C3—100- μ f. midget variable capacitor (Bud MC-1855 or equivalent)
- C4—100- μ f. mica capacitor
- C5—0.1 μ f.
- C6—0.003 μ f. } all 400- or 600-volt
- C7—0.005 μ f. } paper capacitors
- C8—0.05 μ f.
- J1—Open-circuit phone jack
- L1—Antenna coil, wound on 1 $\frac{1}{4}$ "-diameter, 2 $\frac{1}{4}$ "-long, plug-in form (Allied 71 H 714 or equivalent) according to instructions below:
 For 20 meters: 6 turns of #22 enameled wire, 1" long, tapped 1 $\frac{1}{2}$ turns from ground end
 For 40 meters: 11 turns of #22 enameled wire, 1" long, tapped 2 turns from ground end
 For 80 meters: 23 turns of #22 enameled wire, 1 $\frac{1}{4}$ " long, tapped 3 turns from ground end
 For broadcast band: 100 turns of #28 enameled wire, close-wound, tapped 10 turns from ground end
- L2—7-henry, 50-ma. filter choke (Stancor C-1707 or equivalent)
- R1—4.7-megohm, $\frac{1}{2}$ -watt resistor
- R2—50,000-ohm, wire-wound potentiometer
- R3, R6—47,000-ohm, 1-watt resistor
- R4—1-megohm, $\frac{1}{2}$ -watt resistor
- R5—56-ohm, $\frac{1}{2}$ -watt resistor
- V1—6U8-A tube
- 1—4" x 5" x 6" aluminum utility box (Bud CU-3007-A or equivalent)
- Misc.—Tube and coil sockets, hardware, etc.

Actually, of course, today's high-performance communications receivers beat the old regenerative jobs seven ways to Sunday. Nevertheless, a regenerative receiver in skilled hands can be more effective than the uninitiated might think possible.

The receiver described here, for example, uses a 6U8A tube as a regenerative detector and a.f. amplifier. It brings in ham signals from all over the United States and Canada, as well as short-wave broadcast stations from around the world, with adequate headphone volume.

Construction. Since the parts layout is not at all critical, the photograph can be used as a general guide. The 6U8A tube was mounted inside the box primarily to protect it from unnecessary bumps. If desired, however, it may be located on the top. The variable capacitors and coil forms used in the original model came from a spare-parts box; those specified in the Parts List will work equally well.

You can apply plate and heater voltages from any convenient power supply as indicated on the diagram. If your external supply doesn't have a grounded filament transformer center-tap, ground one of the filament leads to the receiver chassis. Then connect an antenna (a 75' outside antenna works very well, and a 20' wire inside the house gives fair results) and plug in the appropriate coil.

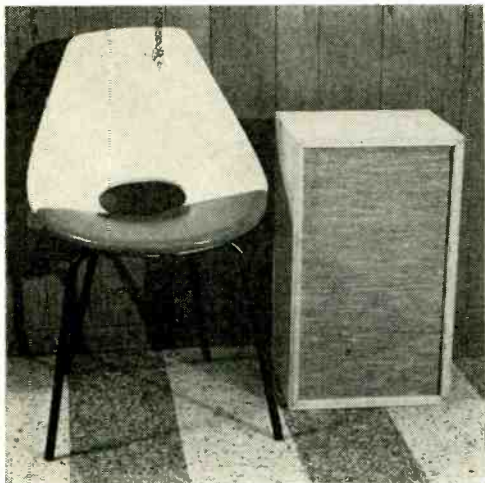
Adjustment. Loosen the screw in the antenna-coupling capacitor (C1) approximately two turns and set capacitors C2 and C3 so that they are about half-meshed. Advance regeneration control

R2 until the detector goes into oscillation, as indicated by a slight hissing or rushing sound in the headphones; advancing R2 too far produces a loud squeal in the phones. Now adjust capacitor C3 until you hear signals, readjusting R2 as necessary to keep the detector gently oscillating.

Should you have difficulty tuning any coil to its specified frequency band, compress or expand the windings as required. Once the desired band is spotted, do your fine tuning on bandspread capacitor C2. And, for final touch-up, adjust capacitor C1 for the loudest signals from the phones.

The setting of the regeneration control is somewhat critical. For c.w. and SSB reception, set the control just above the oscillation point; for conventional AM phone, set it just below this point. Choke L2 and capacitor C6 form a 1000-cycle audio filter—giving more effective selectivity on c.w. For phone reception, you might want to disable the filter by disconnecting one end of C6.

(Continued on page 115)



Regal Sound from Regal 300 Kit

*Electro-Voice offers
easily assembled, 3-way
hi-fi speaker system*

THE heavyweight king of bookshelf speaker systems must certainly be the Regal 300 produced by Electro-Voice, Inc., Buchanan, Mich. Topping 60 pounds, this 3-speaker system leaves no doubts about its *solid* construction. Available assembled—finished (\$179.00) or unfinished (\$149.00)—or as a kit (\$125.00), the Regal 300 has a remarkably smooth sound, extending from below 40 cycles to somewhere over 18,000 cycles.

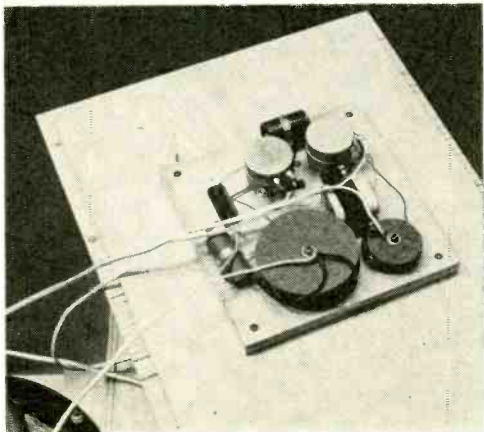
The kit we assembled, in under two hours, did not show audible “doubling” from the 12” woofer until our audio oscillator hit 35 cycles. The “presence” frequencies are handled by a husky 8” cone-type speaker mounted in its own separate enclosure within the Regal box proper, and the treble notes emanate from a compression-type tweeter. Both of the latter speakers have level adjustment controls on the back panel.

All four corners of the 300 fit like a glove, and the back panel slides snugly into place. There are no unusual precautions to be observed during the assembly process—but don’t forget the manufacturer’s recommendation for waxed paper around the grille cloth if you want to stain the enclosure.

—30—

Preassembled crossover feeds 35—200 cycles to 12” bass speaker, 200—3500 cycles to 8” mid-range, and everything above to compression-type tweeter.

The extra-heavy bass speaker has a foam plastic cone. Four pounds and ten ounces of the weight shown here are accounted for by its ceramic magnet.





Carl and Jerry

Tunnel Stomping

MARCH had come in like a lamb, but Carl and Jerry were not feeling very lamb-like. The unseasonably warm evening breeze wafting gently through their open window on the third floor of H-3 Residence Hall on the campus of Parvoo University filled the boys with a strange inquietude. Jerry was sitting at his desk making a desultory attempt to study while Carl paced restlessly back and forth listening to an AM-FM transistor radio he carried in his hand.

"Will you quit switching that thing back and forth between AM and FM?" Jerry demanded. "You're making me nervous."

"I'm nervous; that's why I'm doing it," Carl retorted with a grin. "I'm trying to see, moving to and from the window, if the building's steel framework has more shielding effect on AM or FM reception. Remind me to try this out in that cave down along the river when we're home this summer. I'd like to see what effect a layer of earth has on the two modes . . . Hey! We don't have to wait till then. How'd you like to go tunnel stomping?"

"Go what-ing?"

"Tunnel stomping. A couple of fellows at the library this afternoon were telling me they had a whale of a time last night exploring the steam tunnels that run around beneath the campus. They told me how to get in and everything. And I can check out this AM-FM reception bit while we're at it. What do you say?"

"Well, I dunno," Jerry said slowly. "Parvoo's powers-that-be might take a dim view of our prowling around down there where we have no business."

"Aw, come on!" Carl coaxed. "I've got to do something different tonight or

I'll flip. This is no evening to sit cooped up in a room with a bunch of books. We won't be caught. The fellows never met a soul down there last night."

"You twisted my arm!" Jerry exclaimed as he took a flashlight from a drawer and put on a jacket. "I feel in the mood for a little adventure myself."

CARL snatched up a campus map and snapped a pedometer on his ankle as they headed for the door. Outside, under a starry sky, Carl led the way south for several blocks, turned east, and finally proceeded south again.

"Keep going and we'll soon be outside the city limits," Jerry finally warned as he trotted to keep up with his lanky chum's long strides. "That was the Bull Barn we just passed on the right."

"It's only a little farther," Carl assured him—"Ah, here we are!"

Several flickering red lanterns outlined a large opening in the ground. The boys let themselves down into the excavation and pushed aside a heavy canvas curtain to reveal a long, narrow passageway leading back toward the campus.

"This comes from the new heating plant on the edge of the campus," Carl whispered as he zeroed his pedometer;



"it joins the tunnel system already in use by the old plant. Let's go."

At first the boys advanced slowly, quietly, and cautiously; but as nothing happened and they met no one, they became bolder and more reckless. They soon found that they did not need their flashlight. Along the top of the tunnel ran a row of lights that could be turned on and off in sections. The boys simply lit a string of lights ahead and went to the end of it; then they darkened the tunnel behind them and turned on the next section of lights.

When they encountered the first side tunnel, they followed it until they were stopped by a locked fireproof door. By this time they were so exhilarated by a combination of adventure, spring fever, and the oppressive quietness of their surroundings that they beat on the iron door with their fists and shouted greetings through it; but the only answer was the echo of their shouts coming back from the main tunnel.

Carl's map and pedometer were not needed to keep track of where they were. Every so often an opening in the roof of the tunnel was covered by a rectangular iron plate. By raising one side of this plate very cautiously, a foot or so, they could get a look at the campus and see where they were. They made a game out of it. The first boy who spotted one of these openings would shout, "Up periscope!" Then, while they chuckled at the joke that never seemed

to grow old, the other boy had to climb up and take a cautious peep around.

They lost all track of time as they followed the tunnel north to where it joined the tunnel coming from the old heating plant in a great collection of valves, pumps, and other machinery. Turning left at this point, they followed the tunnel past the Agricultural Buildings and then turned back south again beneath South University Drive.

