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POPULAR

**NOVEMBER
1961**

ELECTRONICS

**35
CENTS**

★ **All About Electroluminescence**

★ **Make Radio Double As Intercom**

Plans For:

- **Squelch For CB-1 Superregen**
- **Stereo Earphones**
- **AG-1 Slave Flash Gun**
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"77 Sunset Strip"



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for the **27 Mc** **CITIZENS BAND OPERATION**

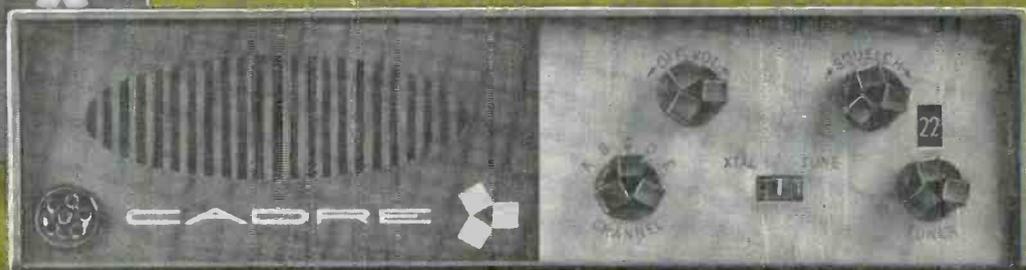
These CADRE units are built to the highest standards of the electronics industry, by a company that has been long established as a prime manufacturer of precision electronic research equipment and computer assemblies. CADRE transceivers are 100% transistorized — compact, lightweight . . . engineered for unparalleled performance and reliability.

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For the time being, it is unlikely that there will be enough CADRE transceivers to meet all the demand. Obviously, our dealers cannot restrict their sale to the fields of medicine, agriculture, transportation, municipal services, etc. However, since these CADRE units were engineered for professional and serious commercial applications—and cost more than ordinary CB transceivers—we believe that as "water finds its own level," CADRE transceivers will, for the most part, find their way into the hands of those who really need them.

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CADRE INDUSTRIES CORP., Endicott, N.Y.

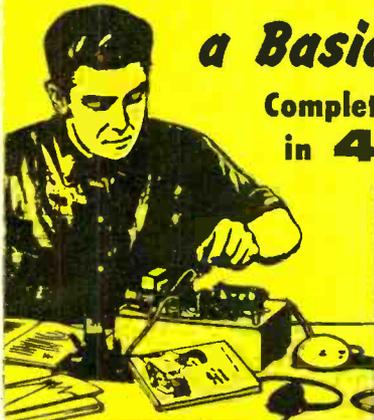
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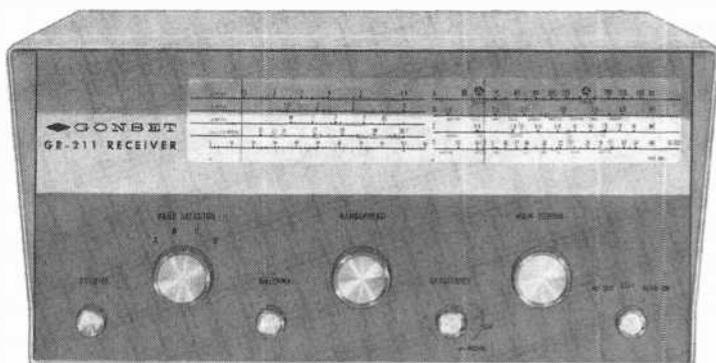
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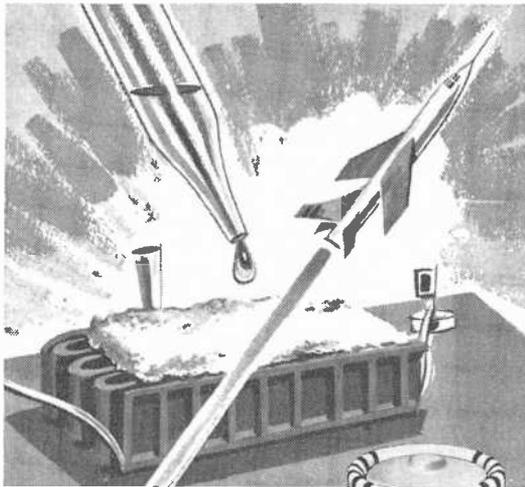
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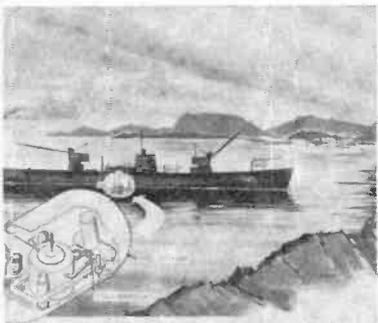
NEWS SCOPE



DEFECTIVE METAL DETECTIVE—Defects within ferrous metals are revealed by a portable "magnetic detector" which can be used to uncover cracked motor blocks in automobiles. Developed by the X-ray department of the Westinghouse Electric Corporation, the hand-held unit operates on auto batteries or may be plugged into any a.c. outlet. Checking for metal defects is simple. A special powder is sprayed onto the surface of the metal part to be inspected. Then the magnetic detector is held close by, and its magnetic field discloses any cracks or defects by forming tell-tale patterns in the powder. Used car dealers are reported to be unhappy.



"HOUSE-CLEANING" AIR is the job of a compact two-stage electronic air cleaner made by Minneapolis-Honeywell Regulator Company. The ionization stage sets up an electrical field between tungsten wires and grounded plates which ionizes the smallest dirt particles and vapors in the air stream. The collecting stage is a series of alternately charged negative and positive aluminum plates which attract and trap the ionized particles. This electronic air cleaning technique is designed to remove particles 100 times smaller than the usual filter in your air conditioner can. Pollen and other tiny airborne irritants that make life miserable for people with chronic allergies, plus unpleasant vapors, tobacco smoke and cooking fumes, "hit the dust" in the air cleaner—making your indoor air cleaner than the out-of-doors.



NUCLEAR BARGE POWER PLANT—The U.S. Army Corps of Engineers has just ordered into production the first floating nuclear power plant, to be built by The Martin Company for about \$17 million. The nuclear plant will be housed in a reconditioned and rebuilt Liberty ship, the "Walter F. Perry." Packing enough power to supply the electrical needs of a civilian community of 20,000, the "atomic barge" will be towed from place to place as needed whenever normal supplies are cut off by peacetime disaster or wartime action. The reactor is a proven "pressurized water" system type. Water passing under pressure through the hot core of the reactor transfers the heat to water at lower pressure in a separate "secondary loop." The steam thus produced turns the blades of a turbine, generating electricity.



TELEPHONE THIEVES? No, just a demonstration of what appear to be two standard telephones with "no strings attached." Actually, the phones are experimental wireless transceivers developed by Automatic Electric Laboratories, Northlake, Ill. These wireless extension telephones could be used at restaurants, conventions, at pool sides or in the lobbies of hotels, and in other public settings. While practical working models have been developed, the wireless phone will not be available to telephone subscribers for a long time because of the lack of available radio frequencies.

(More on page 8)

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William F. Bratton, Jr., 435 Etna Street, Russell, Ky.....	1st	12
Darrell E. Cloce, 25 E. 32nd St., Kansas City, Mo.....	1st	12
Thomas J. Hoof, 216 S. Franklin St., Allentown, Pa.....	1st	22
P. B. Jernigan, Route 2, Benson, North Carolina.....	1st	12
Edward R. Barber, 907 S. Winnifred, Tacoma, Wash.....	1st	20
Claude Franklin White, Jr., c/o Radio Sta. WJMA, Orange, Va.....	1st	12
John M. Morgan, c/o KIRI-TV, 1530 Queen Anne Ave., Seattle, Wash.....	1st	9½

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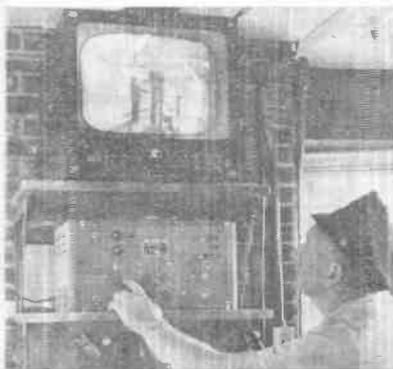
NEWS SCOPE

Continued

AUTOMATIZED STAMP COLLECTING IS HERE! A handy gadget, tabbed the PDQ (for Patents Development Quorum, Inc.), dispenses supermarket stamps automatically and speeds up the checking out of purchases in the following manner: the clerk punches buttons on the PDQ corresponding to the total on the register, a motor is activated, and the PDQ spits forth the correct number of stamps—one for every 10 cents worth of merchandise. The dispenser has two circles of buttons, one for dollars and one for dimes; five small precision switches made by Micro Switch control the unit. A boon for philatelists? Hardly. But the housewife-collector should certainly appreciate it.



SKI SAFETY—A resourceful ski resort owner in Maine borrowed a cost-cutting communications idea from industry to give vacationers an extra measure of safety. Equipping the members of his Ski Patrol with Globe two-way "Pocket-phone" radios has saved up to ten valuable minutes in getting injured skiers down the slopes of Pleasant Mountain. The small 100-milliwatt units permit the ski patrolers to call for help while remaining at the victim's side.



PEEK-A-BOO TV—A costly and troublesome job in American industry is that of plant protection. Merck & Co., Inc., in Rahway, N. J., has solved the "gate-keeping" problem by having a guard keep one eye on the main plant entrance and another eye on a remote gate "around the corner" a half-mile away. This would be difficult for one man to handle if it were not for a Dage closed-circuit TV system. When an employee wants to pass through the remote gate, he simply presses a button. The guard at the main gate identifies the employee by looking into the TV monitor and, if all is well, automatically opens the gate and closes it behind him. The wide-angle view of the TV camera prevents unauthorized people from slipping in unnoticed.



CQ GRIZZLY BEARS! Naturalists with the Montana Cooperative Wildlife Research Unit are tagging grizzly bears in the Yellowstone National Park with tiny Philco transmitters. They plan to keep track of the grizzlies' roaming habits in the hope of discovering some hint as to the reasons for their high mortality rate—fewer than 1000 grizzlies survive south of Canada. The study is being sponsored by the National Geographic Society and the National Science Foundation.

POWER BRAIN—Out Philadelphia way, every time you flick a light switch on or off, an electronic digital computer measures the power need and gives orders to huge turbine generators of the Philadelphia Electric Company. The electronic "brain" is the heart of a complex control system—it automatically and continuously portions off the utility's total electrical load requirements to 34 generating units so that each can operate most economically. Almost as a bonus, the computer also performs billing calculations on the amount of power exchanged with interconnecting utilities.

POPULAR ELECTRONICS

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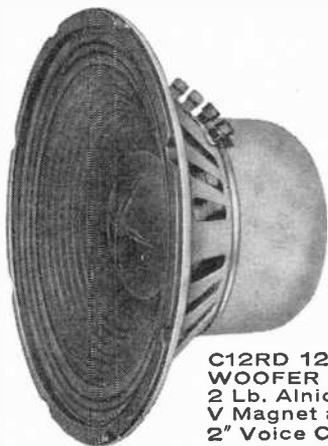


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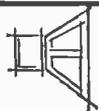


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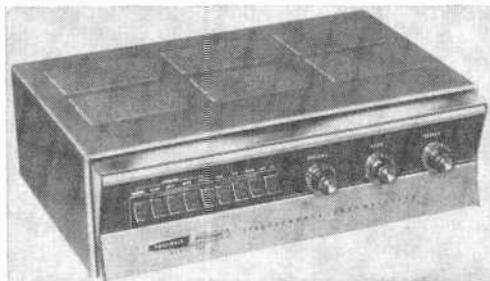
Hi-Fi



Showcase

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

DESIGNED to take advantage of the acoustic benefits of corner mounting, *Argos Products'* three new speaker baffles not only have a "clip-in" front to eliminate unsightly screws, but a slotted-back design makes them easy to hang as wall baffles. In addition, there are outside screw terminals which can be connected internally to the speaker voice coil, making it unnecessary to remove the front of the baffle once the speaker is installed. Produced in both straight and sloping-front models and for both 8" and 12" speakers, the baffles are priced from \$12.50 to \$18.90. An additional model, the SCB-208S, comes complete with an 8" Jensen "Profile" speaker and sells for \$22.75. . . . If you're in the market for a de luxe stereo preamplifier with just about every feature you've ever wanted in a "master control" center, you'll be interested in *Heath's Model AA-11*. For simplicity of operation, all switches and con-



Heathkit AA-11 stereo preamplifier

trols have been divided into two distinct groups: the basic or "primary" controls are located on the plastic front panel, while the "secondary" controls have been placed behind a hinged cover on the lower front panel. Among the primary controls: eight push-button switches for selection of five stereo inputs, three monophonic inputs; a push-button on/off switch; a volume/loudness control; and separate, Bax-andall-type bass and treble controls. Price, f.o.b. Benton Harbor, Mich., \$84.95.

A 4-track tape recorder from West Ger-

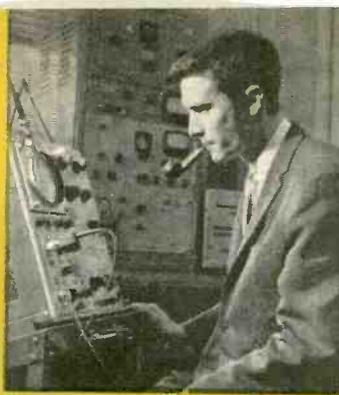
*Write to the manufacturers listed at the end of this column for more data on products mentioned



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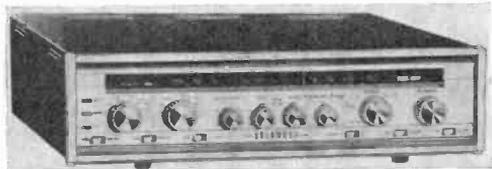
Showcase

(Continued from page 10)

many—the *Korting 114*—features three separate heads for erase, record, and playback; is equipped with a preamplifier/equalizer for both recording and playback; and must be used with an external power amplifier. An ideal unit for incorporation into an existing stereo setup, the 114 is so designed that its internal preamplifier can be bypassed for mono recording or playback, and an external preamplifier used instead. Other features: a dubbing control which allows a previous recording on one track to be dubbed onto another track of the same tape, producing a perfect multiple-synchronized recording; a tape counter with zero adjustment; a pause button; and a recording level meter. Frequency response of the 114 is 40-15,000 cycles at 3¼ ips; 30—20,000 cycles at 7½ ips; wow and flutter less than 0.2% at 7½ ips. The 114 is priced at \$279.50.

If space is at a premium and decor important for your hi-fi setup, the "Verti-Sonic" speaker systems by *Lord's Electronics* may well be the answer. Consisting of one, two, or three speakers mounted on vertical "room divider" poles, the Verti-Sonic systems reproduce frequencies from 60 to over 13,000 cycles and can be pivoted a full 360 degrees. The systems use Jensen hi-fi speakers and prices start at \$129.95. . . . Flexible cabinet end panels constructed of stiff laminated materials and mounted on sponge rubber surrounds help extend the low-frequency response of an ultra-compact speaker system by *Rus-Lang*. Measuring 9¾" x 18" x 9½", the system employs an 8" speaker and has a frequency range of 40-14,000 cycles. The unit is attractive, too: the enclosure is made of genuine oiled walnut, and the grille cloth is a contrasting white and gold. Price, \$34.95.