"Hey," Jerry suddenly exclaimed, "you forgot to try out your radio. Turn it on and let's see what you can pick up."

Carl turned on the little receiver, but all he could hear was a soft buzzing sound. "Maybe that noise is coming from the lights," he suggested. "Cut them off and let's see if it stops."

Jerry snapped off the lights, and the boys stood there in the pitch darkness. The sound did not change, but before Jerry could turn the lights back on there was a grating noise and a dim rectangle of light appeared almost overhead as someone opened a hatch cover. Instinctively the boys retreated quietly back down the tunnel to where some big valves in the steam pipes along the wall hid them from view.

A flashlight beam shone down through the opening for a few moments, and then a sturdy-looking suitcase was carefully lowered with a rope. This was followed by a small roll of wire. Seconds later a pair of well-rounded legs in toreador pants came down through the opening.



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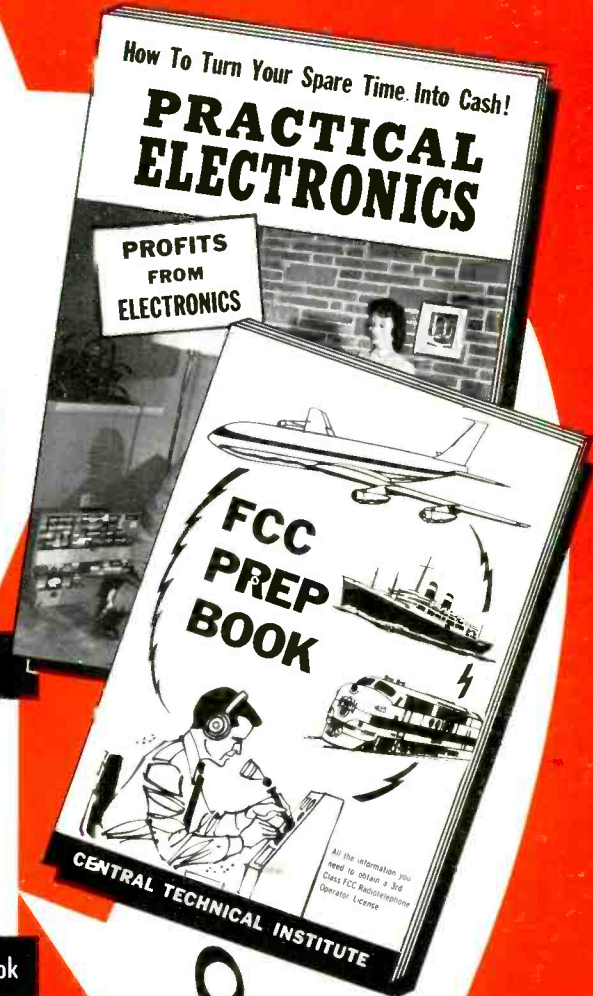
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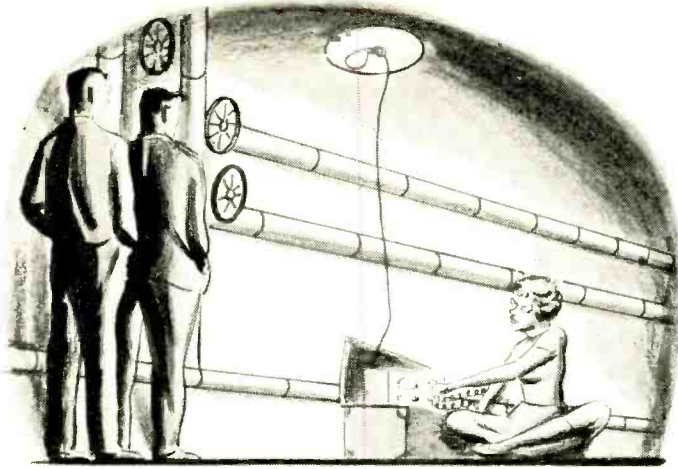
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At this point the flashlight was turned off, and the boys could hear the hatch cover being put back in place. Next there were some fumbling sounds, and then a row of tunnel lights came on. Fortunately the lights ran on down the tunnel from where the intruder had descended and did not reveal the boys hiding in the shadow of the big valves.

"Holy haddock! It's a girl!" Jerry whispered.

"What did you suppose?" Carl asked sarcastically. "I figured that out when I saw the bull-fighter pants. Keep quiet and let's see what she does."

IT WAS a girl, all right, a very pretty slender one with dark curly hair and almond-shaped glasses. With quick, graceful movements, she opened the suitcase to reveal a panel full of knobs, dials, and meters. Then, unrolling the coil of wire which led down from the hatch, she fastened the end to a binding post on the panel. Wire from another binding post was clipped to a valve in a steam line.

Then she replaced a lamp bulb above her head with a Y receptacle that accepted both the bulb and a plug on the end of a wire leading to the suitcase. And finally, she seated herself cross-legged on the floor in front of the opened suitcase and plugged a telegraph key into a jack on the panel.

"Hey, that's a portable radio station! She's getting ready to send a message. I'll bet she's a spy," Jerry whispered.

"She's pretty enough to be one. What are we going to do—?"

Jerry had no opportunity to give an answer if he had one—which is doubtful. The girl threw a switch and closed the key, and instantly a loud, over-loaded squawk came from the little radio Carl still clutched in his hand. He dropped it, stunned by the sudden noise, and lunged backward into Jerry. Both boys toppled into the light.

The girl gave a little shriek and leaped to her feet. But when she saw Carl and Jerry staring sheepishly up at her from where they sprawled in a tangle of arms and legs on the floor, she gave a giggle of obvious relief.

"Oh, it's just boys; I was afraid it was a nasty old mouse," she said in a rich Southern drawl. "I really wish you'd get up from there. You all can't imagine how silly you look just lying there staring up at me. Didn't you ever see a girl before?"

Suddenly her soft brown eyes grew dark in anger behind her glasses. "And you might explain why you were spying on me!"

"We were spying!" Jerry sputtered indignantly. "I like that! I suppose you weren't starting to send a secret message to one of your comrades."

The girl's eyes opened very wide. "Secret message—" she repeated, and then became convulsed with almost hysterical laughter.

"I swear you Yankee boys are wild, utterly wild," she said finally as she leaned weakly against the wall of the tunnel. "You won't understand, but instead of being Mata Hari, I'm a radio

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HEATH

THE MOST ADVANCED STEREO TUNER KIT AVAILABLE



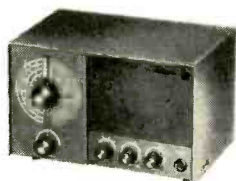
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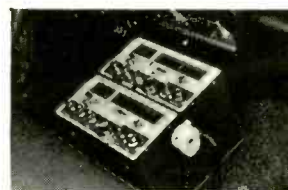
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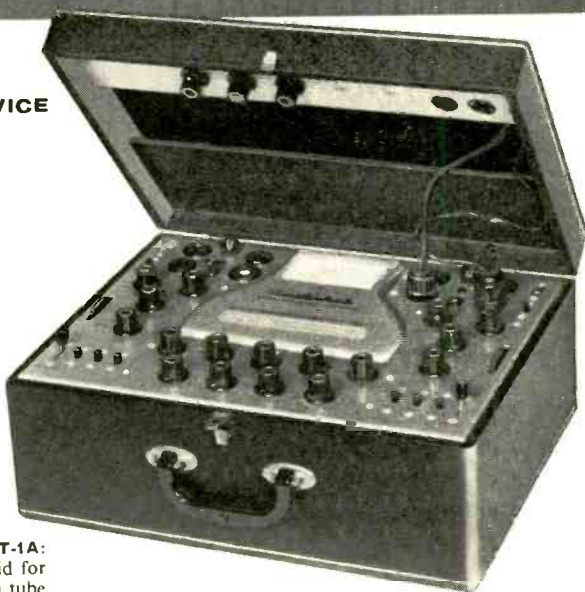
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ITEM	MODEL NO.	PRICE

amateur. This is a portable transmitter and receiver and I'm getting ready to talk over the air to my daddy down in Florida, as I do every Friday night at this time.

"I can't operate my transmitter in the residence hall," she continued, "but I discovered this place by accident late last fall when some men were working down here and had that cover off. I've used it ever since. It's warm; there's power available; and I can string my antenna from a fire escape nearby down through a crack in the hatch cover—but you wouldn't understand about antennas."

"We might," Jerry said with a grin. "We've both had our ham calls for several years. My name is Jerry Bishop, and this is Carl Anderson. We're both freshmen in EE. We just happened to be exploring the tunnel when you—'dropped in,' shall we say?"

"My name is Jodi, Jodi Preston, also a freshman in double-E," the girl said as she held out her hand; "but if you'll excuse me, I'd better call Daddy now. He'll think the Abominable Snow Man has made off with me up here in the Arctic wastes, as he calls anything north of Atlanta."

THE BOYS watched while Jodi expertly tuned up the little transmitter and gave a snappy call to a W4 station. The W4 came back immediately. Used to copying in their heads, the boys followed the ensuing conversation easily, even though the girl was handling the straight key at a clean, rhythmic twenty-five-words-per-minute. It was chiefly family stuff: how Jodi's dog missed her; that the box of cookies arrived okay; and that Jodi was going home with her roommate during spring vacation. She made no mention of Carl and Jerry.

"Well," she declared, as she signed off after a lingering 88, "that's that for another week. Now I've got to get this stuff together and scamper back to the residence hall before the curfew hour."

"We'll help," Carl offered; "but why did a girl like you ever come to a technical school like Parvoo—"

"Stop right there, Yankee boy!" Jodi said with her brown eyes flashing angrily again. "I know what you're thinking: 'She came because the eds outnumber the coeds and it's easy to get a man.'

Well, if I wanted a man, which I most certainly don't, I'd never look for one in Yankeeland. I came to Parvoo because I'm deeply interested in electronics, I want to know more about it, and I think this is the best place to find out."

"Okay; so okay!" Carl said soothingly as he wound up the antenna wire. "I wasn't thinking any such thing, but let's not make a fed—I mean a confederal case of it. Jerry, I'll go up and see if the coast is clear. You hand the transmitter up and join me. Then we'll give Jodi a hand."

As they lifted Jodi easily to the sidewalk the boys, being engineers, could not help noticing how neatly her hundred and twenty pounds were packaged. They had just replaced the cover and wound up the antenna wire when a campus police squad car turned the corner and cruised by.

"Whew, that was close!" Carl said as he picked up the transmitter and the three of them set off through the still warm, star-studded night.

When they arrived at the X-Hall where Jodi lived, just on the other side of the Co-Rec Gym from H-3, she took the transmitter from Carl and the coil of antenna wire from Jerry and said, "You boys have been just as sweet as you could be, and I'm sorry I said such hateful things to you. I had no idea Yankees could be so nice. Are you boys *sure* you don't have any Southern ancestors?"

"My folks came from Pennsylvania, darn it!" Jerry confessed.

"And mine from Minnesota, double darn it!" Carl added.

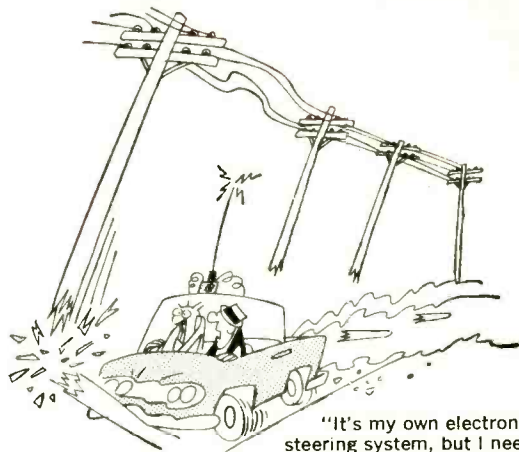
"Now you're making fun of me, but I don't mind," Jodi said, bathing them in a warm smile as she turned reluctantly toward the door. "Anyway, we're all hams, and that means a lot."

Carl and Jerry started off briskly. "Hey, Jer, you know something?" Carl asked as he leaped into the air to pluck a leaf from a tree, "that Jodi is a nice kid even if she can't pronounce an *r*."

"Yes, and she has a beeyoutecfull fist," Jerry agreed. "Say, I don't know about you, but I feel a lot more relaxed after our tunnel stomping. What say we go home and tear into the books for a couple of hours before turning in?"

"Let's go!" Carl said, breaking into an easy jog.

Hobnobbing with Harbaugh



"It's my own electronic steering system, but I need a couple of new tubes."



"He's trying to hear somebody called OSCAR."

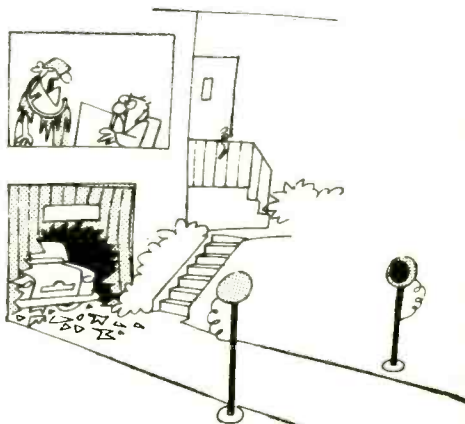


"Have a seat folks ... I'll warm up the stereo."

A Peek at the POP'tronics Reader



"Here's what I call a real QSL card."

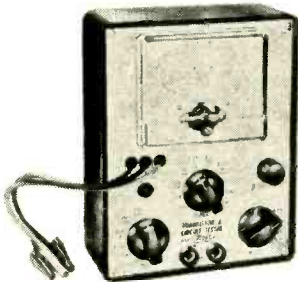


"That gadget you made to open the garage door isn't working."

NEW products

TRANSISTOR TESTER/VOM KIT

A transistor tester produced by EICO also provides all the VOM ranges needed to service transistorized equipment. The Model 680 transistor and circuit tester employs a 50- μ a., $3\frac{1}{2}$ " meter for extra sensitivity and accuracy. Transistor characteristics which can be checked include ICBO and ICEO (with separate ranges for small-signal and power transistors); d.c. β (directly, in two ranges); and a.c. β (indirectly). The VOM section of the instrument has d.c. current ranges of 0 to 50 μ a., 500 μ a., and 500 ma; d.c. voltage ranges of 0-5 and 0-10 volts; and resistance ranges of 0 to 2000 ohms, 200,000 ohms, and 20 megohms. The Model 680 sells for \$25.95 in kit form, \$39.95 fully wired and tested. (Electronic Instrument Co., Inc., 33-00 Northern Blvd., L. I. City 1, N. Y.)



TEST-SOCKET ADAPTERS

Repairing TV and FM tuner sections is simplified by Pomona's "7-high" (shown in photo) and "9-high" test-socket adapters. These devices are intended for checking voltage or resistance at the pins of tubes enclosed in captive or telescoping shields. Plugging into the original tube socket, each adapter provides a new socket located above the level of the shield; with the tube plugged into this socket, checks can be made via special lugs wired to the pin contacts. The "7-high" adapter (Model 1447) is for 7-pin miniature tubes and sells for \$1.85. The "9-high" adapter (Model 1449), for 9-pin miniature tubes, is priced at \$1.95. (Pomona Electronics, Inc., 1500 E. 9th St., Pomona, Calif.)



INTERCOM KIT

Suitable for home or business use, the KT-196 two-station intercom kit introduced by Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, L. I., N.Y.) features a sensitive three-tube circuit. The master unit (illustrated) has a three-way lever switch with "momentary talk," "listen," and "lock-in talk" positions, as well as a combined on-off switch and volume control. A "talk-listen" slide switch on the remote unit can be left set in the "talk" position for baby sitting, or other purposes. Price, complete with 50 feet of 3-wire cable, \$14.75. A factory-wired version, the Model LA-196, sells for \$19.50.



ELASTIC STOP NUT KIT

More than 250 assorted self-locking "Elastic Stop" nuts are contained in ESNA's No. 700 kit. They are plated, carbon-steel hex nuts with an integral Nylon collar that will not loosen under severe vibration conditions. Both standard and thin-height nuts are supplied in a variety of sizes, and the assortment is packed in a 12-section unbreakable plastic box. Price \$15.00, postpaid in the USA. (Elastic Stop Nut Corporation of America, Dept. AD-N700, 2300 Vauxhall Rd., Union, N. J.)

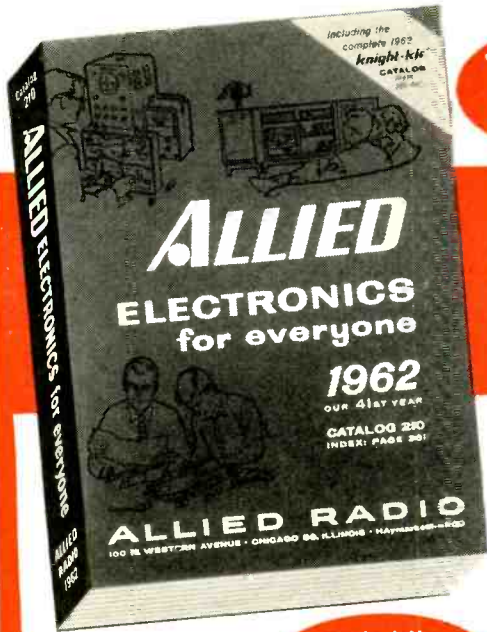


TUBE TESTER ADAPTER

Three new tube bases can be accommodated in the Seco Model 107 tube tester with the aid of an inexpensive adapter. Designated adapter No. 1171, the unit provides sockets for 9-pin Novars, 12-pin Compactrons, and 10-pin tubes. The device comes complete with a 22" cable, installation instructions, and set-up data on the new tubes. Price, \$4.95. (Seco Electronics, Inc., 5015 Penn Ave. S., Minneapolis 19, Minn.)

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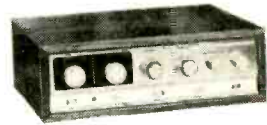
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products

(Continued from page 92)

unit, which comes with two special, re-chargable, 675-size batteries, is powered by two standard penlight cells. Each battery can be recharged about 40 times before the cells need replacing, and a charged battery can be used for about 10 hours. Charging time per battery is about eight hours, and the batteries have a "lifetime" of several thousand charges each. About the size of a small flashlight, the charger can easily be carried in pocket or purse. Price, \$10.95. (Multitone Electronics, 261 Great Arrow Ave., Buffalo 7, N. Y.)

ANTENNA TUNER KIT

The "Mini-Matcher" antenna tuner is one of a new line of Comet kits designed and



priced for the radio amateur. It will operate with any transmitter running up to 100 watts on single side-band or c.w., or up to 75 watts on AM phone. Completely self-contained, the

"Mini-Matcher" is housed in a steel cabinet for TVI prevention. Dimensions of the unit are 5" x 4" x 4" and it's priced at \$10.95. (World Radio Laboratories, 34th and Broadway, Council Bluffs, Iowa.)

SHORT-WAVE RECEIVER KIT

The Model GR-81 short-wave receiver, available in kit form from the Heath Co. (Bent-

ton Harbor, Mich.) covers the frequencies from 140 kc. to 18 mc. in four bands. Ideal for economy-minded SWL's, radio hams, or language students, the set



can be put together in just a few evenings. There is a bandspread control on the front panel as well as on-off/volume, main tuning, regeneration, and bandswitching controls. A phone jack for private listening automatically disconnects the built-in 3" x 5" speaker, and shock hazard is eliminated by a transformer-isolated power supply. Price, \$24.95.

-30-

Emily . . . the Robot

(Continued from page 45)

M2 and *I3*. If the rotation of *M2*'s wheel is not counterclockwise when viewed from the side, reverse the connections to *M2* or the polarity of battery *B4*.

Now turn *S1* to position 3. This will stop the motor, turn on exciter lamp *I1*, and switch photocell *PC2* to *Q1*'s base circuit in place of *PC1*. Position a white card in front of *I1* so that the beam is reflected back into *PC2* and check to see that *K1* pulls in. Then cover the photocell with your thumb; the relay should return to its normal position.

Finally, move *S1* to position 4 and repeat the tests outlined above. With the photocell illuminated, motor *M1* should turn and *I2* should light. When the photocell is covered, power should be switched from *M1* and *I2* to *M2* and *I3*.