One of the first stereo receivers for the new FM multiplex stereocasts is *Sherwood's* S-8000. Incorporating two 32-watt



Sherwood S-8000 stereo multiplex receiver

amplifiers and a stereo preamp for phono, tape, and TV control, the S-8000 also contains a sensitive FM tuner complete with wired-in multiplex circuitry. Frequency re-

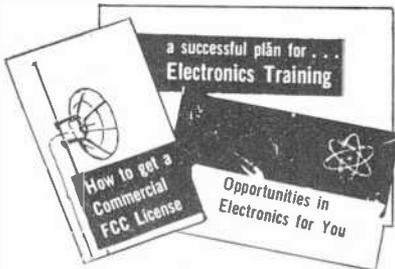
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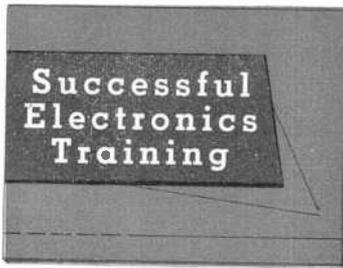


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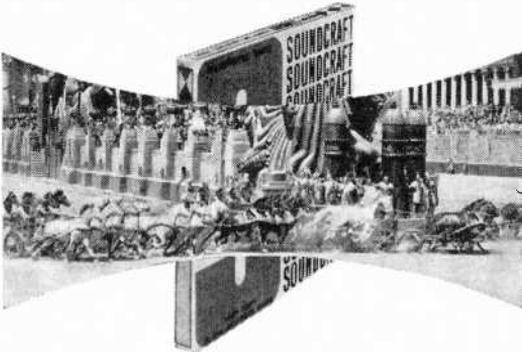
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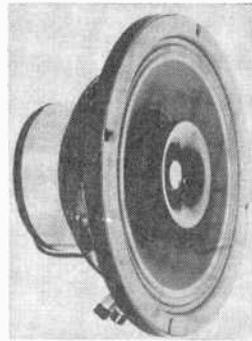
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Showcase

(Continued from page 12)

sponse is within 1 db, 20 to 20,000 cycles, at 30 watts output, and the S-8000 needs only the addition of a pair of speakers to form a complete FM stereo setup. Equipped with 21 tubes and four silicon rectifiers, the S-8000 sells for \$299.50, less case. . . . Two ceramic phono cartridges by *Sonotone* are turnover types suitable for either stereo or monophonic records. With 22 db channel separation, the "16T" has a frequency response within 1 db from 20 to 10,000 cycles and precisely matches the RIAA characteristic. The "18T" offers somewhat higher output (0.7 vs. 0.5 volt), but less channel separation and heavier tracking force. Price: \$12.50 with sapphire styli; \$15.50 with diamond styli.

Stephens Trusonic has an 8" coaxial speaker with a "ring radiator" type tweeter. The 80CX boasts a frequency response of 40-25,000 cycles and is equipped with a 5000-cycle crossover network and attenuator control. Key to the speaker's remarkable performance is the RT-1 tweeter (also available separately) employing an edge-wound aluminum-ribbon voice coil which is attached to its form by



Stephens Trusonic 80CX

a special thermal-pressure method. The 80CX is priced at \$55.50; the RT-1 tweeter alone sells for \$26.50. . . . An adapter kit consisting of 11 frequently used audio adapters and one "universal" molded interconnecting cord is just the thing for interconnecting two pieces of equipment that do not have matching connectors. Manufactured by *Switchcraft, Inc.*, the kit (No. 331A) is supplied in a handy reusable plastic box and is intended for servicemen as well as audiophiles and experimenters. It's priced at \$15.00. —30—

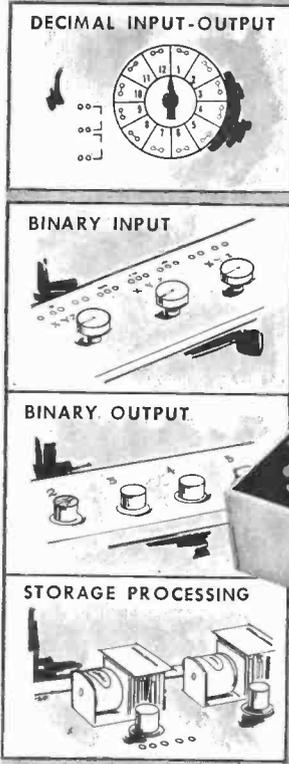
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FCC Report

By **ROBERT E. TALL**
Washington Correspondent

BOMBARDED by requests from doctors, police and fire departments, civil defense officials, and many other "emergency" personnel for fast action on their CB applications, the FCC has, in effect, told these distinguished prospective CB'ers to get in line and sweat out the two-month-plus waiting period along with the rest of us. The standard FCC answer to "expedite" requests is that while the Commission would like to be helpful, only in "rare cases" where "there is an immediate need to use radio for the safety of life or property, or for a similarly compelling reason, have applications been considered ahead of their turns."

The Commission points out that the "sheer number" of CB applications which involve "possible emergency use" of the systems requested "makes it impossible to expedite all of them." Also, the agency "has found it necessary to restrict immediate action to those which deal with actual and existing emergencies." To put it more simply, there's not a ghost of a chance of getting a CB license in less than the normal time unless a disaster is either at hand or just around the corner. As of July 1, the CB license processing "delay time" was about 80 days.

Emergency Action. Examples cited of when CB "expedites" will be granted include applications from areas where a river above the town is at flood stage and preparations are being made to evacuate people from the danger area; where a forest fire is raging and is headed toward the applicant's area; where a risky job requiring radio communications is necessary to avoid disaster or to dispatch relief when disaster strikes; or when a sudden labor shortage endangers a seasonal industrial or agricultural activity and the use of radio would help the situation.

In a second type of example, quick licensing action can be had if it becomes necessary to move a station because of the unforeseen loss of a building when an owner cancels a lease, or if an original station is

(Continued on page 20)

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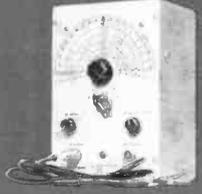
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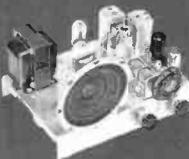
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Please send me more information on the model numbers circled below:

650	ES-150	P-28	1803
G 140	E-75	RS-24	1702
ST-22	48	1904	
IC-60	CB-26	1601	

Name _____

Address _____

City _____ Zone _____ State _____

PE-11

FCC Report

(Continued from page 16)

destroyed by fire, earthquake, flood, or other natural disaster.

A third type of approved *expedite* has to involve "an immediate and urgent need to provide radio facilities in connection with national defense activities important to the country."

As stiff as these criteria are, however, the Commission does relent enough to issue quick, short-term, one-shot, non-recurring authorizations in connection with events of wide public interest, such as the search for and rescue of lost persons, boats, or airplanes, and for auto races, boat races, athletic events, parades, celebrations and political conventions. But the agency does *not* issue these authorizations for routine seasonal operations such as the installation and repair of air conditioners, the delivery of fuel oil, or the routine harvesting of farm products, where no emergency is involved.

What it all boils down to is this: don't ask for quick licensing action unless you are really *looking down the barrel*, because chances are you're not going to get it. Remember, in the time it takes the FCC to write you a letter to reject your rush-rush

request, about a dozen other applications could be processed.

If you do have a valid reason for an *expedite* of a pending application or for a special temporary authorization, you can make your request either by notarized letter or telegram. If you use a telegram, you have to follow it up with a notarized letter giving full details. In either case, you must state your reasons for thinking you should have preferred treatment. And be sure to give the Commission all essential details—such as eligibility and citizenship of the applicant, class of station involved, frequencies, number of transmitters, and other information called for on the CB application form.

Timber! Despite what you may have learned from your mother or Joyce Kilmer, the tree in your back yard is not a "natural formation"—in FCC parlance—and you can't hang your CB antenna on it more than 20 feet above ground, particularly when the limbs are bare and the Commission's field troops are about. This practice has apparently been bothering the FCC lately.

The latest word from the Commission on the subject (without regard to the back of your CB license) is that "no distinction can be made between a tree in its original location and one which has been reset as a *pole*



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STEREO

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\$89⁵⁰

Other tape recorders in the remarkable Sony line include the dual track bantam at \$99.50, the Sterecorder 300, a complete portable stereo portable stereo system at only \$399.50, and the 262-SL parallel and sound-on-sound recorder at \$199.50. ■ For literature or nearest dealer, write: Superscope, Inc., Dept. F, Sun Valley, Calif. *

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Chicago 24, Illinois

Export Sales: International Div., Raytheon Mfg. Co., Waltham, Mass. Canada: Gould Sales Co. Montreal, P.Q.

FCC Report

(Continued from page 20)

or mast" when it comes to your CB antenna.

The FCC notes that when it says "natural formation," it means "all permanent features of the natural terrane"—we lost a bet on the spelling of that one—"such as rocks, soil, etc. It does not include trees or any other form of vegetation which may be growing in or on such soil or rocks, nor does it include masonry or other additions such as dams and levees."

Amateur Reciprocity. Republican Senators Barry Goldwater (Arizona) and Andrew F. Schoepel (Kansas) have thrown a bill into the Congressional hopper providing for the reciprocity of amateur radio licensing.

Briefly, the measure would provide that the Commission "may, if it finds that the national security would not be endangered, issue licenses for the operation of an amateur station to certain aliens for any temporary period, not in excess of three years" provided that similar privileges are granted to U.S. citizens in the reciprocating countries.

-30-

COMING NEXT MONTH



At Christmas time this year, parents will be buying educational electronic kits—not toys—for their budding young Edisons and Marconis. Our cover next month shows one of these new kits—G.E.'s analog computer, and an article explains some of the circuits and principles they are meant to teach.

(ON SALE NOVEMBER 28)

● SILENT SOUND

Does sound have any medical value? Can it clean dishes as well as help make better coffee? The answers are "Yes," and you'll learn why in next month's exciting feature story, "Successes of Silent Sound."

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Central grads HOWARD EDMONDS & FLOYD CONKRIGHT are joint owners of ECCO FACTORY TV SERVICE CO., K. C., Mo., and RANCH MART TV & STEREO, Leawood, Kansas, have three service trucks, seven full-time employees.

Grad FRANK LEHNKNECHT works in missile field for Convair Astronautics, San Diego, Calif., and as Transmitter Engineer for Station KDEO as a sideline.



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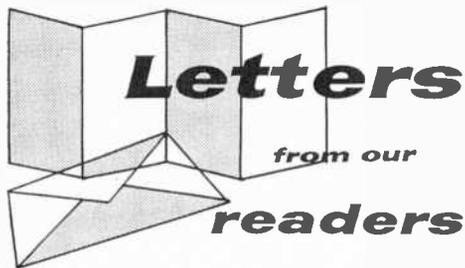
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Accredited Member
National Home Study Council

Central Technical Institute



Letters

from our
readers

Codeless Technician Class?

■ We have just finished reading Mr. Sokol's suggestion in your August "Letters" column that the Technician code requirement be dropped. May we point out that perhaps 6QO48 and his friends without "auditory coordination" in reality lack the cerebral coordination to pass the simple Technician's code test. Without this test, any knucklehead who memorizes the small amount of required theory could operate on the already more than filled ham bands.

JIM KIRTLEY, K1SLK
DAVE EVANS, K1SLL
Ridgefield, Conn.

■ After reading Steve Sokol's letter, I am inclined to agree with him. Why not drop the code requirement for the people who, for some reason, can't learn code, while retaining the written test. The holder of this special license would be allowed to use phone—but not code. With this inducement,

many "rag-chewers" might be attracted away from the Citizens Band, leaving it free for those who would put it to the proper use.

KENNETH DONNELL, JR.
Kirkwood, Mo.

In a recent morning's mail, we received 12 letters disagreeing with Mr. Sokol's proposal that the code requirement for the Technician Class license be dropped—the message from readers Kirtley and Evans was one of the milder ones. Mr. Donnell, so far, stands alone in his support of the idea.

Help Wanted

■ I am a cardiac patient. Since I can only do light work, I must re-educate myself in a new field. I want to learn to repair appliances such as toasters, irons, mixers, electric roasters, stoves, etc., but I have no knowledge of the subject and must start from the very bottom. If you folks can recommend any suitable textbooks or other material, I would appreciate it.

RALPH BASILE
98 Old Bridge St.
West Springfield, Mass.

For a starter, you might contact the National Radio Institute, Appliance Division, Dept. D4J1, Washington 16, D.C.; they'll send you a free descriptive booklet on their correspondence course and a sample lesson. We hope, also, that some of our appliance-repairman readers will be able to help you out.

(Continued on page 28)



*How to buy
your first (or your last)
speaker system*

compare UNIVERSITY (in every price category) against all other brands.

UNIVERSITY.
A Division of Ling-Temco-Vought, Inc.

Explore the totally different TMS-2—a remarkable all-in-one stereo speaker system. One cabinet! Only 30 inches wide! Thus, if you don't have room for two separate speaker systems, or if your decor doesn't permit same—the TMS-2 single cabinet stereo speaker system is the ideal problem solver.

How does the TMS-2 do it? Operating on the principle of the concert hall, where up to 90% of the sound you hear is reflected from the walls, the TMS-2 projects the sound to the sides . . . one side becomes Channel A, the other side, Channel B. Speaker spacing becomes unimportant . . . fully balanced stereo is had everywhere in the room . . . all with superb separation and uncanny depth. As a matter of fact, the TMS-2 is the only stereo speaker system which will work in a corner!

What's the secret? Well . . . there are five speakers operating as two complete 3-way systems. By utilizing the dual voice coil of the C12HC woofer, only one bass cabinet and woofer are required to handle the entire low frequency range of both stereo channels. The mid-range and highest frequencies of each channel are covered by an 8" cone speaker and a wide-angle horn-loaded tweeter . . . each with its own level control.

In two styles—Contemporary and Early American—the TMS-2 looks more like a fine piece of furniture than a speaker cabinet.

For complete information write:
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And only Electro-Voice has these facilities, plus the production "know-how" . . . all under one roof! Every vital process from die-making to die-casting, from wire-flattening through automatic voice-coil winding, precision grinding, plating and polishing, to a completely automated belt assembly is under E-V's continuous personal control.

Introducing the new Wolverine LT12 — the latest addition to the famous Wolverine budget-priced line of quality speakers!

Imagine! A speaker that sounds better than speakers costing twice as much. With deep, rich bass and clean, clear treble from two cones, coupled by the famous E-V Radax principle. Plus smooth, peak-free highs that spread evenly throughout the room — without beaming — for outstanding stereo any-

where in the listening area . . . possible only with an E-V diffraction-horn compression-type tweeter.

The impressive list of LT12 "high-priced" features also includes a new ceramic magnet, plus edgewise-wound voice coil for highest efficiency . . . rugged die-cast frame to ensure perfect alignment of all moving parts . . . "deep-dish" bass cone design for higher power handling . . . long-throw suspension for minimum distortion . . . 3-position tonal balance switch that matches the LT12 to your acoustics . . . and a rich, jewel-like precision finish to all vital parts.

But, best of all, the LT12 is versatile: mounts in most high fidelity speaker enclosures, in the wall, ceiling, or even in a closet. And its wide dispersion makes placement far less critical than ordinary speakers — even for stereo!

See and hear the exciting new Wolverine LT12 at your nearby Electro-Voice/Wolverine high fidelity headquarters . . . today!

SPECIFICATIONS: Frequency response, 40 to 18,000 cps. Power handling capacity, 20 watts, program. Built-in crossover and 3-position balance switch. Impedance, 8 ohms. Size, 12 $\frac{1}{2}$ inches diameter, 6 inches deep. Shipping weight 15 pounds.

NOW, A COMPLETE LINE OF BUDGET-PRICED WOLVERINE SPEAKERS

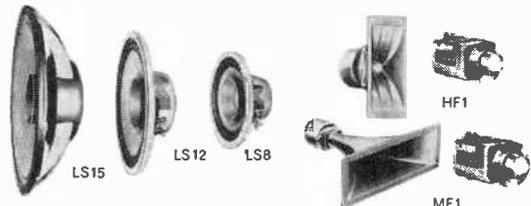
Model LS15 15" coax speaker, \$24.50

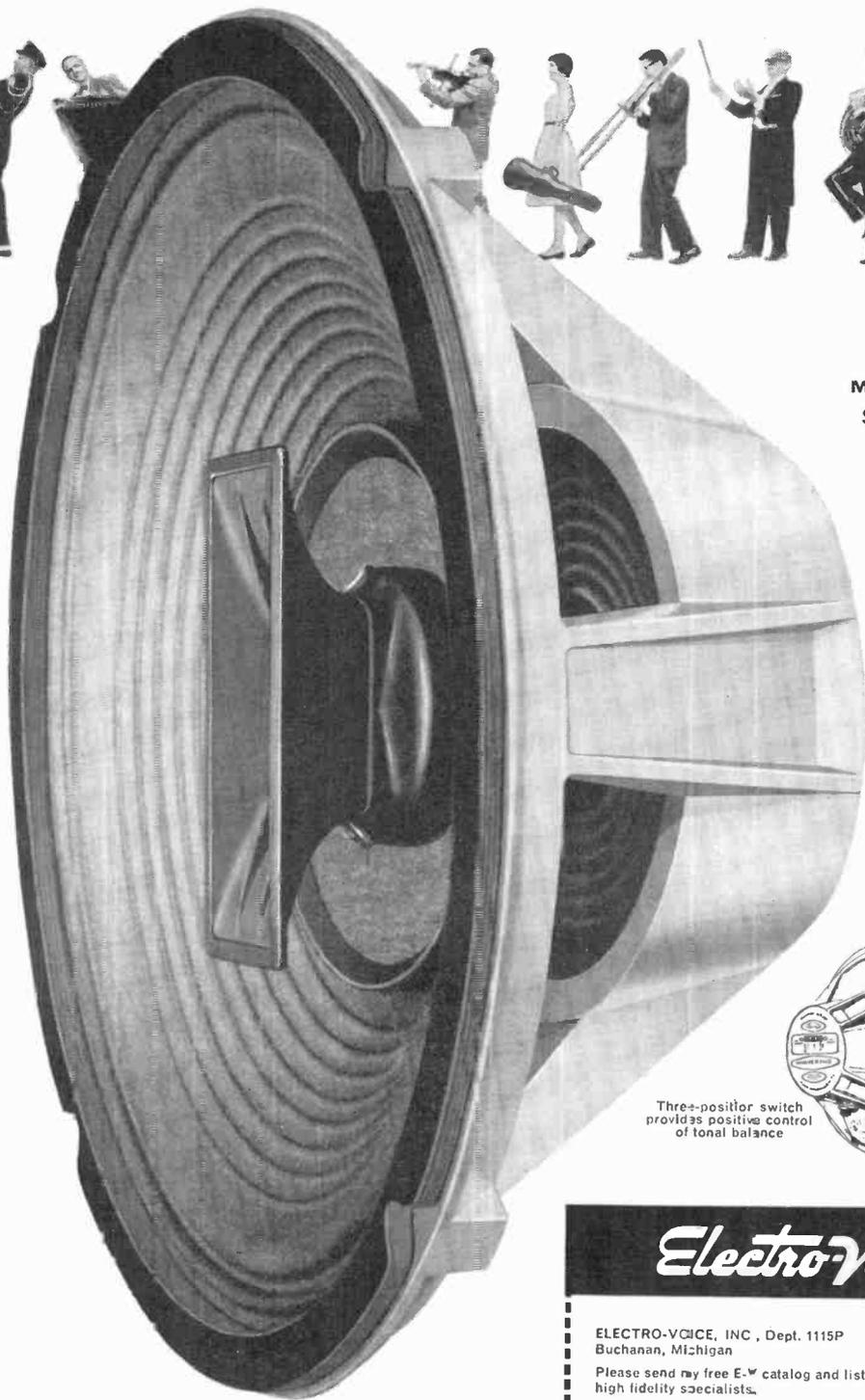
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Letters

(Continued from page 24)

Metronome Calls Lobsters

■ I assembled Norman Latner's fine metronome circuit from the instructions in the June 1961 issue, and have been using it almost every day when practicing my guitar lessons. But recently I discovered another, quite different, use for the metronome—which might be of interest to some of your readers.