If Emily passes these preliminary tests, you're ready to try her out. Use $\frac{3}{4}$ " masking tape, or some similar light-colored material, to lay out a patch on the floor (pick out as dark a floor as pos-

sible which is not too shiny). The path may curve in as many directions as you wish, but a turn that is too sharp can make Emily "lose her way." A little experimentation will soon show you just how sharp a turn she can take.

Center Emily directly over the path and set *S1* to position 4. The robot should travel to the right until she "finds" the path, then follow it to the end. When the end is reached, she'll turn in circles until you shut her off or place her on the path again.

If Emily doesn't work properly at this point, chances are one of two things is wrong. Either motor *M1* is running all the time (*PC2* receiving too much illumination) or motor *M2* is continually running (*PC2* receiving too little illumination).

Should the problem be too much illumination, *PC2* is probably picking up a reflection of *I1*'s beam from the floor. You can make the photocell less sensitive by masking off part of it with black tape (experiment to determine the best area to mask). This tape can be removed when battery *B2* becomes so weak that *I1* no

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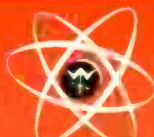
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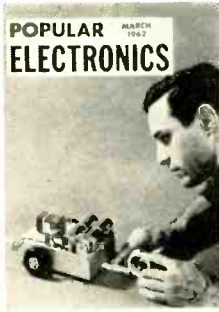


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longer gives quite enough illumination to operate the relay, and replaced when a new battery is installed.

On the other hand, if *PC2* is not receiving enough light when it passes over the tape, you may have to make an adjustment in the position of *I1*. Place Emily on a table with the exciter lamp-photocell assembly close to the edge. Lay a white card under the assembly and turn *S1* to position 3. If the beam of *I1* doesn't reflect back into the photocell, bend *I1*'s bracket one way or the other until it does.

Emily can also be used on a white, or light-colored, floor with a dark path. In this case, though, you'll have to start her to the right, instead of the left, of the line.

To make her follow a light beam, turn *S1* to position 2. Then, standing in front of the robot, aim a flashlight (at a shallow angle) to the left of *PC1*. Emily will travel to her right until she reaches the beam, then follow it as if it were a white line. -30-

430 and Down

(Continued from page 49)

and the receiver should be made with single-conductor shielded wire, with the shield serving as the ground connection between the two units. The receiver should be set at 1500 kc.

At the low frequencies covered by the converter, a short length of wire is seldom an adequate antenna. An outdoor antenna, 75' to 100' in length, is recommended for best results, as is a good water-pipe ground.

Since a minimum of tuned circuits are used in the converter and a wide difference exists between the oscillator and input-signal frequencies, some difficulty may be experienced with interference from strong broadcast stations. If so, a simple wave trap can be placed in series with the antenna. Alternatively, a loading coil can be used to change the effective length of the antenna—a small, slug-tuned coil such as the CTC Type LS3-1 connected in series with the antenna at the converter should do the trick nicely. -30-

Transistor Topics

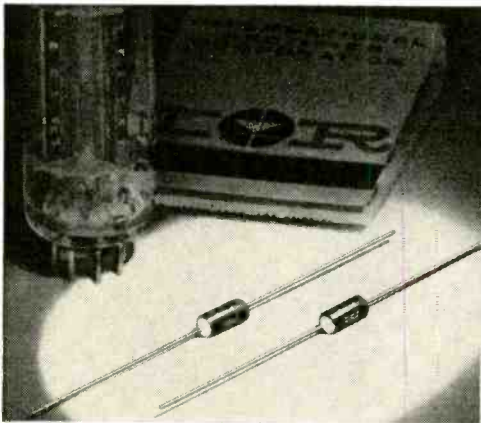
(Continued from page 76)

mc.) generator, with approximately 0.5 to 1.0 volt required for operation.

Product News. Here's an interesting innovation for builders of Geiger counters, oscilloscopes, or other devices requiring high voltages at low currents. International Rectifier Corporation (233 Kansas St., El Segundo, Calif.) has introduced a series of subminiature rectifiers capable of supplying from 85 to 100 ma. at PRV ratings of from 1000 to 2500 volts. Designated as Types Q10X through Q25X, the diodes are silicon units suitable for use in voltage multiplier as well as standard configurations. Prices range from \$4.00 to \$9.20 each in small quantities.

A relatively new firm, Paralan Electronics Corp. (54 Long Beach Rd., Rockville Centre, L. I., N. Y.), has introduced a series of transistorized audio preamplifiers and other types of equipment, including a low-cost "in-circuit" transistor tester. Specifications and price data are available from the company on request.

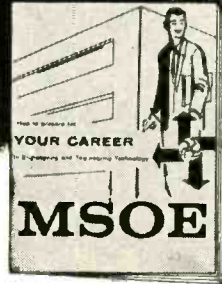
Motorola Semiconductor Products, Inc. (5005 East McDowell Rd., Phoenix 8, Ariz.) is now offering a new series of germanium *pn*p diffused-junction mesa transistors. Types 2N968 to 2N975, the units have excellent high frequency response, with h_{FE} ratings up to 40, and are priced well below comparable mesas



Subminiature silicon rectifiers developed by the International Rectifier Corporation will handle up to 2500 volts and currents as high as 100 ma.

March, 1962

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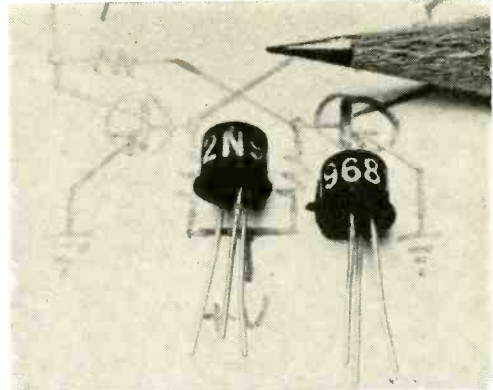


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offered by other manufacturers. Prices range from just above \$1.00 to under \$5.00.

Good-All Electric Manufacturing Co. (Ogallala, Nebr.) is now producing a Mylar printed-circuit capacitor, Type 605, designed specifically for transistor applications. The hermetically sealed units are available in standard capacity values from 0.01 to 0.33 $\mu\text{f.}$ in 50-volt ratings.

Back next month . . .

—Lou



SPACE AGE SLANG

If you happen to overhear someone saying he was **eyeballs in**, don't assume that he had too much to drink. Chances are he's one of the new Space Age linguists, speaking a growing language that already ranges from **A-Okay**, meaning all systems working perfectly, to **Zero-G**, the state of weightlessness. In astronomical jargon, **eyeballs in** means the direction of the pressure caused by a great acceleration, such as a take-off. **Eyeballs out**, of course, signifies the opposite pressure, under deceleration.

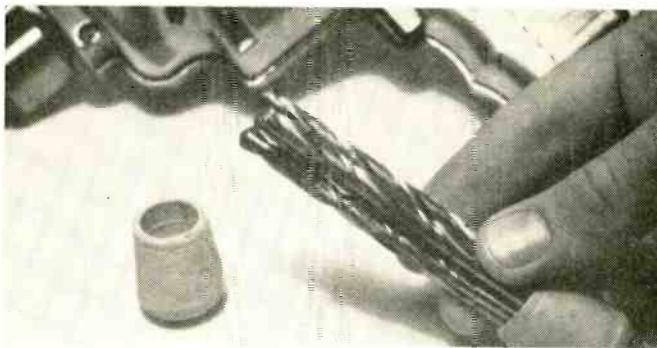
In many cases, the men of the Space Age—as astronauts, scientists and technicians—simply grasp the handiest coinages of the moment to describe their new and exciting world. **Blowoff**, for example, might sound like the "loudmouth" of the launch site, but it's really the separation of the payload from a rocket by means of an explosive device. **Gimbal** is not the kind that tries to undersell Macy—it means to swivel a rocket's nozzle in order to alter its course.

Similarly, **Sitting Fat** sounds like a suggestion that somebody might need a course at Vic Tanny's; actually, it means that a vehicle is in orbit with everything working fine—or **A-Okay**. **T-Time** is not an afternoon break with crumpets, but rather the time when the button is pushed to launch a missile. And a **Sunseeker** has nothing to do with a bikini—it's an electronic gadget which keeps instruments aimed at the sun.

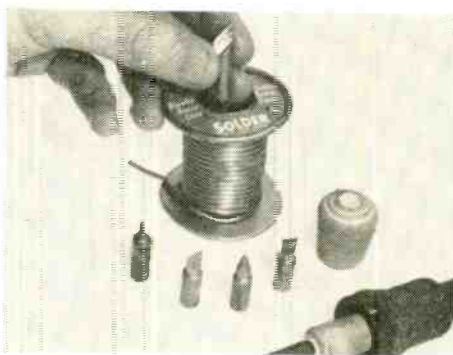
—Courtesy of Aerojet-General Corporation

Tips on Leg Tips

Suggested by **JOHN A. COMSTOCK**



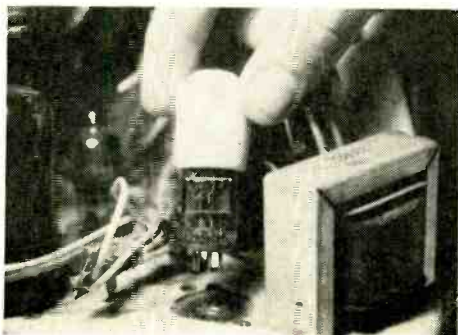
DRILL HOLDER. Why let your twist drills rattle around in the bottom of a tool chest? Fit two $\frac{5}{8}$ " rubber leg tips over the ends and you'll have a handy, low-cost drill holder.



PENCIL TIP STORAGE. Do you have a soldering pencil with spare tips of different sizes and shapes? Seal off one end of your solder roll and plug the other with a rubber furniture tip—keeping the extra tips safe and snug inside.



SLEEVE REPLACEMENT. Did a clumsy friend break the Bakelite insulating sleeve on your phone plug? A furniture tip makes an easy replacement. Just punch out a hole for the cable connection.



TUBE PULLER. There's no point burning your fingers the next time you grab a red-hot miniature tube. The painful sensation should remind you to use a rubber leg tip, saving the wife's ears and your epidermis.