Taking a cue from the "Fish Caller" article in the same issue, I installed the metronome in a large (restaurant-size) mayonnaise jar—adding enough lead ballast so that it would barely float—



and took it along on a SCUBA diving trip. As I suspected, the metronome showed promise as a device for calling lobsters out of their holes.

Unfortunately, my experiments are temporarily

at a standstill because, at a depth of about 25 feet, the water pressure crushed the jar. This catastrophe had a somewhat dampening effect on the circuit oscillations.

JAMES R. WETHERBY
Long Beach 3, Calif.

This is a startling use, we must admit, for the transistorized metronome. Your idea may replace the lobster pot, Jim, but don't you think you'll have trouble practicing your guitar under water?

Solenoid for Coin Toss

■ Your magnetic coin tosser ("Heads . . . or Tails?" June, 1961) interested me very much, so I decided to build one for the family. Instead of winding my own solenoid, though, I managed to locate an excellent commercial substitute. It's a Guardian intermittent-duty model (Type 1A) and sells for only \$2.35, including plunger.

MICHAEL KAHANE
Brooklyn, N.Y.

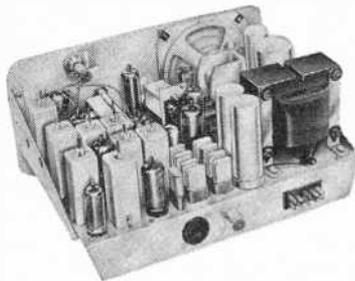
It sounds as though you took the easy way out, Michael. Like to tell us how far your model tosses coins?

Radiation Detector Improvement

■ I'd like to suggest a minor improvement for my "Radiation Detector" (January 1961 issue of POPULAR ELECTRONICS). Placing a 1-megohm, 1/2-watt resistor in series with V1's positive lead will prevent the possibility of excessive pulse cur-

POLY-COMM "N"

WITH THE NUVISTOR RF STAGE

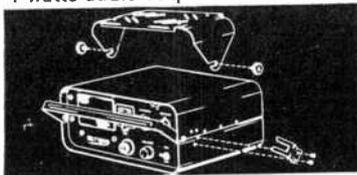


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For matchless **CB RANGE**

Look inside the Poly-Comm "N". See why you get matchless performance! Nuvistor front end; Sensitivity—better than .1 microvolt for 6 db S/N, readable to .04 uv; dual conversion; 11 tubes and 7 diodes give you eighteen tube performance, unlike the usual 7 or 8 tubes found in other transceivers at the same price; sixteen tuned circuits for 60 db adjacent channel rejection; improved Noise Limiter; New steel encased ceramic mike and New audio system for sparkling modulation; better than 3 watts power output and 4 watts audio output.

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plink, plank, plink

Who can't play the piano? It's easy! Just pounding on the keyboard sounds like celestial music when you're small.

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Letters

(Continued from page 28)

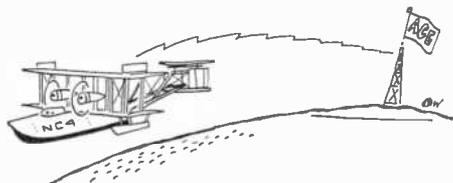
rents at high count rates. The addition of this resistor makes no noticeable change in the sensitivity of the instrument.

J. E. PUGH, JR.
Menominee, Mich.

Pioneer Radio Broadcaster

■ One of the main contenders for the honor of having made the first public radio broadcasts on a regular daily schedule is Station KDKA at Pittsburgh, Pa. This station began its operation by broadcasting the Harding election returns in November, 1920. I believe, however, that I have a prior claim.

In late 1918, I founded the Precision Engineering Association in Cincinnati, Ohio. We later in-



corporated as the Precision Equipment Company and began to manufacture and sell radio receivers and transmitters. Our trade name was "Ace," and we were licensed under the Armstrong regenerative patents.

With a c.w. transmitter which I built, the only one in the midwest at the time, I communicated with the NC-4 on her famous trip around the world. Copies of messages sent by Commander Read and another officer (I believe his name was Cirowich) are still in my possession.

It wasn't much of a step to adapt the c.w. rig to transmit voice and music, and this was soon done. In September, 1919, I got the call letters 8XB, erected an umbrella antenna on the roof, and went on the air.

In 1926 the Cincinnati Post appointed a Mr. Cooper and a Mr. Temple to check my claims against those of KDKA and some other stations. Their published findings gave the Precision station a lead of many months.

If this letter should be seen by Mr. Breck, who was my valuable assistant, I wish he would write to me. I'd also like to hear from any other old-timers who may still be around.

THOMAS E. NEW
651 Copeland Court
Santa Monica, Calif.

We can't resolve your disagreement with KDKA, Mr. New, but thanks for giving us such an interesting picture of your early radio activities. Our edition of the Encyclopaedia Britannica, incidentally, merely states that KDKA was "one of the earliest and most successful" commercial broadcasters.

Space-Saver Satisfactory

■ I'm in the process of putting together a component hi-fi system and, since my budget is limited, I

decided to try the "Space-Saver Speaker System" (July 1961 issue). A few evenings ago I hooked the system to my amplifier and was gratified by what I heard. Although some of the materials cost a little more than I anticipated, I'm quite happy with the outcome.

DICK SEDDON
Chariton, Iowa

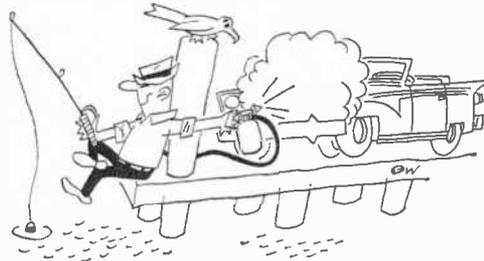
Experienced Correspondent Wanted

■ I have just finished a course in electronics and plan to open a radio and TV service shop. As the experience of someone established in this business would be quite helpful to me, I'd like to correspond with an American serviceman. Advice on equipment, materials, and other problems would be very much appreciated.

INDUS MEMBER
Apdo. Postal 21
Tlalnepantla, Mex.
Mexico

Convertible Confusion

■ Carl and Jerry were pretty quick to find the cause of the "floating fish" in the August issue of P.E., but they failed to explain the real mystery,



namely, how did J. P. Sellers' "brilliant red convertible" (p. 103) change into a "yellow convertible" (p. 108) overnight?

BOB DUPWE
Russellville, Ark.

We can't explain it either. Maybe Mr. Sellers (who is obviously rich enough to throw around his dough) has a stable of cars. Or, on the other hand, he may occupy himself by painting cars when he's not busy fishing.

—30—

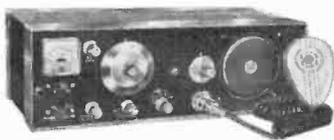
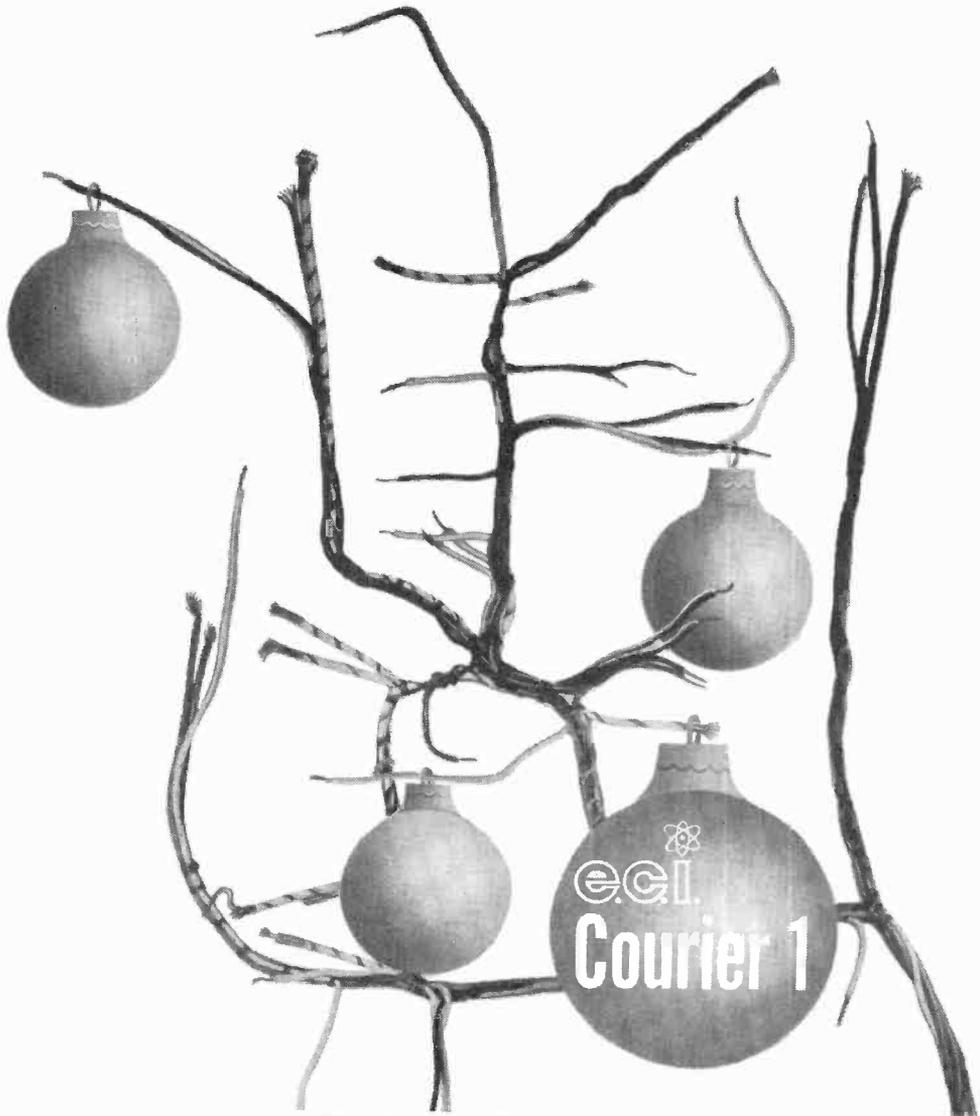
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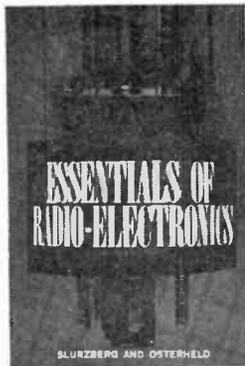
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ESSENTIALS OF RADIO-ELECTRONICS, Second Edition by Morris Slurberg and William Osterheld

In a careful revision of the original edition, the authors use a minimum of mathematics to present an overall coverage of the principles of vacuum tube and transistor operation. Basic circuits are shown and their application to audio systems and radio receivers is discussed. Three chapters are devoted to transistors, and another one covers the principles and operation of FM receivers. An entirely new

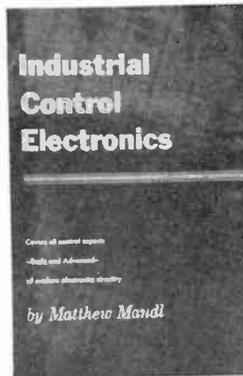


chapter is devoted to equipment and procedures used to check receiver circuits.

Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y. 716 pages. Hard cover. \$10.00.

INDUSTRIAL CONTROL ELECTRONICS by Matthew Mandl

This volume covers all of the fundamental principles and practices of modern electronics control circuitry. Following a summary and review of control signals solid-state devices amplifiers and oscillators, the author discusses thoroughly the more advanced materials used in industrial electronics, including reactors, generators, power supplies, transducers, motors, servo-mechanisms, and magnetic amplifiers;



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All requests for literature and information should be forwarded to Browning Laboratories, 101 Union Avenue, Laconia, N.H. — *Advt.*



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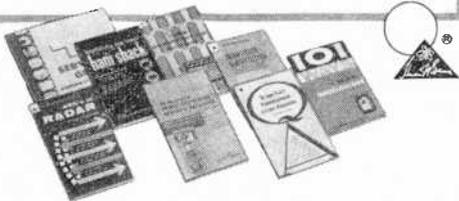
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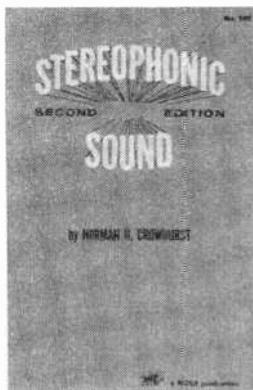
commercial counting and indicating equipment is also analyzed. The mathematical treatment is kept to a minimum and review questions are provided at the end of each chapter.

Published by Prentice-Hall, Inc., Englewood Cliffs, N. J. 344 pages. Hard cover. \$10.65.



STEREOPHONIC SOUND, Second Edition by Norman H. Crowhurst

Stereophonic Sound was originally written in the pioneering days of stereo, but this



new edition contains the latest advances in the field. Comprehensive information has been included on the 45/45 disc (the now-accepted standard), and stereo tape and playback units are also thoroughly covered. An entirely new chapter helps the reader evaluate conflicting claims of component manufacturers when selecting a stereo system, and discusses the

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Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York, N. Y. Soft cover. 144 pages. \$2.90.



1961 REGISTRY OF BUSINESS AND MISCELLANEOUS RADIO SYSTEMS edited by Ethel V. Sleeper

Compiled from the official license files at Washington, D.C., this revised edition contains data on radio transmitters operated by business, manufacturing, telephone maintenance, common carrier, and radio paging organizations. Part I lists the licensees by company name and gives addresses, call letters, number of mobile and fixed transmitters, operating frequencies, and make of equipment used. Part II, a listing by fre-

(Continued on page 38)

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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

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(Continued from page 34)

quencies, gives the locations of fixed transmitters, headquarters of the mobile units, class of service, and call letters.

Published by *Communication Engineering Book Co., Radio Hill, Monterey, Mass.* 184 pages. Soft cover. \$5.00.



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A collection of factory-prepared data for all popular 1962 TV sets, this manual is designed to simplify servicing and adjustment. Double-page schematics, alignment data, and printed-board views are included, as well as recommended changes, waveforms, and voltage charts.

Published by *Supreme Publications, 1760 Balsam Rd., Highland Park, Ill.* 192 pages. Soft cover. \$3.00.

New Catalogs Available

You can keep informed of the latest equipment, parts, and prices with free 1962 catalogs now available from Lafayette Electronics, Allied Radio, and Radio Shack. For 340-page Catalog 620, write Lafayette Radio Electronics Corp., 165-08 Liberty Ave., Jamaica 33, N.Y. The Allied 444-page Catalog 210 is obtained from Allied Radio, Dept. 201-K1, 100 N. Western Ave., Chicago 80, Ill. "The Shack" will send along a copy of its 336-page "consumer" catalog if you drop a line to Radio Shack, 730 Commonwealth Ave., Boston 17, Mass.

Kit builders will want to have the latest Heathkit and EICO catalogs. Heathkit's comprehensive 100-page catalog lists over 250 different units—40 of them new ones; it's available for the asking from the Heath Co., Benton Harbor, Mich. The free 28-page EICO catalog includes over 80 items—write EICO Electronic Instrument Co., Inc., 33-00 Northern Blvd., L.I. City 1, N.Y.

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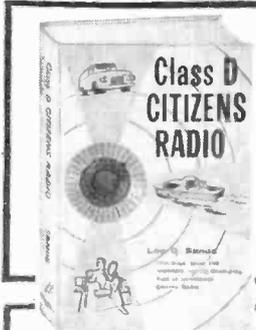
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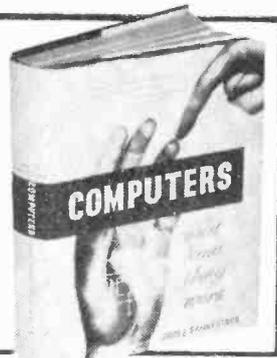
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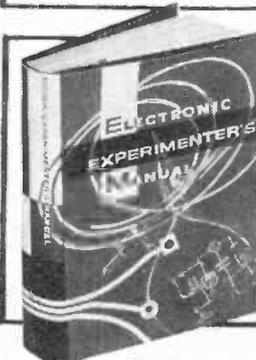
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electroluminescence electroluminescence

At one time only a dream of science, heatless illumination is now a reality. Electroluminescence is being put to work to make paper-thin panels which someday may light your home.

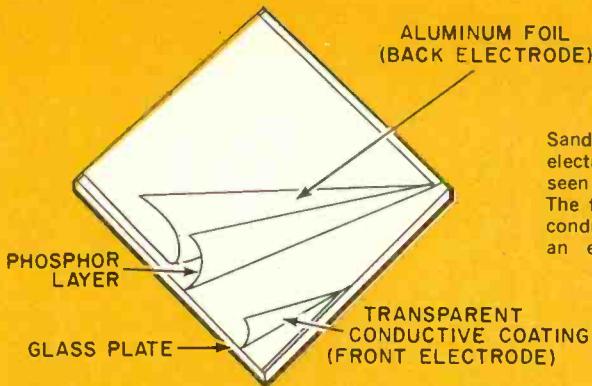
By JAMES E. PUGH, Jr.

IN EARLY TIMES, the glowing tree-trunk seen by a lone traveler in the woods or the strange "burning" of the sea noticed by a wide-eyed sailor seemed to portend evil and disaster. Today we know that both are caused by chemical reactions in the cells of tiny living things, and our superstition has changed to active interest. Scientists have been fascinated by the heatless light produced by certain organisms for decades but, until recently, they couldn't even come close to duplicating it on a practical scale.

The introduction of the fluorescent lamp (1938) was a step in the right direction. Here, less power was wasted in the production of useless heat than with an incandescent bulb, though the loss was still substantial. In the late 1940's, however, the phenomenon of electroluminescence, a direct conversion of electricity to a "cold" light much like that found in nature, moved out of the laboratory. Today you can buy an electroluminescent lamp for a few cents in any hardware store.

But just what is electroluminescence? Well, Webster defines *luminescence* as "any emission of light not ascribable directly to incandescence, and therefore occurring at low temperatures." Generally speaking, luminescence is caused by excitation of the electrons in a chemical compound called a "phosphor." In the case of living things which luminesce, the excitation is brought about chemically and the phenomenon is usually referred to as chemiluminescence. Therefore, electroluminescence, as you might guess, is luminescence produced by a phosphor which has been excited electrically.

Electrical "Sandwich." Though electroluminescent lamps are not yet efficient enough to provide general lighting (being most commonly used as night-lights), they have some unique physical and electrical char-



Sandwich-like construction of an electroluminescent lamp can be seen in this simplified drawing. The front plate has a transparent conductive coating which acts as an electrode, yet passes light.

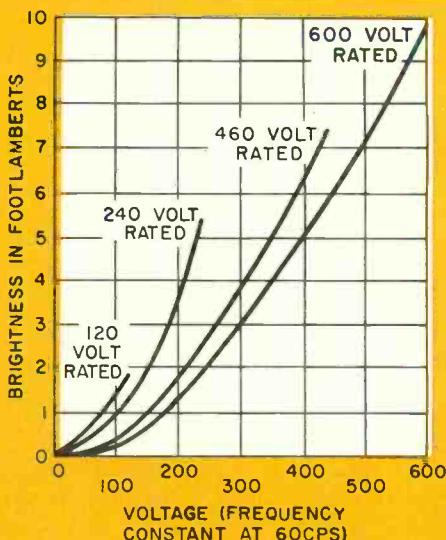
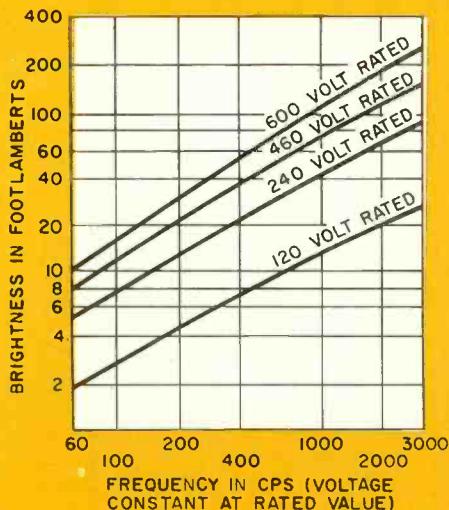
acteristics which suggest many uses. The lamps are made by sandwiching a layer of phosphor (often zinc sulfide) between two plates of electrically conducting material. The front plate usually consists of glass having a special transparent coating which allows it to act as an electrode, and the complete unit is not much thicker than that plate.

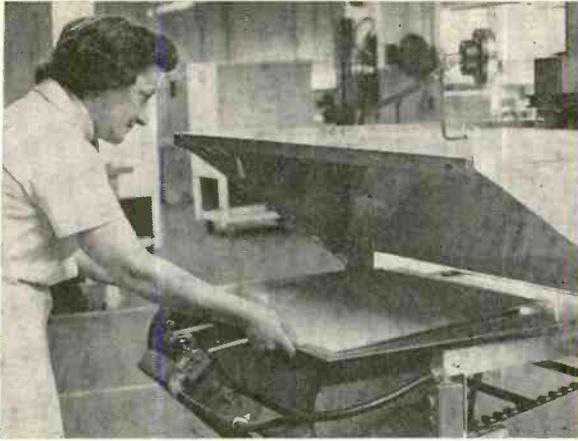
When an alternating current is connected across the two plates, the electrons in the phosphor are excited to a higher energy level—causing it to emit a soft, glareless light with almost no accompanying heat. The color of the light depends on the selection of the phosphor

and the impurities which are deliberately introduced into it. Green, blue, orange, yellow, gold, red, and white phosphors are available, but at present green yields the most light.

Contrast the way in which light is produced by an electroluminescent lamp with the operation of standard fluorescent or incandescent units. Though a phosphor is also used in the fluorescent lamp, it is not excited directly by an electric current—but rather by ultra-violet rays. These rays are produced (along with wasted radiations at other frequencies) by an electrical discharge through mercury vapor gas. In the case

Graphs show brightness versus frequency (left) and voltage (right) for lamps of different ratings.



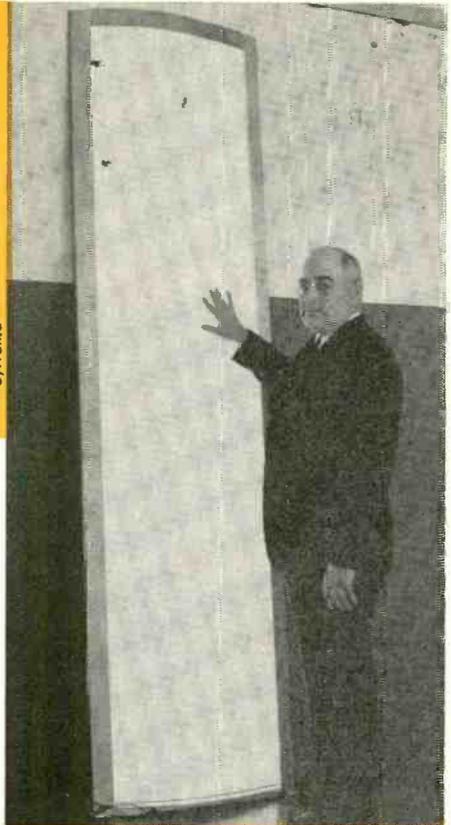


Westinghouse

The manufacturing equipment, in theory, imposes the only limitation on the size of the lamps. Here, a phosphor layer is being baked in an infrared oven.

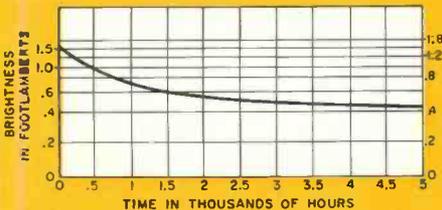
of the incandescent lamp, of course, the light is only a byproduct of the heat generated in a fine wire by the passage of an electric current.

Advantages and Drawbacks. The new light source is usually produced as a flat sheet, but it can be cut into almost any conceivable shape. And, since no vacuum is required for its operation, the only limits to its physical size are those imposed by the manufacturer's equipment. One unit recently made by Sylvania measures eight by two feet—a whole wall could be made to glow with a soft, pleas-



Sylvania

What may be the world's largest electro-luminescent lamp measures eight by two feet. It has a brilliance of five foot-lamberts, an estimated life of five years.



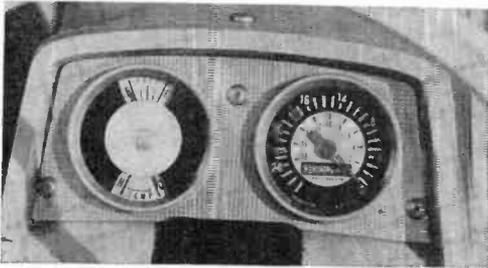
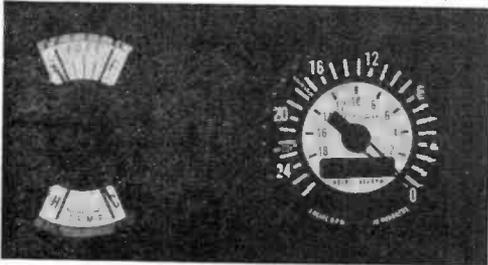
Freedom from "burn out" is one feature of the new light source. Light output simply diminishes with time as illustrated in this graph of a typical lamp operating at 120 volts, 60 cycles. One manufacturer's conservative estimate of the maximum usable life of his product under these operating conditions is 5000 hours. Another maker claims up to 20,000 hours of useful operation.

TYPICAL CHARACTERISTICS OF ELECTROLUMINESCENT LAMPS

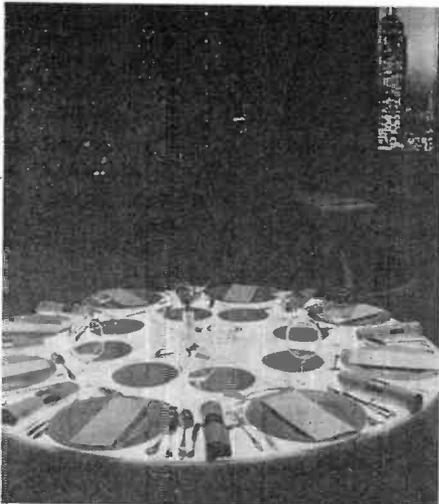
Operating Voltage	Available in standard voltages from 120 to 600 volts
Operating Frequency	Most useful range: 25-1000 cycles
Resistance (of a square foot)	24,000-55,000 ohms, depending on voltage rating
Capacitance	0.35-0.109 uf./sq. ft., depending on voltage rating
Operating Current (@ 120 v., 60 cps)	16-36 ma./sq. ft.
Light Output (@ 120 v., 60 cps)	0.5-1.9 footlamberts
Life Expectancy (@ 120 v., 60 cps)	5000-20,000 hours



Sylvania photos



Electroluminescent lamps are well suited for use as indicators of all kinds: above is a glowing street sign, plus night-and-day photos of a tractor dashboard incorporating the new light source. Interior decorators have also been finding applications for electroluminescent lighting—table top in photo below emits a soft “candlelight” glow flattering to diners.



Westinghouse

ant light by installing a number of these panels side by side.

The electroluminescent lamp's main drawback is its present inability to produce enough light for high-intensity applications. The light output of a given phosphor, however, can be increased by raising its supply voltage and/or frequency. Though 120-volt, 60-cycle operation is common, special oscillators have been used to provide higher frequencies (up to 20,000 cycles), and lamps rated at voltages up to 600 are readily available. An interesting idiosyncrasy of these lamps is that, with some phosphors, a color shift occurs as the frequency is raised. In the case of one green phosphor, the color changes to blue at frequencies over 400 cycles.

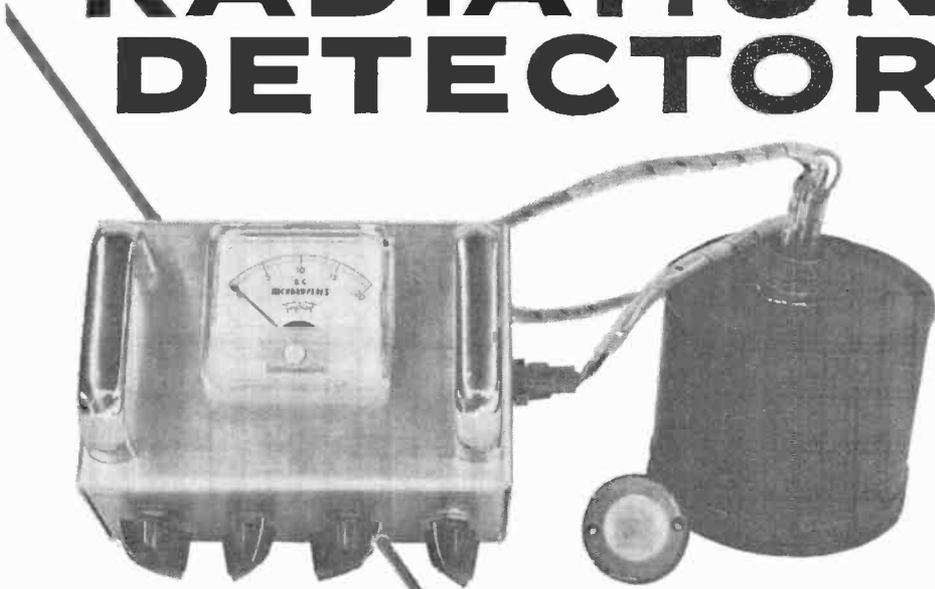
It will be a while before you can light your house with glowing ceiling or wall panels but, in the meantime, electroluminescent lighting will find plenty of applications. In addition to their other advantages, these “miracle” lights have a usable life expectancy of up to 20,000 hours. During this time a burn-out never occurs—the light intensity simply decreases slowly until it reaches a level so low that the unit must be replaced. Then, too, power consumption is quite low. A Westinghouse “Rayescent” lamp, for instance, draws only 0.6 watt per square foot when operating at 120 volts, 60 cycles.

Present and Future. Long life, freedom from “catastrophic” burn-out, and glareless light make these lamps particularly well suited for use as indicators of all kinds. Among the applications in this category which have been suggested or already developed are lighting for aircraft, auto, and boat instrument panels, highway signs, and “read-out” numbers.

Interior decorators, too, are excited by the possibilities of this flexible light source. Glowing walls and ceilings (primarily for decorative effect rather than illumination) are already a reality, and electroluminescent panels have been incorporated into many types of furniture. Perhaps in the not-too-distant future this revolutionary lighting material will be improved to the point where it can be used for general lighting as well as decoration—and you may have to look in an antique store to find one of today's “old-fashioned” light bulbs.

—30—

Build a RADIATION DETECTOR



By JACK MANDEVILLE

CONSTRUCTION of an ionization-chamber type radiation detector is usually limited to a "laboratory" of sorts, since this is the only place where the special tools and machinery normally needed to fabricate and assemble such a detector will be found. But building the ionization chamber described here requires only hand tools and readily available, inexpensive materials.

This radiation detector is actually a rate meter which indicates radiation in terms of time (i.e., 10 milliroentgens per hour). The instrument gives a relative reading based upon the rate of radiation before and during exposure to the radiation source. With proper facilities, it could be calibrated to indicate the actual amount of radiation present.