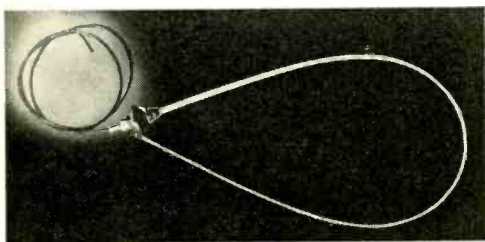
On the Citizens Band

(Continued from page 58)

The FCC was set up by Congress as an administrative agency to regulate all forms of radio service for this country, in accordance with the various international treaties governing radio in which the United States is involved. While the FCC is not a police force, per se, it does have some powers of enforcement and, so far, has been relatively immune to political influences.

While some CB'ers may disagree with the FCC's stand on a few matters, they should remember that it was the FCC which gave us our band in the first place; and it would be the FCC which would take the band away, if abuses warranted it. Obviously, FCC restrictions are not meant to hamper CB users, when one considers the purposes of the band as set up by the Commission. It's for local communications of a personal and business nature—not for the pleasure derived from operating itself.

New Antenna. "The Switch" (Style 156), a Shakespeare normal-mode helical antenna, molds an efficient, space-wound coil over an air core into a slim 4-foot whip of white fiberglass that looks and mounts like a standard car antenna. It's extremely flexible (you can bend it end to end without breaking), and with the addition of your own antenna coupler, it will provide extremely efficient transmis-



sion as well as CB and broadcast reception. Put out by Columbia Products Co., Columbia, S. C., the antenna comes with either 4½ feet or 9 feet of cable and sells for less than \$11.00.

Tech Notes. Two often-overlooked installation factors in a CB station are lightning protection and equipment grounding.

There is a lightning arrester on the market, called the "Blitz Bug," which is

especially designed for coaxial lines. The mounting mast of any CB fixed-station antenna should be grounded *via* a length of aluminum ground wire run from it to a ground rod driven into the earth to a depth of at least six feet. Your local TV serviceman can be of help in installing this lightning protection, since it would be similar to that used for TV masts.

The grounding of your transceiver, on the other hand, represents a safety feature in your "shack." Many CB units employ a power-line filter which may have a connection to the transceiver case. Although "leakage" through it might cause no more than a slight tickle when you touch the unit with one hand and grab a good ground with the other, it could be fatal if the filter became shorted!

Since the filter consists of one or more capacitors which do short every now and then, a good ground to your transceiver could save your life. Just run a length of #18 wire from the transceiver case to a nearby cold water pipe. Do *not* connect a ground to a hot water pipe or to a gas pipe!

Club Notes. The Southern California Radio Assistance Unit (P. O. Box 115, Bellflower, Calif.) has been cooperating closely with local police, fire and CD agencies, in addition to helping stranded motorists. Recently they were of great help to police in locating a group of runaway teen-agers. . . . The Allegheny Valley Citizens Band Club (P. O. Box 7819, Pittsburgh 15, Pa.) is sponsoring code lessons for those members who are trying for their ham licenses. . . . An item in the "3-W Scribbler" of the Bux-Mont Citizens Radio League (49 Ridge Ave., Sellersville, Pa.) warns members against communications with unlicensed hand-held portable units. In many cases, these units are owned by people with no knowledge of CB regulations—and, as the item points out—little concern for the seriousness of radio communications. . . . Boasting about 50 members, the CB 5 Watters of Virginia (232 Powhattan Parkway, Hampton, Va.) helped needy families at Christmas with food, clothing and toys. Nice work, fellows!

Please address all letters intended for this column to Dick Strippel, CB Editor, POPULAR ELECTRONICS, One Park Ave., New York 16, N. Y.

-30-

They'll Teach You Electronics

(Continued from page 67)

solution on the basis of their comments.

There are times when even a *correct* answer will draw comment from an instructor. This is so when the instructor feels that you have stumbled onto the right answer without really understanding the subject. Since you are always encouraged to ask questions, and these questions bring a prompt, complete answer in writing, there is no excuse for having anything but a full grasp of the subject.

It is interesting to note that the way in which examinations are handled and graded by the instructor is also a good measure of the course's overall quality. If the examination is essentially a "copy" exercise, tests only what you have learned, and could be graded by a clerk (or a machine), its quality is likely not "top-drawer."

A good examination should help you understand the lesson, help you learn more, and require an expert to grade. In general, the more you have to analyze and write out, and the more hand-written comments you receive back, the better the course.

What Will It Cost? The question "How much does an electronics home-study course cost?" is in the same category as "How long is a piece of string?" As a very rough rule of thumb, however, each lesson will cost somewhere between \$2.50 and \$5.00. Thus, a 60-lesson TV servicing course might cost \$150.00, while a 100-lesson Advanced Trade School course could cost \$500.00.

The reason for this difference in cost is *quality*. If the lessons are better prepared and more comprehensive, the kits are of better quality, and you receive more personal attention from top-grade

Capacitor Quiz Answers

(Quiz on page 54)

1	E	4	A	7	B
2	G	5	I	8	H
3	F	6	C	9	D



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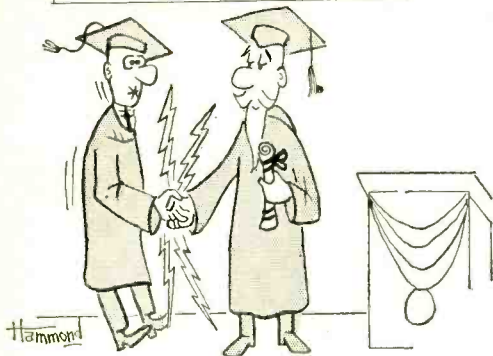
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ELECTRONICS SCHOOL



instructors, the cost per lesson is naturally going to be higher than for a course which gets by with the minimum.

But all this does not necessarily mean that the minimum-cost courses provide inferior instruction. To a large extent, what is "good" or "bad" here depends on *what you need* in the way of training. And only you can be the proper judge of that.

How Will I Pay? Although individual schools vary, there are primarily three

basic payment plans available. First, if you are prepared to pay cash in advance for the entire course, most schools will allow a discount.

The next and most popular plan is to pay for the lessons more or less as you get them. After making an initial down-payment, you receive a group of lessons. When you are about half-way through this group, you make another payment, and receive a second group. In this way, you always have lessons on hand. The schools which offer this type of pay-as-you-go plan also supply their kits in essentially the same manner.

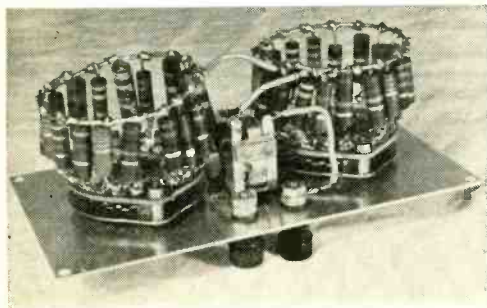
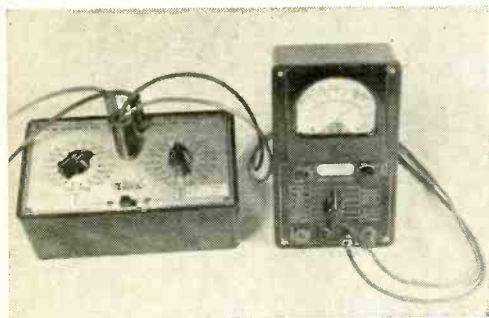
The third plan involves a contract whereby you make an initial down-payment and fixed monthly payments, no matter how many or how few lessons you use.

The pay-for-each-lesson type of course is usually easier to discontinue or interrupt than the monthly contract arrangement. Except for this, the plans are about the same and are a matter of choice.

-30-

NEXT MONTH: Residence Schools

More Uses for Resistance Box



If you have a resistance substitution box (such as the EICO #1100) in your workshop, you can increase its usefulness in this fashion. Mount a Mallory "Midget" shorting-type phone jack (Type A-2) on the panel just below the output terminal posts. Insulate the jack from the front panel using $\frac{3}{8}$ "-i.d. extruded fiber washers. Then connect the jack terminals in series with the lead to either of the unit's terminal posts.

Take a phone plug and make a patch cord with the necessary leads to connect it to your wide-range milliammeter. Now you are all set to measure current being drawn by the circuit under design—as you substitute resistances.

The resistors in the substitution box are all 1-watt units and will safely pass over 30 ma. of current up to 1000 ohms in the circuit; between 30 and 9 ma. from 1000 up to 10,000 ohms; and 2.5 ma., or more, up to 150,000 ohms.

—Carleton R. Elliott



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BUILDING ELECTRONIC CIRCUITS on specially-designed plug-in type chassis, is the work of Robert H. Laurens, Hammonton, N. J. He is an Electronic Technician working on the "Univac" computer. Laurens says, "My NRI training helped me to pass the test to obtain this position."



"I OWE MY SUCCESS TO NRI" says Cecil E. Wallace, Dallas, Texas. He holds a First Class FCC Radio-telephone License and works as a Recording Engineer with KRLD-TV.



MARINE RADIO OPERATOR is the job of E. P. Searcy, Jr., of New Orleans, La. He works for Alcoa Steamship Company, has also worked as a TV transmitter engineer. He says, "I can recommend NRI training very highly."



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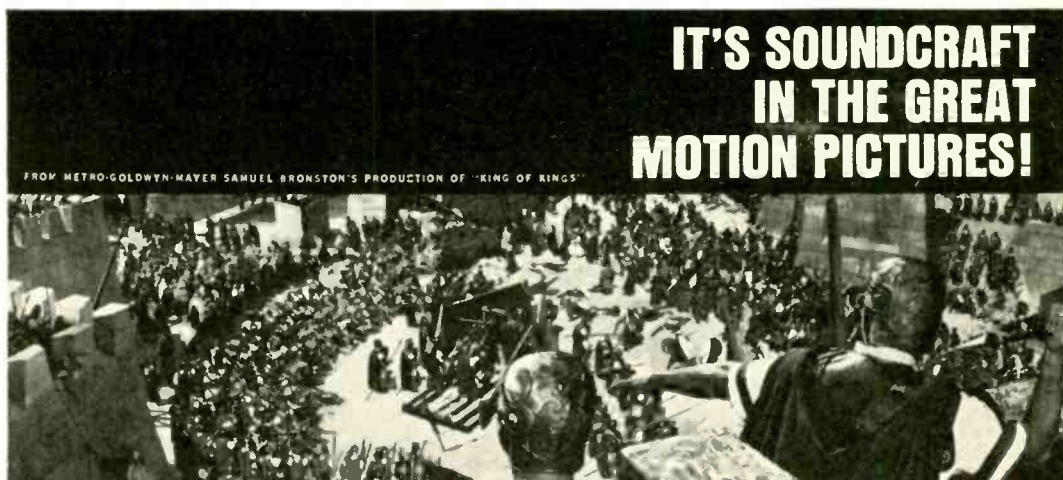
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The Magic Matrix

(Continued from page 57)

glowing lamp from one row to another . . . the other should "move" the lamp across the columns. By rotating both switches to different positions, you should be able to light *any* lamp in the matrix.