Except for a tube and a meter, the necessary parts are frequently encountered in the spare parts box of any electronics experimenter. And even if you start out by purchasing all neces-

*Sensitive ionization chamber
detects ions produced by
nuclear radiation*

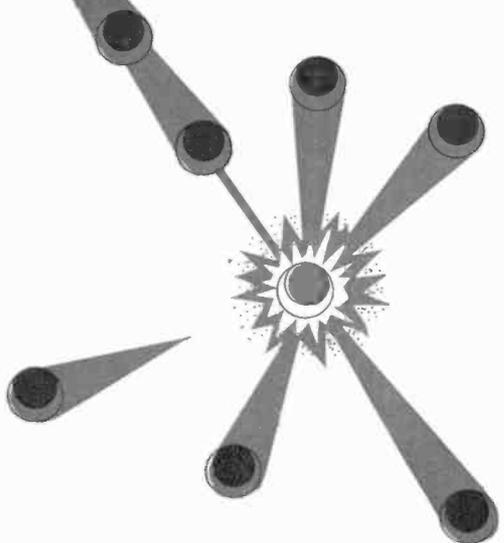


Fig. 1. Ionization chamber is made up of photometer tube (V1) and three-pin connector housed in empty shortening can.

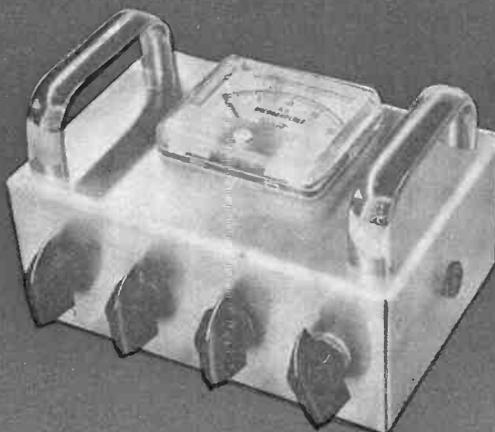
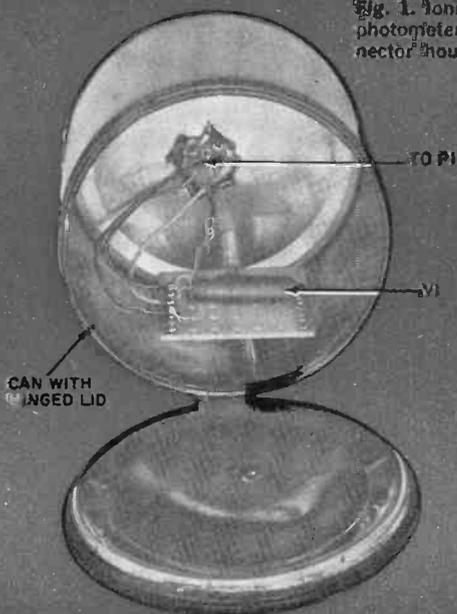


Fig. 2. Meter chassis contains simple d.c. amplifier and controls. Three-conductor cable (not shown) feeds output from ionization chamber into amplifier.

sary materials, you'll probably find that the total cost of the instrument won't exceed \$30.00 or so.

Construction. The ionization chamber consists of a medium-sized, thin-walled can with a lid. (A half-pound shortening can with a hinged lid is ideal.) Mounted in the chamber are a three-pin connector and a device (terminal board or clamp) to hold subminiature electrometer tube V1 (see Fig. 1).

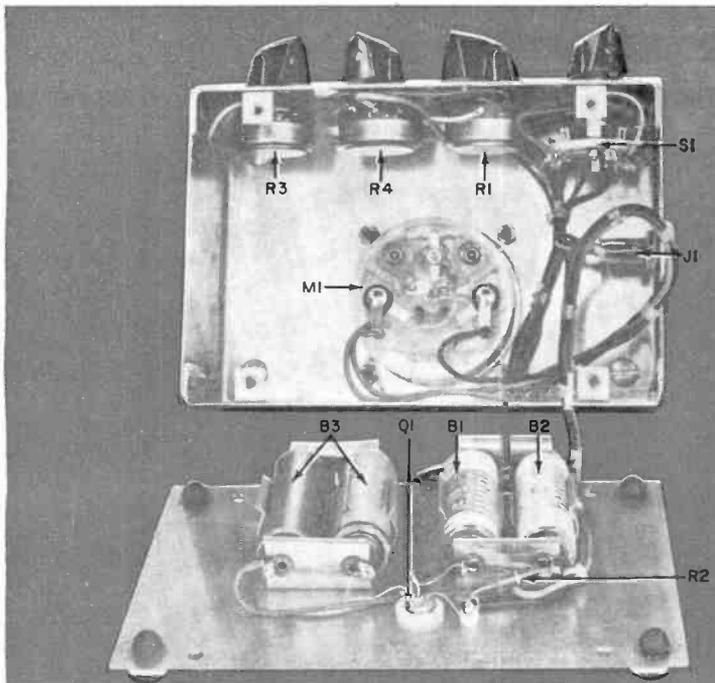
The meter chassis (shown in Figs. 2 and 3) is connected to the ionization chamber by a plug and cable combination and contains a 0-50 μ a. meter, three potentiometers, a switch, batteries, and a transistor. Actually, meter M1 can be almost any basic movement up to 0-250 μ a.—the more sensitive the meter, the more sensitive the instrument. (As a matter of fact, the author used a 20- μ a. Triplett unit he had on hand rather than the 50- μ a. meter specified.)

Take care during construction to avoid contaminating the electrometer tube by breathing on or holding its base. If the tube is thus contaminated (zero-signal plate current will exceed 150 μ a. in such cases), you can decontaminate it by washing it with alcohol and cleaning it with a brush.

Adjustment Procedure. To set up the unit for radiation measurements, perform the following steps in the order indicated here.

- (1) Turn potentiometer R1 to its full counterclockwise position.
- (2) Turn potentiometer R3 to its full clockwise position.
- (3) Turn potentiometer R4 to its full counterclockwise position.
- (4) Switch S1 to "on."
- (5) Allow about a minute for conditions to stabilize.
- (6) If the meter reading is below mid-range, rotate R4 clockwise until the meter indicates mid-range. If the meter reading is above mid-range, rotate R3 counterclockwise until the meter indicates mid-range.
- (7) Adjust R3 for zero (background radiation without source).
- (8) Place a radioactive source next to the chamber.
- (9) Adjust R1 and R4 for a full-scale meter reading.
- (10) Repeat steps 7, 8, and 9 until readings are constant.

Properly adjusted, this instrument is capable of detecting radiation from such weak sources as the dials of luminous wrist watches. But remember that the



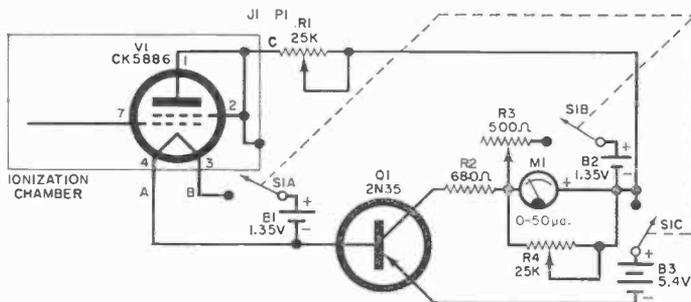
PARTS LIST

- B1, B2—1.35-volt mercury cell (Mallory RK 12R or equivalent)
- B3—5.4-volt mercury cell (Mallory TR-134R or equivalent)
- M1—0-50 μ a. d.c. meter (Beede Model 14 or equivalent)
- Q1—2N35 transistor
- R1, R4—25,000-ohm potentiometer, linear taper (Ohmite CU2531 or equivalent)
- R2—680-ohm, 1/2-watt resistor
- R3—500-ohm potentiometer, linear taper (Ohmite CU5011 or equivalent)
- S1—3-position, 2-pole rotary switch (Centra-ab 1405 or equivalent)
- V1—CK5886 tube
- 1—2" x 7" x 5" chassis (Bud AC-402 or equivalent)
- 1—5" x 7" bottom plate for chassis (Bud BPA-158 or equivalent)
- 1—Cup with hinged lid—see text
- Misc.—Hardware, wire, solder, connectors, handles, rubber feet, knobs, etc.

Photos by Arthur Suto

Fig. 3. Controls and meter M1 are mounted on chassis (top), with batteries and transistor attached to bottom plate. Handles (see Fig. 2) and rubber feet (above) are both optional.

Fig. 4. Circuits for ionization chamber (box at left in diagram) and d.c. amplifier; J1 and P1 at top refer to connectors on cable between two units. Cable consists of three wires to connect points A, B, and C.



intensity of radiation varies inversely with the square of the distance, and large fluctuations in rate cannot be expected from weak sources at great distances.

About the Circuit. Radiation particles from the source to be detected will enter the chamber and ionize the atoms and/or molecules in the air. The resulting ions will have either a positive or a negative charge and will therefore be either repelled or attracted by the collector grid and the shell of the ion chamber.

The flow of these ions constitutes a flow of current in the grid cathode-shell circuit. This flow of grid current in the

electrometer tube results in a corresponding increase or decrease in plate current.

The actual circuitry is shown in Fig. 4. The electrometer plate current (approximately 100 μ a.) is used for base bias and signal current for the transistor d.c. amplifier. Connected in series with the collector of transistor Q1, the meter effectively monitors the amplified d.c. signal.

Potentiometer R1 controls the basic sensitivity of the ion chamber and the base-emitter circuit of Q1. Resistor R2 is a current limiter for transistor protection, while potentiometers R3 and R4 control calibration of the meter. —30—

CB GOES ON TV



Private eye Roger Smith (center) awaits report via CB from colleague Efrem Zimbalist, Jr. (at left), as "Roscoe" hovers in the background. Zimbalist and Smith are the mainstays on ABC's "77 Sunset Strip."



EVERY Friday evening between the hours of 9 and 10, some 20 million-plus TV viewers watch "77 Sunset Strip." A Warner Bros. production broadcast over the ABC television network, "77 Sunset Strip" is the pioneer hour-long detective/adventure show.

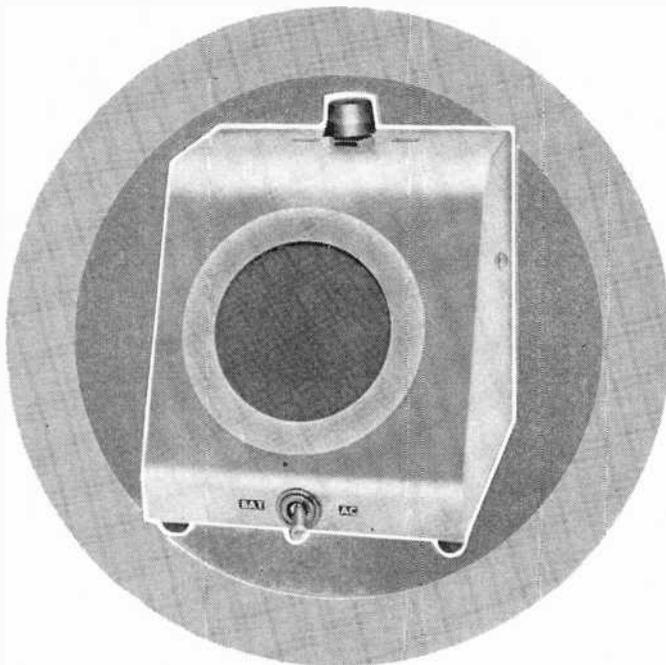
Much credit for the continuing success of this show goes to the two leading men, Efrem Zimbalist, Jr., and Roger Smith. Ideally suited for the parts they portray, Zimbalist and Smith typify the American concept of a "private eye."

In the series of this show now being broadcast, observant POPULAR ELECTRONICS readers will be able to see these two detectives make use of CB equipment—employing the phony call-sign 11J5486. A CB transceiver has been made a part of the office furniture in this TV series, and hand-held transceivers will also appear from time to time.

We at POPULAR ELECTRONICS are proud to report that we assisted in this exposure of CB on network TV. Needless to say, we urge all of our readers to tune in the following three shows where CB equipment plays an important part: "The Bridal Trail Caper," "The Bel Air Hermit" and "The Unremembered." Your local TV program listings will tell you when these shows are on the air.

-30-

FLEA-POWER GLOW LIGHT



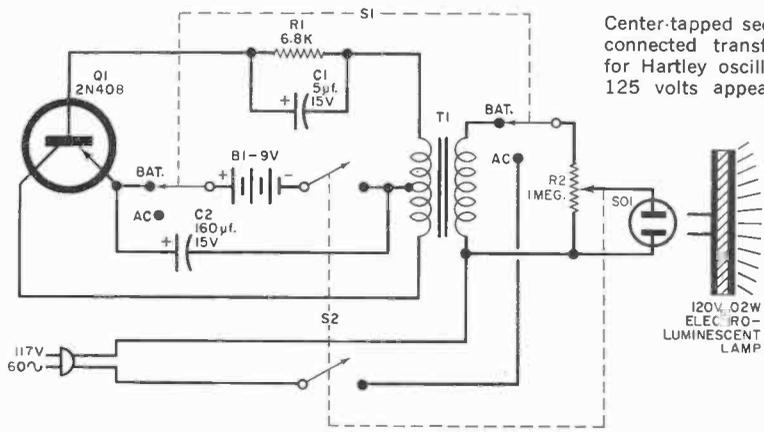
A battery-operated power supply for portable operation of a standard electroluminescent lamp

By JAMES E. PUGH, JR.

THE electroluminescent night-lights now on the market are handy gadgets to have around. Drawing a minimum of current, they'll bathe a room in a soft, pleasant glow—yet can be left burning day and night at a cost of only a few pennies a year. Though designed to work on the a.c. line, the current demand of these units is so small that a battery-powered Hartley oscillator is more than adequate as a power supply.

With the oscillator described here, you can use your night-light on hunting trips; in trains, boats, and cars; or anywhere a soft, low-intensity lamp is needed. A line cord has been included for switching to a.c. when such operation is possible, and a convenient intensity control allows you to vary the brightness.

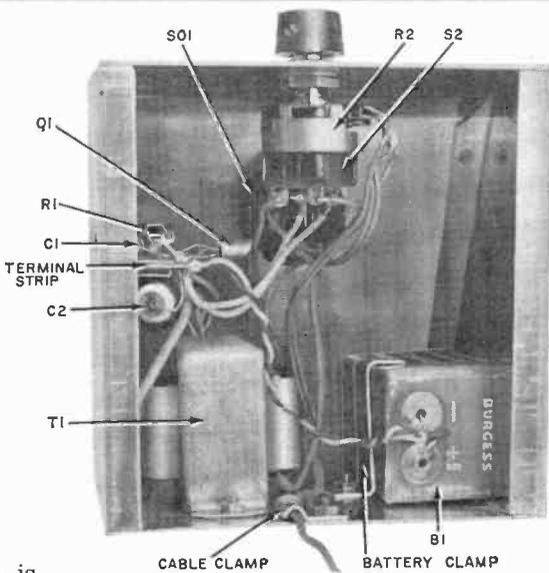
The Circuit. Transistor *Q1* is connected as a Hartley oscillator and powered by battery *B1*. The 6.3-volt secondary of transformer *T1* serves as a tapped oscillator coil. Resistor *R1* and capacitor



Center-tapped secondary of reverse-connected transformer T1 is coil for Hartley oscillator circuit. About 125 volts appear across primary.

PARTS LIST

- B1—9-volt battery (Burgess 2N6 or equivalent)
- C1—5-µf., 15-volt electrolytic capacitor
- C2—160-µf., 15-volt electrolytic capacitor
- Q1—2N408 transistor
- R1—6800-ohm, ½-watt resistor
- R2—1-megohm potentiometer (linear taper)
- S1—D.p.d.t. toggle switch
- S2—D.p.s.t. switch (on R2)
- SO1—Chassis-type a.c. receptacle (Amphenol 61-F or equivalent)
- T1—Filament transformer; primary, 117 volts; secondary, 6.3 volts @ 1.2 amp. CT (Stanco P6134)
- 1—4½" x 4¾" x 4¼" sloping panel utility box (Premier ASPC-1200 or equivalent)
- 1—120-volt, 0.02-watt Sylvania "Pancelcent" night light
- Misc.—Pointer knob for R2, 7-lug terminal strip, rubber feet, battery connector, cable clamp for line cord, hardware, etc.



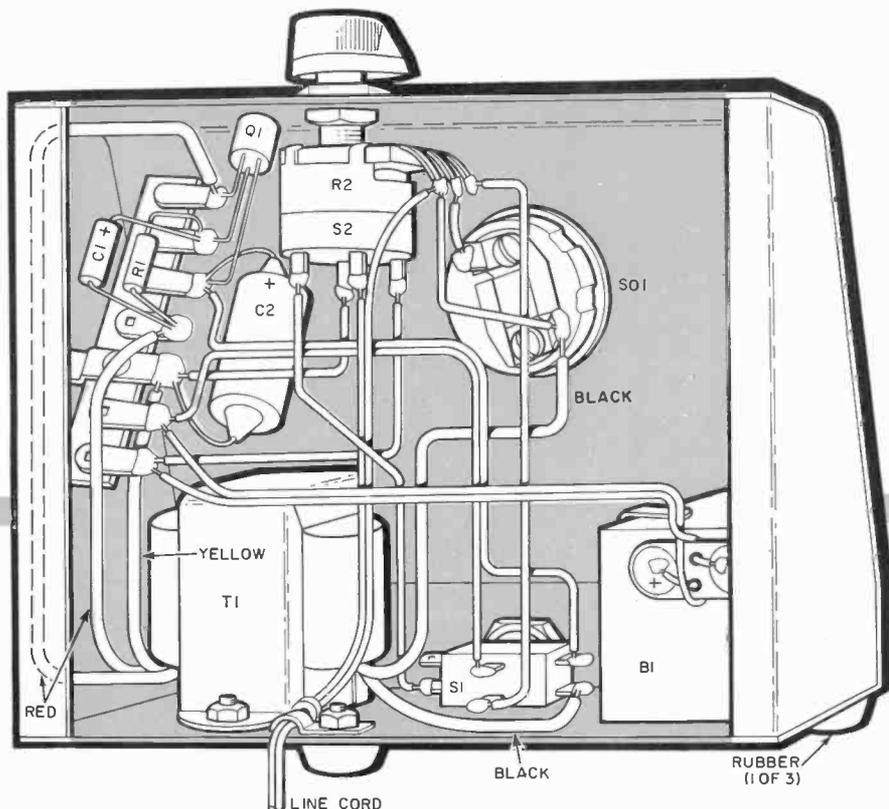
C1 determine the pulse rate, which is about 60 cycles with the values specified. When the oscillator is in operation, its output is stepped up by T1, and approximately 125 volts are available at the primary of this reverse-connected transformer. The primary of T1 is wired to the night-light socket (SO1) through intensity-control potentiometer R2.

In the schematic, switch S1 is shown set for battery operation as described above. When S1 is in the A.C. position, however, battery B1 is disconnected and potentiometer R2 and socket SO1 are switched from T1's primary to the a.c. line. Switch S2, which is ganged to po-

Parts fit neatly in compact utility box. Note that most oscillator components mount on the terminal strip.

tentiometer R2, turns the unit on and off regardless of which type of operation S1 is set for.

Construction. For best appearance and ease of operation, the circuit is housed in a 4½" x 4¾" x 4¼" sloping-panel utility box. To avoid damage to furniture, fasten three small rubber feet to the bottom of the box.



Pictorial diagram clearly shows parts layout and wiring details. Terminal strip at left is tilted forward for a better view of its connections, and color coding of T1's leads is shown.

Using the photograph as a rough guide, drill all the mounting holes. It's most convenient to make the opening for socket *SO1* with a $1\frac{5}{32}$ " punch or hole cutter, but it can be drilled out and filed to size. Now bend a $2\frac{1}{4}$ " x $\frac{1}{2}$ " strip of soft steel as shown to form a battery clamp.

With the above construction details carried out, you can proceed to the mounting and wiring of the components. Begin by mounting transformer *T1* and cutting its leads to the lengths needed. Next, solder all wires to switch *S1*, making sure to allow enough lead length to reach the various other components, and fasten the switch in place.

All of the connections to the terminal strip should now be made—take care to avoid heat damage when soldering in the transistor. Then mount the terminal strip, as well as socket *SO1* and poten-

tiometer *R2*/switch *S2*. Finally, install the line cord and battery and complete the wiring.

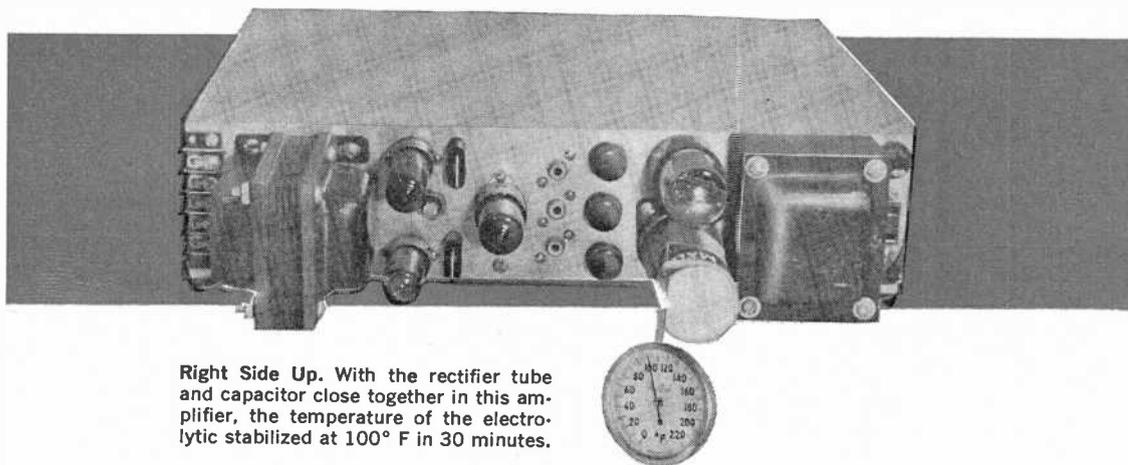
Using the Supply. For battery operation, set *S2* to the *Battery* position; to operate from the a.c. line, set the switch to *A.C.* In either case, *R2/S2* will turn the light on and off and control its intensity. The lamp glows green when operated from the line, but you'll notice that it's blue when the oscillator is being used as the power supply. The color change is caused by a high-frequency component in the oscillator's pulse.

If you'd like to experiment with different oscillator frequencies, you can change the values of *R1* and *C1*. Reduce either or both to increase the frequency, or increase them to decrease the frequency. For greater light output at very low frequencies, the pulse should be broadened by making *C1* much larger. -30-

HI-FI HEAT WAVE

Prolong the life of your equipment by giving it adequate ventilation

By CHARLES H. WELCH



Right Side Up. With the rectifier tube and capacitor close together in this amplifier, the temperature of the electrolytic stabilized at 100° F in 30 minutes.

THE DAMAGING EFFECT of heat is one of the least understood and most neglected problems in operating electronic equipment. Hi-fi amplifiers and tuners have been particular casualties—they are often placed in poorly ventilated enclosures where excessive heat can make the most trouble.

To obtain a clear picture of what heat damage means to hi-fi owners, let's take a typical audio power amplifier tube, the 6AQ5, fit it with a standard tube shield, put the tube in an unventilated cabinet, and apply voltages equal to those found in the average amplifier. Within a few hours, the tube's glass bulb will reach a temperature of about 400°C, or 750°F. In other words, the tube is HOT.

What is the 6AQ5's response to this treatment? You may consider yourself lucky if the tube lasts for 1000-1500

hours. Since it is not uncommon for a 6AQ5 to last about 10,000 hours, excessive heat has lopped off possibly 90% of the useful tube life.

However, this isn't the only thing that has occurred—if the tube happens to be part of a hi-fi amplifier. The 6AQ5, together with other heat-dissipating components in the circuit, will have raised the temperature in the unventilated enclosure to about 125°C. This exceeds the rated operating temperatures for electrolytic capacitors, some resistors, and even a few transformers.

Our amplifier has started a frantic race to see which of its components will fail first. Let's look at what heat does to the various components.

Capacitors. Practically all capacitors used in hi-fi equipment will be temporarily or permanently damaged by ex-

cessive heat. The most sensitive is the electrolytic capacitor. When it is operated near its maximum voltage rating, and the temperature exceeds the manufacturer's rating, the leakage current goes up sharply. This causes additional heating, which again causes the leakage current to increase . . . making for a vicious spiral which ends abruptly in the explosive demise of the electrolytic.

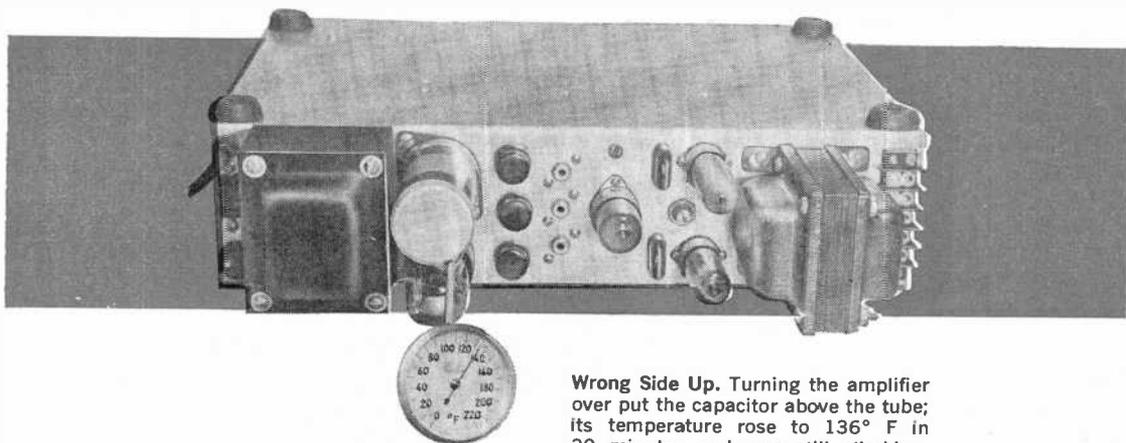
Resistors. Not only can composition resistors be damaged by excessive heat, but in normal operation they may give off some heat of their own which adds to their problems—and those of surrounding components. One manufacturer of

emission, interelectrode leakage, and cathode emission loss.

When you purchase an amplifier, take a close look at how and where the tubes are mounted. They should be in a position where air can circulate freely.

Use of the common J-type tube shield generally raises the temperature of the tube envelope by 50°C. Some designers of hi-fi equipment now feel that too many tubes are often shielded in preamplifiers and amplifiers unnecessarily.

Give your hi-fi a chance to breathe, and you'll find that it will work better and longer, with fewer—if any—break-downs due to excessive heat. —[30]



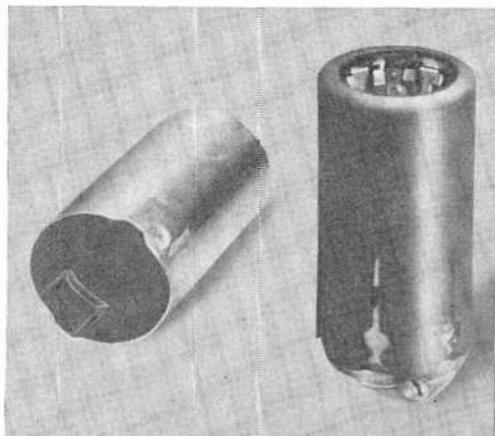
Wrong Side Up. Turning the amplifier over put the capacitor above the tube; its temperature rose to 136° F in 30 minutes and was still climbing.

quality composition-type resistors says that his product can be expected to increase in resistance by about 6% for each 1000 hours of operation at a temperature of 150°C. This means that the voltages and currents applied to the tubes in your hi-fi system can be expected to change, either throwing the system out of balance, or introducing distortion.

Semiconductors. Practically all selenium or silicon rectifiers and diodes are affected by heat. Generally speaking, the maximum forward current of a semiconductor must be lowered as the temperature goes up. In one typical unit, a forward current rating of 750 ma. at 40°C drops to 250 ma. at 125°C.

Tubes. Operating tubes above their rated temperatures often leads to the tubes becoming gassy. Other heat-induced reasons for tube failures are grid

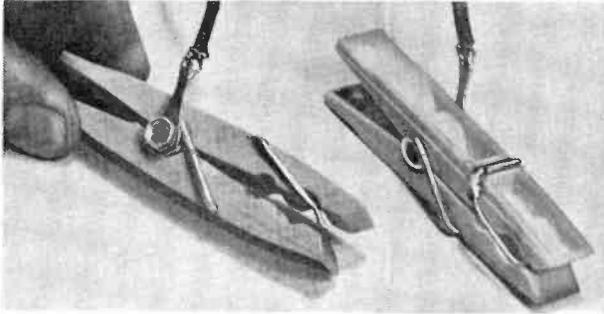
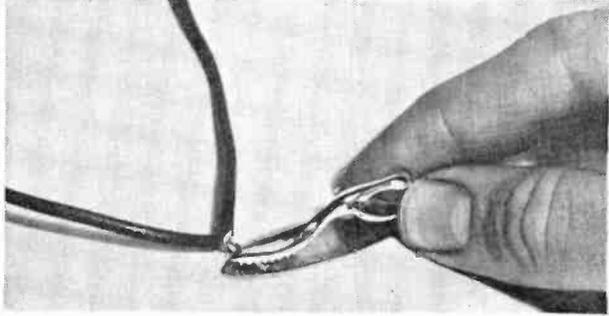
Improved Tube Shield. Five times as expensive as the J-type tube shield (left), the Type B shield from International Electronic Research (right) dissipates heat rapidly. In tests by the author, tubes fitted with this shield were 200° F cooler.



4 WAYS TO GET CLIPPED

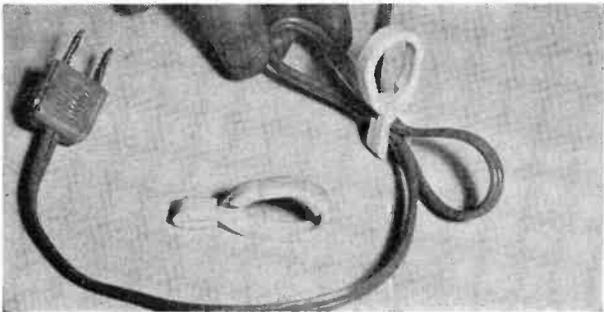
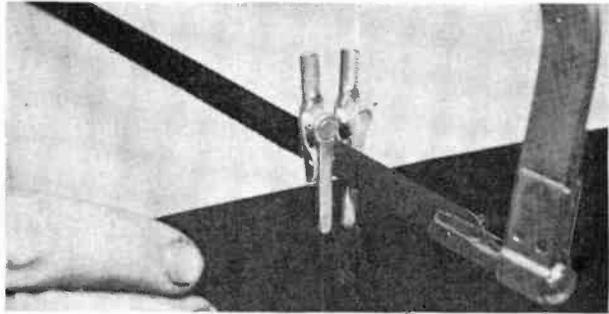
Suggested by **JOHN A. COMSTOCK**

TIE CLASP—TEMPORARY CLIP. Almost every male experimenter has a few old, battered tie clasps in his dresser. They can be put to use as heat sinks in transistor experiments, or as temporary connectors to hold several wires together which don't need to be soldered. A tie clasp will also serve as an alligator clip in the negative lead of a VOM or VTVM.



CLOTHESPIN TEST CLIPS. You can make a couple of jumbo-size test clips in a hurry from plastic spring-type clothespins. Solder lugs to the ends of your test leads and fasten them to each clip with self-tapping screws turned into the coil of the spring. Then cut a small U-shaped wire and solder it to the spring on either side of the clip; the other end of this wire is your electrical contact in the jaws of the plastic clip.

ALLIGATOR CLIPS GUIDE SAW. A pair of alligator clips will help keep a hack-saw blade in place when you're starting a cut in thin sheet metal. On many occasions, you'll find that using these clips will be easier than filing a notch to start the new cut.



CURTAIN CLIP COILS CORD. If you're tired of tripping over dangling power leads, take up some of the slack with plastic curtain clips. These clips can be found in the housewares department of any five-and-dime store. If the cord is excessively long, use two curtain clips—one near the plug, the other near the appliance.

ADD A SQUELCH TO THE CB-1

Simple diode circuit eliminates superregenerative hiss



By R. L. HAWBAKER, 10W0975

IF YOU OWN one of the popular Heathkit CB-1 Citizens Band transceivers, here's a neat way to add an efficient squelch circuit to the receiver section. The squelch will block almost all of the "between - stations" superregenerative hiss and man-made noise—yet, if set properly, it will pass the weakest r.f. carrier. Installation involves adding only a few components and making some simple wiring changes.

About the Circuit. The changes to be made center around the plate circuit of detector *V1b*. This circuit, before and after modification, is shown in Figs. 1 and 2 respectively. In both diagrams, all original components are marked with their Heath part numbers. In Fig. 2,

all new components are designated by numbers beginning with "50" (i.e., *V501*, *R502*, etc.). Portions of the circuit which are left unchanged have been drawn with dotted lines.