With all mechanical and electrical work completed, and the toy's wiring checked as outlined above, the playing board should be permanently mounted in a case or box. Any wooden or plastic box of adequate size may be used for housing the completed Magic Matrix. A wooden cigar box covered with "Contact," an adhesive-backed plastic film, was used to house the author's model.

OPERATION

To use the completed Magic Matrix, insert the line plug in a wall receptacle. Rotate S2 and S3 at random, and depress S1. One of the lamps in the matrix should glow.

Since the rotary switches are equipped with round, unmarked knobs, and no neon bulbs are lit while the switches are rotated, there is no convenient way to tell their relative positions. Thus, the selection of any bulb in the matrix depends on pure chance.

Because the Magic Matrix is an electronic device which permits the random selection of any of a large number of positions, it may be used in *any* game in which a random selection of numbers is desired. Each lamp position in the matrix may be given a letter or number value . . . for example, each position may be assigned a number from 1 to 144.

Electronic Roulette. To play this game, first make up a separate "playing board" with a number of squares corresponding to the number of neon lamps in the matrix. Each square is given a number, with a corresponding number assigned to each neon lamp. One of the players is chosen by lot to serve as "croupier" or "banker." The rest of the players are given a quantity of poker chips, stage money, or counters to serve as a "stake."

Players can then "bet" on any of the numbers on the playing board. Once all bets are placed, the croupier spins the two rotary switches at random and de-

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presses the *Push-to-Play* switch, lighting one of the neon lamps in the matrix. He then "pays" the player who has bet on the number corresponding to the lighted lamp.

It is customary for the banker to "pay off" at odds *slightly* less than the total number of positions in the matrix, thus insuring a small percentage for the "bank." With a 12 x 12 (144-position) matrix, "odds" of 100 or even 120 to 1 can be offered the winning player.

Each player may select a number at the beginning of the game. When his number comes up, he becomes the banker and continues as such until another player's number comes up.

Rows and Columns. Similar to Electronic Roulette, this game is especially suited for a small number of players since the chances of winning are much greater. The matrix is divided into numbered rows and columns, with each player betting on *either* the "row" or the "column" in which he believes the lamp will light.

Since the odds against picking the correct row (or column) are much less than those of picking one correct number out of 144 possible choices, the *bank* offers much lower "odds" to the winning player. The exact odds are 11 to 1, but the bank may offer odds of, say, 10 to 1.

Electronic Bingo. This game is played like conventional Bingo, except that the Magic Matrix is used to select letters and numbers. Each player is supplied with a standard Bingo card, while each neon lamp in the matrix is given a letter and number value.

Again, the selection of matrix lamp positions is at random. Each time a position is selected, its letter-number value is called out, and players having that number on their cards cover it with appropriate counters. The operator covers each selected lamp with half of a medium-sized colored gelatin capsule obtained from the local drugstore; this permits him to spot selected numbers easily when checking an individual player's card and to ignore duplicate selections.

As in conventional Bingo, the first player filling a line on his board wins the game.

Blank the Board. Here, the matrix board itself is used as a playing board;

March, 1962

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it is divided arbitrarily into a number of smaller areas, with one area assigned to each player. Allot a number of colored gelatin capsule halves to each player for use as "counters."

As a neon bulb lights each time, the player assigned to the area in which the bulb lights places a counter over it. The player who first "blanks" his assigned area by covering all the neon bulbs with capsules wins the game. Or each covered lamp can be given a "point" value, and the game played for a specific number of rounds.

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The detective is said to have "caught" the crook if his counter is within one space of the crook (lighted bulb) in any direction, and he receives 5 points. If a detective's man happens to be on the bulb representing the crook, he receives 25 points. The first player to score 100 points wins and becomes the "Chief of Detectives."

-30-

Solution to Crossword Puzzle

(Puzzle appears on page 70)

R	O	B	O	T		N	O	I	S	E		
I	D	E	S		U	S		F	R	I	A	
G	E	T		C	R	O	P		A	G	C	
S	R		G	O	N	S	E	T		S	H	
			F	I	L		R	I	D			
C	R		N	O	V	I	C	E		T	O	
L	U	G		R	A	S	H		A	S	H	
I	S	L	E		N	O		D	R	A	M	
P	H	O	N	E				D	X	E	R	S

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Short-Wave Report

(Continued from page 78)

expected to be ready for delivery by late summer of this year. The mobile facility will be complete with long-range receivers, studio, workshops, microwave communications system, generators, fuel tanks, transmitters, and "knock-down" antennas.

The basic purposes of this station (three of its four 50,000-watt transmitting units are intended for the short waves, the fourth for medium waves) are to augment existing fixed *Voice of America* stations on a temporary or emergency basis; to provide temporary service in those areas where fixed radio relay stations are being built; and to provide emergency service, when necessary, in



Samuel Hevener, WPE3WH, Sharon, Pa., uses an Airline receiver (shown) for medium-wave and FM DX'ing, a 1938 Westinghouse for the short waves. To date he has 29 countries logged and 13 veries.

remote areas where no adequate *Voice of America* broadcasting service is now available.

We are indebted to the "World At A Twirl" flash sheet for the above information.

Leaflets Available. Your Short-Wave Editor still has a small supply of various leaflets which may be of interest to you. Included among them are: leaflet "G"—"Verifications;" leaflet "H"—"Clubs and Publications;" "I"—"Reporting Codes;" "J"—"Time Zone Conversion;" "K"—"QSL & SWL Card Printers;" "L"—"Time and Standard Frequency Stations;" and "M"—"Callsign Allocations."

A new leaflet, "N," is now available as

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1H5GT	5R4	6BC5	6CM7	6SR7	12CA5
1S5	5T8	6BC8	6CM7	6T4	12D4
1T4	5U4	6B06	6CQ8	6T8	12F8
1U5	5UB	6BE6	6CR6	6U5	12K5
1V2	5V4C	6BF5	6CS7	6V6GT	12K7
1X2	5V6GT	6BG6	6CU5	6W6GT	12L6
2A4	5B6	6BN6	6CU6	6X4	12Q7
2B4	5Y3	6B16	6D6	6X5GT	12R5
2C5	6A84	6BK5	6DE6	6X8	12S47
3A15	6AM4GT	6BK7	6D66GT	6Y6G	12S17
3B5	6AH6	6B17GT	6D66	12A8	12SK7
3B6	6AL5	6BH6	6F6	12A85	12SN7GT
3B6	6AM8	6BQ6GT	6H6	12A85	12S07
3B6	6AQ6	6BQ7	6J5	12A7B	12V6GT
354	6AQ7	6BR8	6J7	12A86	12W6GT
3V4	6AR5	6B58	6K6GT	12AV6	12X4
4B07A	6AS5	6B15G	6K7	12A77	19AU4GT
4B5B	6AT5	6B76	6L7	12AX4GT	19B6G6
4B7	6AU4GT	6B27	6SA7	12A27	19T8
4C8B	6AUSGT	6C4	6SD7GT	12B47	25E6GT
5AM8	6AUG	6CA8	6SF5	12B77	35A5
5AN8	6AYSGT	6CB6	6S07	12B06	35B5
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well. It is a resume of some of the reasons why *your* reports may not have been used in this column as yet, and it also contains a few suggestions you might take into consideration in preparing reports to increase the possibility that they will be used.

Any or all of these leaflets may be obtained just by writing to your Short-Wave Editor at P. O. Box 254, Haddonfield, N. J., asking for them, and enclosing return postage.

Current Station Reports

The following is a resume of current station 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 EST and the 24-hour system is used.

Angola—CR6RO, *R. Clube do Bie*, Silva Porto, is currently noted on 7107 kc. at 1538 with Port. news; very weak. Non-stop music follows, then another newscast at 1630. Madrid on 7105 kc. and a c.w. station on 7108 kc. make this station very difficult to copy. (WPE3NF)

Australia—Here is the complete Eng. schedule from Melbourne: to Indonesia, S.E., S. and S.W. Asia at 1714-0100 and 0230-0430 on 21,540 kc., at 1714-0800 on 25,735 kc., at 1915-0100 on 17,840 kc., at 1714-1915 on 15,210 kc., at 0100-0800 on 15,180 kc., at 0955-1230 on 11,890 kc., at 0800-1000 on 11,740 kc., at 0459-1230 on 9570 kc., and at 0800-1230 on 7220 kc.; to E. Asia and N.W. Pacific Islands at 0244-0500 and 0600-0700 on 11,810 kc., at 1559-1800 on 15,240 kc., and at 0600-0900 on 9580 kc.; to N.A. (East Coast) at 0714-0815 and (West Coast) at 1013-1115 on 11,710 kc.; to Africa at 2329-0045 on 21,680 kc.; to the British Isles and Europe at 0315-0415 on 11,710 and 9580 kc.; to Mid-Pacific Islands at 2129-0230 on 21,600 kc., at 1500-1700 on 15,315 kc., and at 0244-0700 on 7190 kc.; to S. Pacific Isles at 0100-0415 on 11,710 kc., at 1500-1700 on 11,840 kc., and at 0314-0415 on 9580 kc. (WPE1DAD, WPE2GFF, WPE4CCO, WPE4DGB, WPE4DMW, WPE8BUB, WPE8MS, WPE9CGQ, LA1PE1R)