Tube *V501* is a 6AL5 dual diode, only half of which is used. Its plate voltage is taken from dropping resistor *R501* and filtered by a network consisting of *R503* and *R504* and capacitors *C502* and *C503*. The cathode is biased through resistor *R502* and potentiometer *R106*; it receives the audio output of tube *V1b* through capacitor *C501*. Capacitor *C504* couples *V501*'s audio output (by way of volume control *R108*) to the grid of the first audio amplifier (*V2b*).

Potentiometer *R106*, formerly the re-

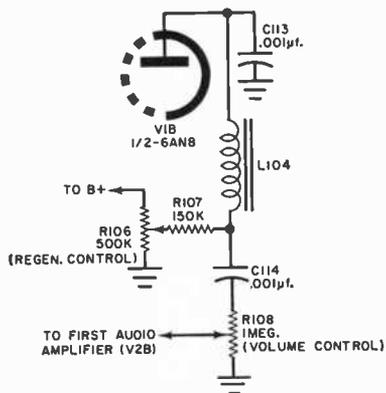


Fig. 1. Plate circuit of Heathkit CB-1's detector before modifications are made. Regeneration control R106 will become the squelch control.

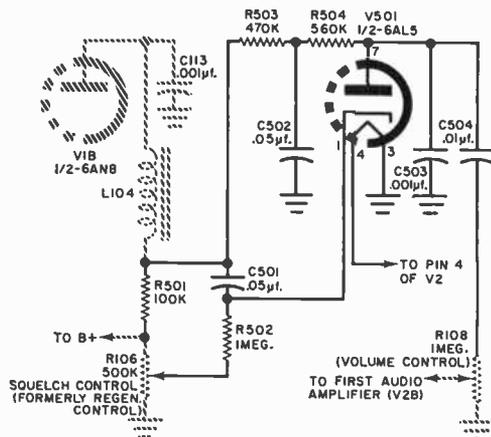


Fig. 2. The circuit in Fig. 1 after it is modified. Dotted portions of the schematic represent sections which have been left unchanged.

generation control, serves to control the squelch. Resistor *R501* sets the regeneration at a fixed value, and the author found that this causes no inconvenience—the model shown has operated over the entire Citizens Band with no noticeable loss in sensitivity.

Squelch control *R106* is normally set so that the cathode of diode *V501* is slightly more positive than the plate. In this condition, the tube will not conduct and no signal will pass through to *V2b*. When a carrier is received by detector *V1b*, however, the diode's plate voltage will rise until the plate becomes more positive than the cathode. The tube then conducts and the signal passes through.

With *R106* set so that *V501* is just on the threshold of conducting, a rise in plate voltage of only one volt will "break" the squelch. The average readable signal causes a rise of 3 to 5 volts, but superregenerative hiss and/or most man-made noise will not increase the voltage to the value necessary for conduction.

Remember, though, that this device is not a noise limiter. It serves mainly to squelch the hiss which is characteristic of a superregenerative receiver when no signal is being picked up. Man-made noise is also suppressed when no signal is present, but once a carrier causes the tube to conduct, any noise will ride through as well.

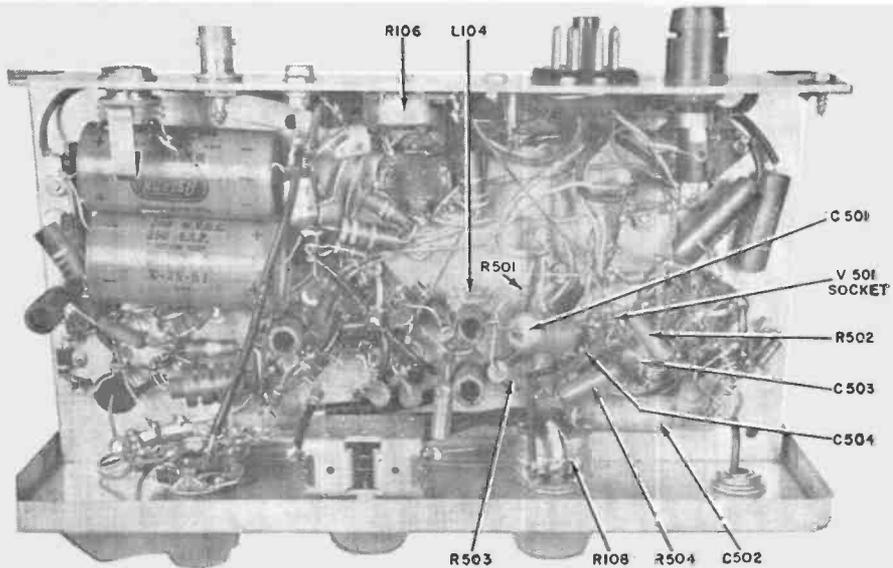
Installation. The only mechanical changes which must be made in the

CB-1 are the addition of a socket (*SO1*) for *V501* and an extra terminal strip (*TS1*). The pictorial diagram (Fig. 3), which shows the corner of the chassis (wiring eliminated) where these parts are located, will help you with the placement. The original parts are marked with their Heath designations.

The author installed a 5-terminal (one grounded) terminal strip, even though a 3-terminal unit would have worked, to get good spacing of the parts. Only the terminals marked 1, 2, and 3 are used. Notice also that, to conserve space and avoid drilling an extra hole, one side of the new socket is held in place by one of the mounting nuts for *V2*'s socket. Place a solder lug under the mounting nut for the other side of the socket.

Wiring Steps. Once *SO1* and *TS1* are in place, you're ready to go ahead with the wiring. The steps are itemized below—carry them out in order and check off each one as you have completed it. An asterisk appearing after a terminal means that the last connection has been made to it and it's okay to solder.

All of the terminal numbers mentioned in the following instructions refer to Fig. 3, and the photo of the underside of the chassis will give you an idea of the relative positions of the components. When wiring, be sure to route all component leads so that they are as short and direct as possible. In this way, undesirable effects, such as hum pickup or

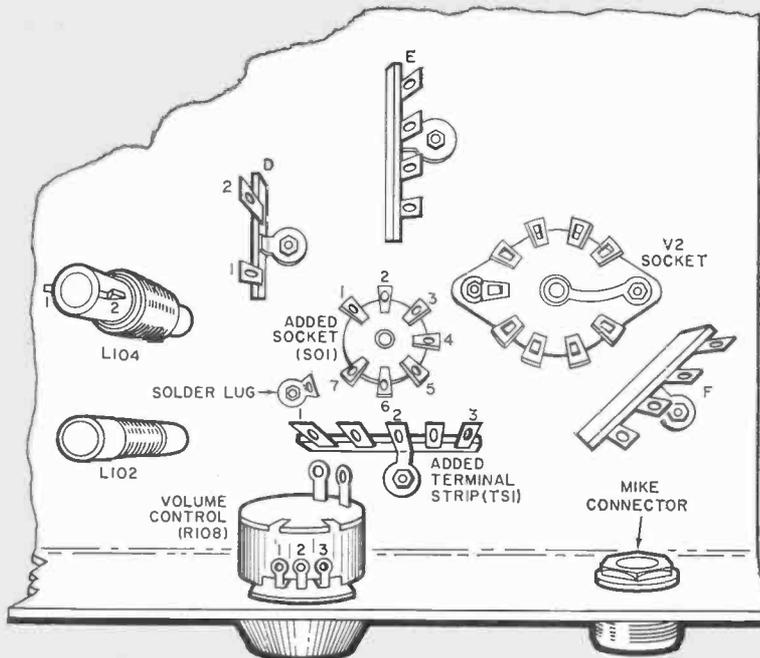


PARTS LIST

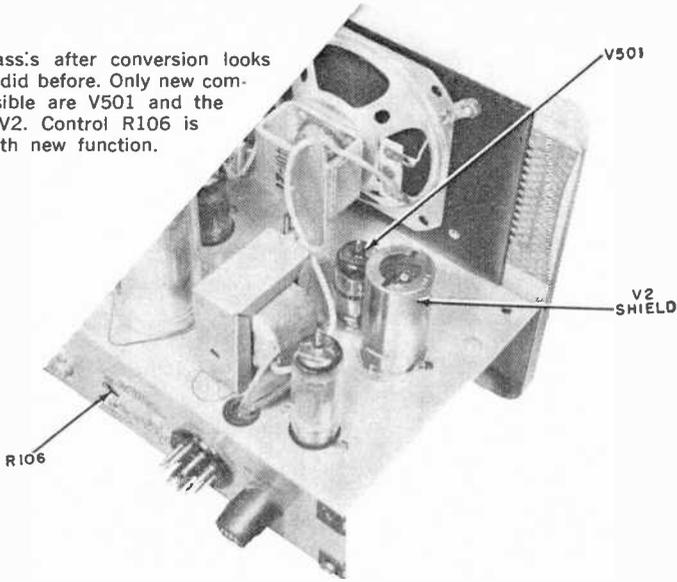
C501, C502—0.05- μ ., 400-volt capacitor
C503—0.001- μ . ceramic disc capacitor
C504—0.01- μ . ceramic disc capacitor
R501—100,000 ohms
R502—1 megohm
R503—470,000 ohms
R504—560,000 ohms
SO1—7-pin miniature tube socket
TS1—5-lug terminal strip (center lug grounded)
V501—6AL5 tube
Misc.—Tube shield for V2, solder lug, hardware, etc.

Bottom view of CB-1 chassis shows some of the components to be added. Extra terminal strip (not visible) makes for a professional-looking installation.

Fig. 3. Components in area of chassis where changes are made. Part and terminal numbers are keyed to installation and wiring instructions in text.



Top of chassis after conversion looks much as it did before. Only new components visible are V501 and the shield for V2. Control R106 is old part with new function.



the introduction of feedback will be avoided. In addition, you'll have a neater-looking job.

(1) Remove the 150,000-ohm resistor (*R107*) connected between terminal 2 of choke *L104* and terminal 1 of terminal strip "D."

(2) Remove and save the 0.001- μ f. capacitor (*C114*) connected between terminal 2 of *L104* and terminal 1 of volume control *R108*.

(3) Connect a 100,000-ohm resistor (*R501*) between terminal 2 of *L104* and terminal 1* of terminal strip "D."

(4) Disconnect the lead from the center terminal of regeneration control *R106* (not shown in Fig. 3) and move it to the ungrounded end terminal.*

(5) Connect the center terminal* of *R106* to terminal 3 of terminal strip *TS1*.

(6) Connect pin 3* of socket *SO1* to *SO1*'s center shield terminal.

(7) Connect *SO1*'s center shield terminal* to the solder lug* installed under *SO1*'s mounting nut.

(8) Connect pin 4* of *SO1* to pin 4* of *V2*'s socket.

(9) Connect *R502* (1,000,000 ohms) from terminal 3* of *TS1* to terminal 1 of *SO1*.

(10) Connect *C501* (0.05 μ f.) from terminal 2 of *L104* to terminal 1* of *SO1*.

(11) Connect *R503* (470,000 ohms)

from terminal 2* of *L104* to terminal 1 of *TS1*.

(12) Connect *C502* (0.05 μ f.) from terminal 1 of *TS1* to terminal 2 (ground) of *TS1*.

(13) Connect *R504* (560,000 ohms) from terminal 1* of *TS1* to terminal 7 of *SO1*.

(14) Connect *C503* (0.001 μ f.—formerly *C114*) from terminal 7 of *SO1* to terminal 2* of *TS1*.

(15) Connect *C504* (0.01 μ f.) from terminal 7* of *SO1* to terminal 1* of volume control *R108*.

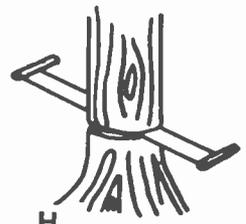
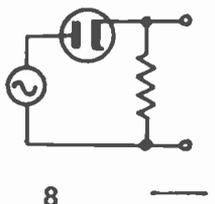
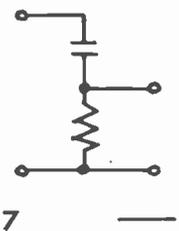
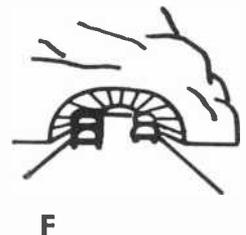
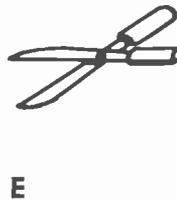
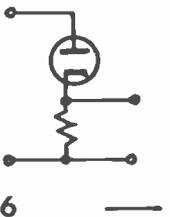
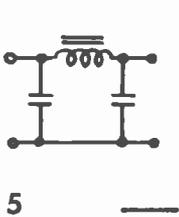
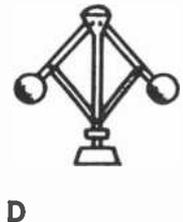
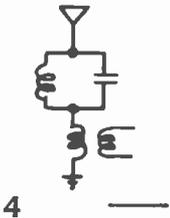
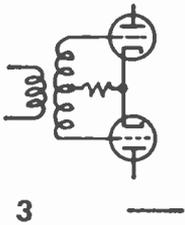
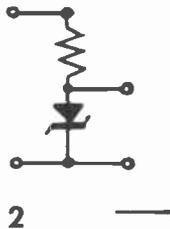
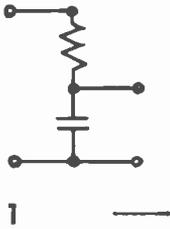
With the wiring completed, the only work remaining is to install a shield on *V2*. Tube *V2*'s socket could be changed to the type having a fitting for a shield, but the author found it more convenient simply to slip the shield over *V2* and solder it to one of the socket mounting screws.

Using the Squelch. After all of the wiring has been double-checked, turn on the receiver and let it warm up. Start with *R106* at its maximum resistance position, rotating it until the super-regenerative hiss just stops. The control is now set for proper operation and need not be readjusted until the set has been shut off and turned on once more. After you've used your new squelch circuit for a while, you'll wonder how you ever got along without it. —50—

ELECTRONIC ANALOGY QUIZ

By ROBERT P. BALIN

Electronic circuits perform functions similar to many mechanical devices and natural phenomena, and finding an analogy between them often leads to a better understanding of both. See if you can match the numbered electronic circuits on the left with the lettered sketches on the right. Answers appear on page 124.

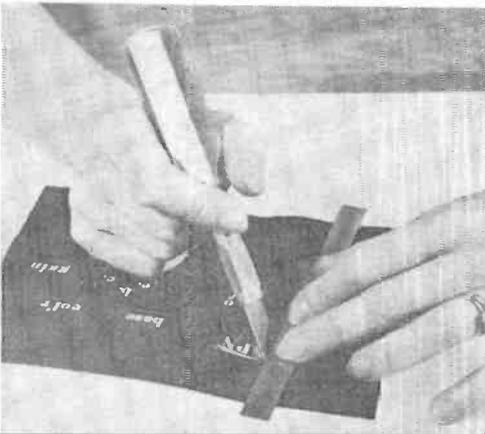
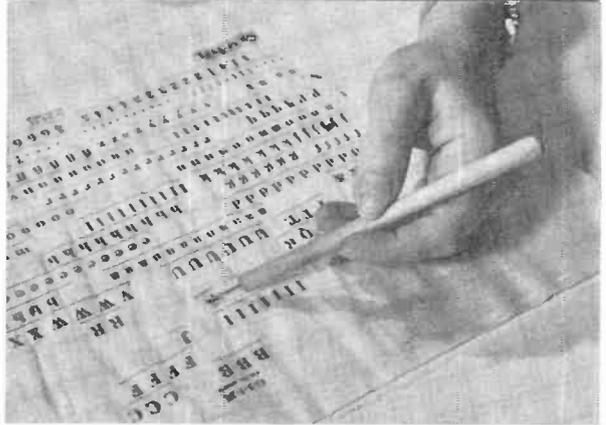


EQUIPMENT



Does it strike you that some home-built equipment should go back where it came from—the junk box? You can make good-looking labels from Cello-Pak, Artype or Prestype, available from your local art supplier.

Letters are printed on cellophane sheets having a weak adhesive backing. Cut them out with a needle-sharp stylus and transfer them to a sheet of transparent acetate. White paper will do if you plan to use photostat labels.



With a straight edge and sharp knife, carefully cut the individual labels from the photo negative (white lettering on black background) or photostat. Make the cuts evenly to insure that the labels will all be rectangular.