Austria—Vienna was recently noted at 0830-0852 with music and an amnt that they were in parallel with 6155, 7105, 9525, 9720, and 11,785 kc. Other observations: the 0300-0600 xmsn to N.A. on 7200 kc. has been deleted, but there is a xmsn to N.A. at 2010-2300 on 9770 kc.; the program to Japan on 15,305 kc. is now aired at 0130-0300. (WPE4BC, WPE9CHO, VO1PE1AJ)

Bolivia—*R. La Cruz del Sur*, Cajon 8, La Paz, is now on the air daily. The schedule is 0600-0800, 0930-1300, and 1700-2215 (Sundays only at 0615-2145). All xmsns are in Spanish except for German at 0745-0800 and 1915-1930 (on Sundays), and at 0625-0630 (weekdays); Eng. on weekdays at 2130-2145; and language lessons on Mondays, Wednesdays and Fridays at 1845-1900 (in French) and at 1945-2000 (in Eng.). (WPE8MS)

Brazil—ZYR232, *R. Universitaria Santos Dumont*. San Jose dos Campos, transmits the program "A View of Brazil" in Eng., French, and German on Mondays at 1900 on 17,725 kc. Verifications are not being sent at present but a "Listener's Department" is in the planning stage. (WPE8MS, SCDX)

Dominican Republic—*La Voz Republica Dominicana* network stations are now identifying as *La Voz Santo Domingo*. Their location is Santo Domingo—formerly Ciudad Trujillo. (WPE8CKW)

East Germany—*R. Berlin International* operates as follows: to Europe at 1300, 1500, 1700, and 1800 on 6115, 7300, and 9730 kc.; to the Middle East at 1100 and 1800 on 11,765 kc.; to the U.S. at 1930 and 2100 on 9560 kc. (WPE2GOQ, WPE3BCM, WPE4BXG, WPE3CXT, WPE8MS, WPE9CQC)

England—London is noted in the General Overseas Service at 1915-2000 on 3952 kc., easily overriding the 75-meter amateur stations. (Ed.)

Gabon—*Radiodiffusion du Gabon*, Libreville, is on 4775 kc. at 0030-0130, 0615-0800, and 1200-1600, and on 9515 kc. at 0400-1100. (WPE1DDC)

Greece—*Radio Athens* broadcasts in Eng. at 1230 on 11,720 and 17,742 kc., with a xmsn in French preceding the Eng. xmsn by 10 minutes. (WPE1DDC)

Greenlands—*Gronlands Radio*, Godthaab, still does not transmit on the short waves; however, according to word from the station, such service may begin in 1962 or 1963. (WPE8MS)

Hong Kong—The Hong Kong branch of Cable and Wireless, Ltd., operates ZEN42 on 9331 kc. at times with a xmsn consisting of a

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India—The External Services of *All India Radio* list news in Eng. at 1930 on 7225 and 9765 kc., at 2330 on 17,855 and 21,620 kc., at 0500 on 11,760, 15,105, 15,310, 17,705, and 17,855 kc., at 0830 on 15,365 and 17,705 kc., at 1045 on 15,105 and 17,830 kc., and at 1445 on 7235, 9635, 9690, and 11,955 kc. An unlisted Eng. newscast

March, 1962



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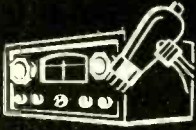
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was also noted at 1030-1045 on 7225 kc. (*SCDX*)

Iran—Teheran carries Arabic news and talks at 1345 on 7096.5 kc. The 7024-kc. channel is still being used at 1500 (Russian), at 1515 (Turkish), at 1530 (French), and at 1545 (Eng.), with s/off at 1700. The Home Service is operated on 9755 kc. (replacing 9680 kc.) at 0100-0730; also from 0730 on 6025 and 3840 kc. (*WPE2FMH*, *WPE2GJD*, *WPE3NF*, *SCDX*)

Iraq—*R. Baghdad* operates on 6030 kc. at 1500 in French, at 1530 in Arabic, at 1600 in German, and at 1630 in English. The Home Service is carried evenings on 3990 kc. (replacing 3955 kc.) and 7180 kc. (*WPE2FMH*, *WPE2GJD*, *SCDX*)

Japan—The Far East Network is now operating on 6155 kc. (replacing 6160 kc.) and 15,200 kc. (replacing 15,257 kc.) (*Far East Network*)

Luxembourg—Eng. xmsns from *R. Luxembourg* have been extended to 2100 on 6090 kc.; music, sports, and news. (*WPE8CUS*)

Martinique—*Radiodiffusion Francaise*, Fort-de-France, sent the following schedule. The short-wave outlet on 5995 kc. (1500 watts) can be heard at 0515-2115 (on Saturdays to 2300); the tropical-wave outlets on 3315 kc. (8 kw.) at 0515-1100, on 4895 kc. (8 kw.) at 1100-1500, and on 2420 kc. (8 kw.) at 1500-2115 (on Saturdays to 2300). It is possible to hear the medium-wave outlet on 1500 kc.; try for it during the latter portion of their 0505-2115 schedule (on Saturdays to 2300). Despite the schedule, the 3315-kc. outlet was noted closing at 2107 weekdays and 2304 on Saturday. (*WPE8MS*)

Monaco—*Trans-World Radio*, Monte Carlo, has slipped down to 5942 kc. and was noted at 1430 with a music box IS and Eng. ID. (*WPE3NF*)

Mongolia—This schedule was received from *Ulan Bator Radio*: first program at 1755-1005 on 5960, 5067.5, and 10,910 kc.; the second program at 0400-0905. Both of these programs are in Mongolian. There is a Moscow relay at 0430-0500 and at 0815-0900. English has been noted at 0445-0505 on 5960 kc. (*WPE4BXG*)

Morocco—Rabat was noted opening at 1300 with music and native language, then Eng. with Eastern music to 1317. A request for

SHORT-WAVE ABBREVIATIONS

- annt—Announcement
- c.w.—Morse code
- Eng.—English
- ID—Identification
- IRC—International Reply Coupon
- IS—Interval signal
- kc.—Kilocycles
- kw.—Kilowatts
- N.A.—North America
- Port.—Portuguese
- QSL—Confirmation: verification
- R.—Radio
- s/off—Sign-off
- xmsn—Transmission

letters at 1343 ended the Eng. xmsn and French followed. (*WPE4BC*)

New Guinea—VLT6, Port Moresby, 6130 kc., has been tuned strong at 0400 with a London news relay. (*WPE6WB*)

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Peru—OBX4C, *R. El Sol*, Lima, has moved from 15,170 to 17,745 kc., and was noted at 1900-2200. Has anyone else heard it? (*WPE3CTB*)

Philippines—DZCA, National Civil Defense Administration, Manila, was noted on 6015 kc. with a good signal at 0740-0832; Eng. pop music, time checks, and frequent ID's. The

SHORT-WAVE CONTRIBUTORS

Alan Fajerman (*WPE1ADI*), Bridgeport, Conn.
 Edgar Scott (*WPE1CPS*), Brewer, Maine
 Joseph Cagnina (*WPE1DAD*), Woburn, Mass.
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 James Herkimer (*JH*), Caledonia, N. Y.
Far East Network (FEN), APO 67, San Francisco, Calif.
Swedish Calling DXers (SCDX), Radio Sweden, Stockholm, Sweden

Eng. programs ended at 0832. Announced power is 1000 watts. (*WPE0VB*)

Portugal—Lisbon can be tuned with Eng. at 0815-0900 on 21,495 kc. to S.E. Asia and at 1315-1430 on 17,895 kc. to S. & S.E. Africa, on 17,880 kc. to W. Africa, and on 6025 kc. to Europe. (*WPE2CRX*, *WPE2FHU*, *WPE8CUS*, *WPE8MS*, *WPE9CEW*, *VOIPE1AI*, *JH*)

Portuguese Guinea—CQM, *Emissora de Guine*, Bissau, was noted on 7948 kc. with improved signals from 1719 to 1801 s/off; dance music and Port. anmts. (*WPE0VB*)

Portuguese India (Goa)—*Emissora Goa* has been noted on 15,385 kc. at 1155 in native language with music and ID at 1200. At 1230 this station started broadcasting in Port. but it was overridden by WRUL. (*WPE4BC*)

South Africa—The South African Broadcasting Corp., Johannesburg, was noted on 15,084 kc. at 1300 asking for reports, at 1400 with Eng. news. It was heard until 1500. Other xmsns were tuned on 11,810 kc. at 1300, on 3316 kc. at 1245 in Eng., on 4895 kc. with spirituals at 1050, and on 11,715 kc. at 1100 in

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Afrikaans. (WPE4BC, WPE0FO, LA1PE1R)

Sudan—Sudan Broadcasting Service, Khartoum, has been noted on 9600 kc. in Eng. at 0700-0730. Anmt gave next Eng. period as 1400; presumably this is 1400 GMT or 0900 EST. (WPE8BBL)

Tunisia—Tunis has been heard on 5950 kc. as early as 1300 with Arabic news; this channel is usually heavily c.w.-QRM'ed. Another xmsn was noted at 1620 on 9635 kc. (WPE2FMH, WPE3NF)

Yugoslavia—Radio Belgrade was observed broadcasting in Eng. at 1700-1715 over 6110 kc. (keep in mind that *Deutsche Welle*, Cologne, opens at 1715 on 6100 kc. for Eastern N.A.). Belgrade's German program at 1545-1600 on 6100 kc. is also heard well. (WPE8MS)

Clandestine. We are listing the following two stations as clandestine even though mailing addresses are available for both of them. Their exact locations are not known.

Radio Libertad. La Voz de Anti-Comunista de America. P. O. Box 135, Miami, Florida, is noted on 7441 kc., dual to 7322 kc. at 2030-2100, with frequent Spanish ID and an excellent signal. Other reports also list it as being on 14,820 kc. at 0830-0900 with news, and s/off at 0900 with a march number. (WPE2CRX, WPE2FHU, WPE3NF, SCDX)

Radio America (presumably former *Radio Swan*—see page 77) is tuned well on 1160 and 6000 kc. as early as 1315 with chimes IS and Spanish ID, then pop music. It was also tuned from 0715 with music until 0800/close. There is an Eng. period at 1800-1830. The 1160-kc. broadcast is reported to be from 0500 to 2330, but it is not known at present whether this straight-through schedule is also maintained on 6000 kc. Reports go to P. O. Box 352, Miami, Florida. (WPE1ADJ, WPE1CPS, WPE2RS, WPE3NF, WPE4BC, WPE8CUS, VE1PE3Q, WB)

-30-

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IF THE 1B3 ISN'T SHOT, BE SURE YOU CHECK THE RESISTORS IN THE WAVE-SHAPING NETWORK OF THE HORIZONTAL OSCILLATOR.

Across the Ham Bands

(Continued from page 81)

News and Views

James M. Alcorn, W3VEJ/3, 25 Cobbs Hill Dr., Rochester 10, N.Y., leads off "News and Views" this month. Jim receives with a 1-tube (6SL7) regenerative receiver and transmits on a "soft" 6146, crystal-controlled on 7035 kc. The tube runs 60 watts input, and feeds a 150' bent 'long-wire' antenna. In four months, Jim has worked 33 states with this combination. . . . **Bob Beig, K5FLK**, Route 4, Box 324G, Woodvale Rd., Ft. Worth, Texas, rates himself as "just a 6-meter Technician," but the equipment in his shack indicates that he'll be going for the General Class license soon. On 6 meters, he operates a Heathkit "Sixer" in his car and has worked 16 states plus three countries. Not bad for a "local" band! . . . **Rick Klobucher, KN7QWC**, 402 N. Crestview Dr., Moses Lake, Wash., has worked 26 states—17 confirmed—including Alaska and Hawaii, and Japan in two months on the air. His magic box is a Globe Chief 90A transmitter feeding either a 40-meter dipole or a "1-element, 15-meter beam." Rick forgot to mention the type of receiver he is using. . . . **Bart Prater, WN4DME**, 635 Henry St., Marion, Va., transmits on a Heathkit HX-11 and receives on a Heathkit AR-3 helped along by a Q-multiplier. Operating on 80 and 40 meters, Bart worked 15

states during the first week that he spent on the air.

If you work **K1RSX**, Melrose, Mass., the ham station of the National Co. Employee's Amateur Radio Club, don't argue with the operator about frequencies. This station uses a National "Atomichron" cesium tube atomic clock as a frequency standard—it's accurate to within one second in 30,000 years. "Atomichrons" are also used to determine the frequencies and times transmitted by the National Bureau of Standards on Station WWV.

Glenn Elmore, WV6ST5, 8300 Appian Way, Sebastopol, Calif., has huffed and puffed signals into eight states on 80 and 40 meters with his Heathkit DX-20 transmitter and National NC-183 receiver. A center-fed antenna is the link between his station and the ionosphere. Contact him if you need California. Glenn is looking for someone to nominate him for the Rag Chewer's Club. . . . **Craig Cool, WNØAFT**, 908 Denver St., Waterloo, Iowa, squeezed QSL cards out of 25 of the 35 states he has worked with his Heathkit DX-60 transmitter and Hallicrafters SX-110 receiver. Craig uses a Gotham vertical antenna with his receiver and transmits on a 40-meter inverted-V. He has organized a local group called the "Twilight DX Club."

Phil Hoefler, KNØJGA, 4019 St. Louis Ave., St. Louis, Mo., must say his prayers regularly. He has the 15-meter beam described in the January, 1960, issue of P.E. (page 50) mounted 70' high on the roof of a nearby church. He also has a 40-meter dipole 35' high. Although

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3CB6	6AG5	6AX5GT	6B26	6DQ6	6SL7	7B7	12A8
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Phil doesn't get much time for hamming, his Heathkit DX-20 transmitter and Hallcrafters SX-99 receiver do a good job when he is on the air, as shown by his eight states worked.

... **Ronnie Greenberg, KN1TDP**, 646 Walk Hill St., Mattapan 26, Mass., likes 40 and 15 meters. His Globe Scout De Luxe transmitter, Hammarlund HQ-100C receiver, and two dipole antennas have given him a states-worked total of 30—27 of them confirmed. A 10-wpm code certificate also graces Ronnie's shack.

... **Glen Myers, WV2VJV**, 43 Elm St., Saugerties, N.Y., builds most of his ham equipment himself, including a 65-watt, 80-through 6-meter transmitter, a Q-multiplier, and a mobile converter. His latest project is a 17-tube receiver still under construction. On the air, Glen sticks to 80 meters; he QSL's 100%.

Jack Foreman, KN5HPI, 606 Bois D'Arc, Lockhart, Texas, thinks his station is a good example of what you can do with \$125.00. He transmits with a Globe Chief De Luxe assembled from a kit, and receives on a used Hallcrafters S-40B plus a Heathkit Q-Multiplier. The antenna is a 40-meter dipole. In eight months on the air, Jack has worked 25 states—all on 40 meters. He is now building a 15-meter beam. ... **Jim Cain, WN9AUM**, 134 S.W. J St., Richmond, Ind., doesn't want to brag about how well he gets out. Instead, he just wants all the hams who have helped him with his license and transmitter to know how much he appreciates their help. ... **Chuck McMullen, KN3PLX**, 537 Highland Ave., Lewistown, Pa., receives on a Hallcrafters SX-110 aided by a Q-multiplier, and transmitter on a Globe Chief 90A. A VFO awaits the day his General Class license arrives. The antenna with which Chuck has worked 23 states is a multi-band "trap" dipole—a 2-element, 15-meter beam is waiting to go up.

If we haven't talked about your favorite band or type of operation this month, it is probably because you didn't write and tell us about it. How about doing it now? The address is: Herb S. Brier, W9EGQ, C/O POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana. Until next month, 73,

Herb, W9EGQ



Peter Lohner, KN7PSQ, Forest Grove, Ore., became interested in ham radio through reading *Across the Ham Bands*. In his first two weeks on the air, Pete's Hallcrafters HT-40 transmitter and SX-99 receiver, RME DB-23 preselector, and vertical antenna helped put 26 contacts in his logbook.

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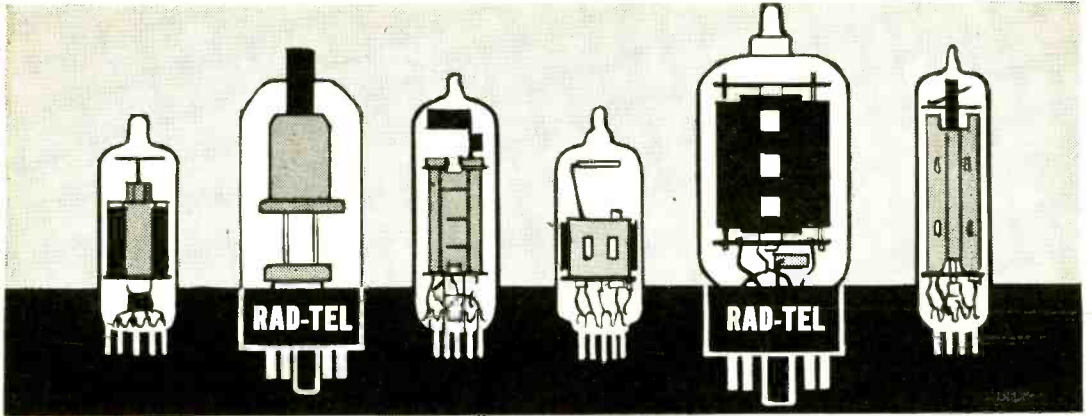
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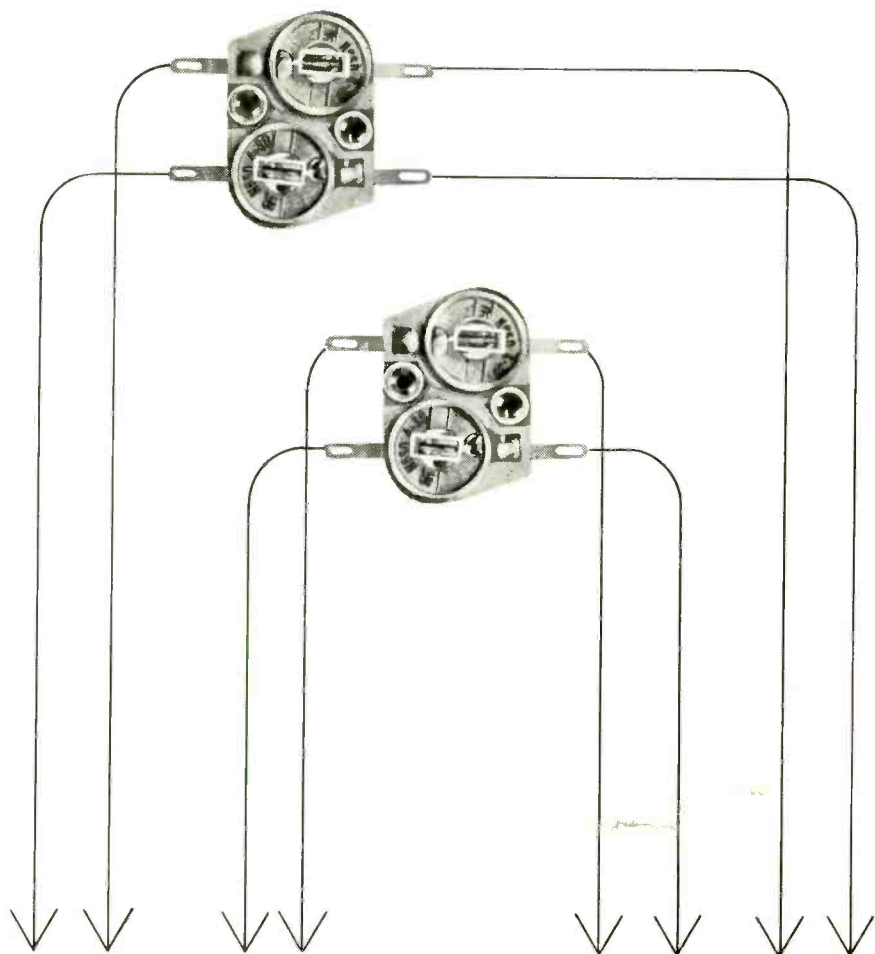
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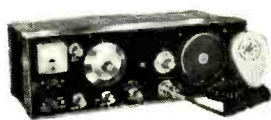
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