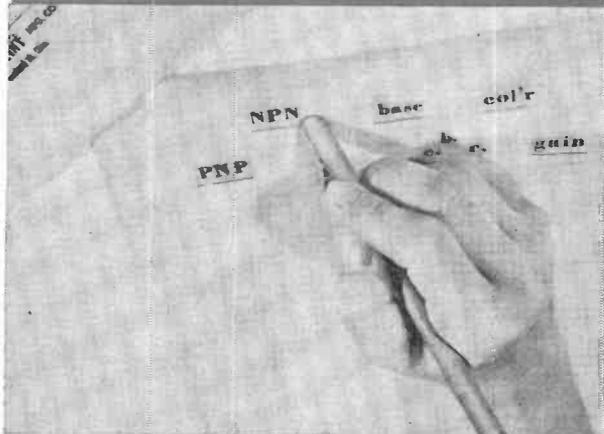


Carefully glue each label into its proper position on the instrument's panel. You can use any one of the numerous glues and adhesives that will bond dissimilar substances. Do NOT use rubber cement—the labels will peel off.

LABELING--SIMPLIFIED

By CHARLES SMITH

Align the horizontal lines printed below each letter. Watch your letter-to-letter spacing. Using a bone burnisher or the bowl end of a tablespoon, press the letters down on the acetate so that the adhesive holds them in place.



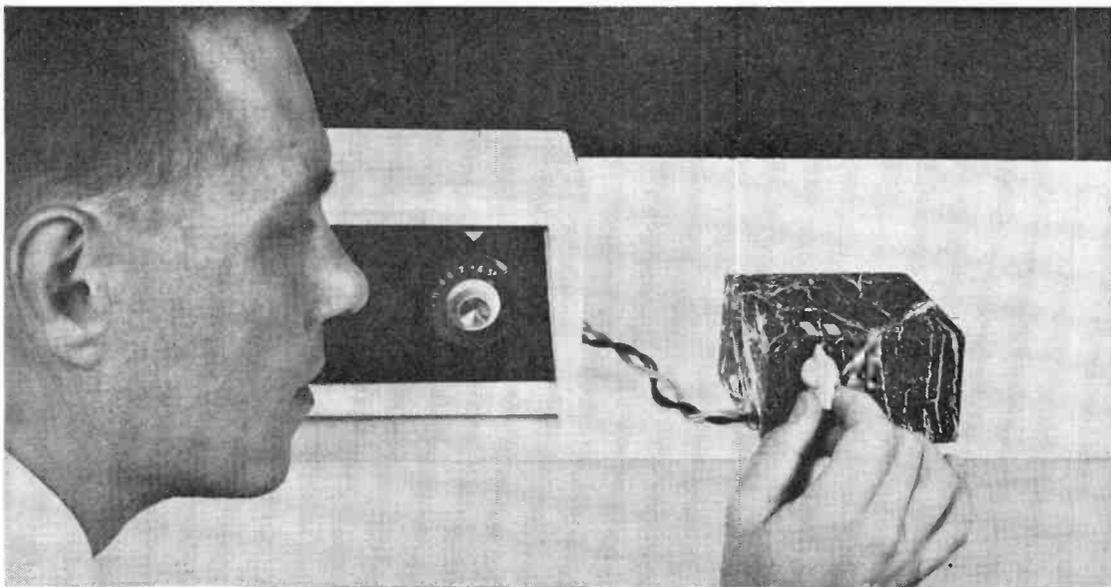
The acetate with the pressed-on letters can be used as a negative to make a contact print. Ask a photographer friend to let you use his enlarger to increase or decrease type size. Photostat copies are good but cost a bit more.



After gluing a label in place, you may find the white edge of the photo paper distracting. Paint the edge with thinned-out black nail polish or with India ink. Use a very fine brush and take care that the ink doesn't run.



A world of difference! This looks like a professional piece of equipment—one that you can proudly show to your friends and acquaintances.



RADIO DOUBLES AS INTERCOM

Hartley oscillator circuit transmits intercom signal through home receiver

By MARTIN H. PATRICK

ALMOST any home radio receiver will perform as an efficient intercom with the addition of this simple circuit. Because the intercom signal is actually "broadcast" into the receiver, it's not necessary to make extensive modifications to the radio's audio system. When it isn't in use for communication, the set can be operated normally—or even played through the remote intercom speaker. Handy to have around the house, the sensitive intercom can be used as a "baby sitter," door announcer, or paging system.

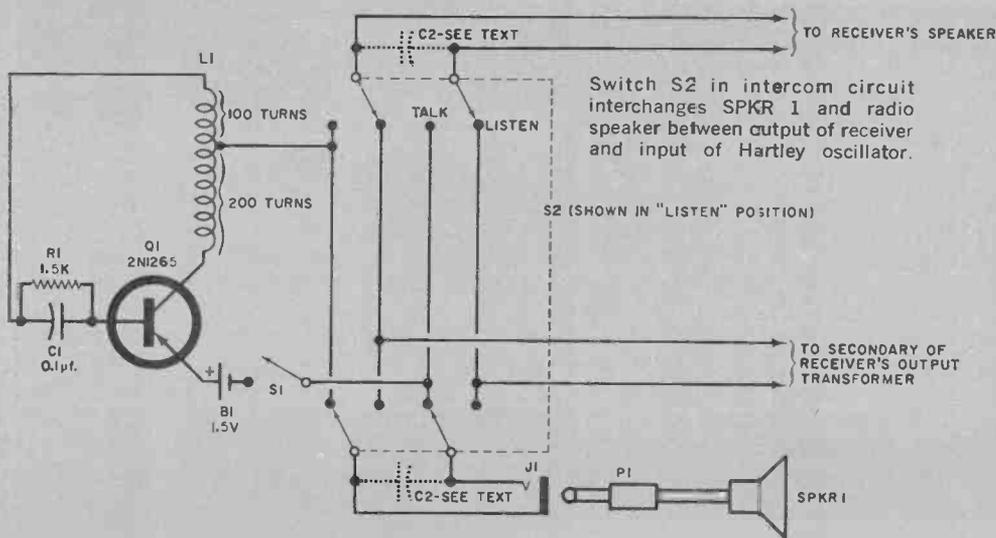
The Circuit. Transistor *Q1* is connected in a simple Hartley oscillator circuit which is tuned to the broadcast band. A PM loudspeaker, connected in series with the tap of coil *L1* and used as a microphone, supplies the modulation. The oscillator is powered by *B1*, a single penlight cell.

The receiver's loudspeaker is discon-

nected from the output transformer, and the speaker and transformer leads are connected to "Talk-Listen" switch *S2*. Also connected to *S2* is a second, remote speaker (*SPKR 1*).

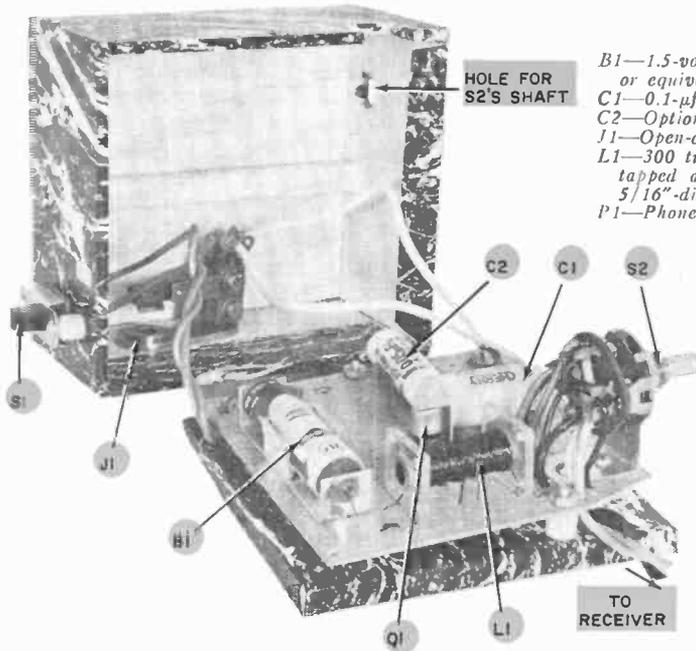
Switch *S2* is so wired that, in its "Listen" position, remote speaker *SPKR 1* modulates the oscillator and the receiver speaker is connected to the output transformer. Anything spoken into *SPKR 1* is transmitted to the receiver by the oscillator and heard in the receiver speaker. In the "Talk" position, the connections are reversed—the receiver speaker does the modulating and the receiver's audio output is connected to the remote speaker.

Construction. First check to see that the receiver you're planning to use has a PM (permanent magnet) loudspeaker. Most of the newer sets do, but older ones are often equipped with dynamic speakers (you can recognize these units by



PARTS LIST

- B1—1.5-volt penlight cell (Burgess Type "Z" or equivalent)
- C1—0.1-µf., 200-volt paper capacitor
- C2—Optional—see text
- J1—Open-circuit phone jack
- L1—300 turns of #29 or #30 enameled wire, tapped at 100 turns, scramble-wound on a 5/16"-diameter, 1"-long form—see text
- P1—Phone plug
- Q1—2N1265 transistor
- R1—1500-ohm, 1/2-watt resistor
- S1—S.p.s.t. switch
- S2—4-pole, 2-position rotary switch (Mallory 3242J or equivalent)
- SPKR 1—PM speaker to match unit in radio—see text
- Misc.—3 1/2" x 3 1/2" perforated board, wood or plastic box, transistor socket, battery holder, enclosure and cable for remote speaker, etc.



Major components are mounted on perforated-board chassis housed in wooden box, but plastic case could be used instead.

the fact that they have four leads rather than two). Receivers with dynamic speakers are not suitable for use with this intercom circuit.

When you've got your set picked out, remove it from its cabinet and disconnect the loudspeaker from the output transformer secondary. Next, attach new sets of leads (each about three feet long) to the speaker and transformer secondary. The receiver can now be re-

installed in the cabinet with the new leads running through a convenient opening in the rear. The free ends of these leads will be connected to S2.

With the receiver modifications completed, proceed to the construction of the oscillator/control unit. The author mounted all of the parts, with the exception of switch S1 and jack J1, on a 3 1/2" x 3 1/2" piece of perforated board.

The board was housed in a homemade

wooden box to which *S1* and *J1* were fastened. Switch *S2*'s shaft extends outside the box through a $\frac{5}{16}$ "-diameter hole.

You can vary the construction details to suit yourself, but don't use a metal box. Coil *L2* is also the oscillator's "antenna," and to shield it in a metal enclosure would prevent the signal from reaching the receiver. A small plastic instrument case or utility box should make a good substitute.

Wiring the unit is a simple job, but be sure to keep the leads as short and direct as possible. Capacitor *C2* should not be installed at this point, since it may not be necessary (see "Operation" section).

Coil *L1* consists of 300 turns of No. 29 or No. 30 enameled wire "scramble-wound" on a $\frac{1}{8}$ "-diameter, 1"-long form. At the 100th turn, make a tap about 4" long by twisting together a loop of the wire. Bring the tap out to the end of the coil and wind the remaining 200 turns over it. The form can be cut from a piece of $\frac{5}{16}$ "-diameter polystyrene rod or tubing. A $\frac{3}{4}$ " x $\frac{3}{4}$ " plastic square glued to each end of the form retains the wire and makes a handy mounting base.

To finish up, select a remote loudspeaker (*SPKR 1*) that matches the one in the receiver as closely as possible and house it in an appropriate enclosure.

Install phone plug *P1* on the end of *SPKR 1*'s cord, plug it into *J1* on the oscillator/control unit, and you're ready to try out the intercom.

Operation. Place the oscillator/control unit so that coil *L1* is parallel to the receiver's loop antenna and as close to it as possible. Then move remote speaker *SPKR 1* into the next room (to avoid feedback) and snap on power switch *S1*. Turn on the receiver and tune in the oscillator's signal; it should be strong enough to "drown out" any broadcast station which happens to be on the same frequency.

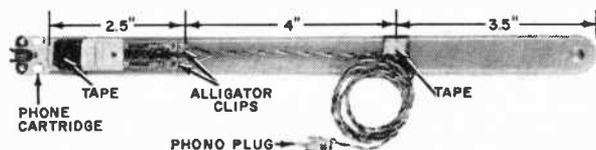
With a friend stationed at *SPKR 1*, turn *S2* to "Talk" and speak into the receiver's speaker—your voice should come from the remote speaker. To receive an answer, turn *S2* to "Listen" and have your friend talk into the remote unit—you should be able to hear his voice through the receiver speaker.

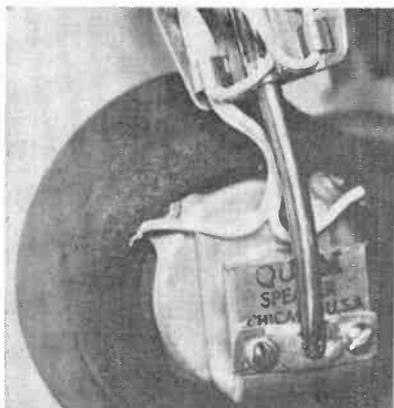
If *SPKR 1* and the receiver speaker are well-matched, the remote and local volumes should be about the same. If they are not, you should be able to equalize them by connecting a paper capacitor, size determined by experimentation, across one speaker or the other (see *C2* in the schematic). In the author's model, a 0.05- μ f. unit was installed at *SPKR 1*. -50-

FLY SWATTER BECOMES CARTRIDGE TESTER

An inexpensive plastic fly swatter is the basis for this simple, but handy, gadget for testing phono cartridges. Cut off 10" of the swatter's handle and discard the "business end." Then tape a 30" length of standard phono pickup arm cable to the handle as shown in the photo below, installing a pair of miniature alligator clips on the short end and a phono plug on the long end. In use, the cartridge is taped to the end of the

handle and connected to the cable via the alligator clips. Plug the free end of the cable into an amplifier and support the cartridge over a record revolving on any turntable. —Art Trauffer





Headband bracket matches tapped holes.



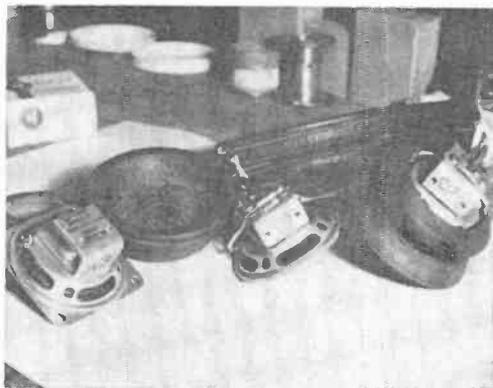
Use separate leads for each speaker, and phase for best bass.

STEREO HEADSET on a BUDGET

By R. F. DRISCOLL

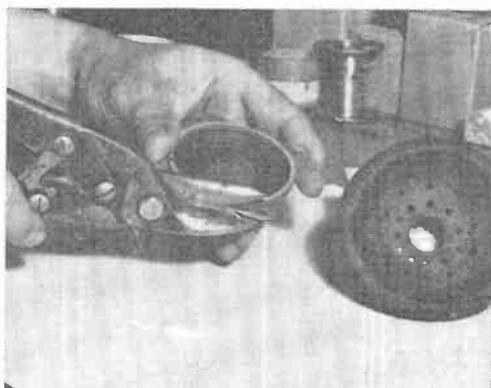
YOU CAN ASSEMBLE your own stereo headset for about half the price of a factory-made product. Pick up a pair of Quam 25A07N replacement speakers (they come with holes tapped in the back plate), a pair of headset cushions, and a Trimm headband. Cut the four flanges off the speakers, and fit the speakers into the headset cushions (be careful of the speaker cones) after attaching some flexible wire leads to the voice coil terminals. Attach the Trimm headband by sweat-soldering a bracket with holes to match the spacing of those already in the speakers. Connect each pair of leads to plugs, reversing the leads to one plug for best bass, then sit back and listen. —30—

Total cost of the five items you will need to make the stereo headset should be approximately \$4.60.



November, 1961

Speaker mounting flanges should be clipped off as shown. Enlarge holes in cushions for best response.





PEDIACOUMETER

Electronic jack-in-the-box aids hearing tests of small fry

TESTING the hearing of children too young to understand the usual methods is a difficult problem. To solve it, Dr. C. Olaf Haug of the University of Texas medical school has developed an electronic jack-in-the-box.

Called a "Pediacoumeter," the machine is equipped with seven dolls—each representing a different audio tone. The child is told (see photo sequence starting at top left) that if he hears a doll cry out and presses the button, the doll will be released.

Each ear is tested for the seven tone signals. A hidden operator controls the test via a selector switch and a master switch to prevent accidental or premature release of a doll head. Then the operator increases the strength of the tone signal until the child reacts.

With 3- and 4-year olds, the Pediacoumeter has been providing complete audiograms in 80% of the cases tested. Dr. Haug reports that evaluation of hearing deficiencies at a time when they are most easily cured can prevent permanent psychological damage to a child.

—Dennis J. Cipnic





for photographers

Bi-Slave for AG-1's

The flash bulb on your camera triggers the slave into action—providing an extra “sync-in” flash

By JIM GOSS

PHOTOFLASH FANS, both amateurs and pros, are always interested in adding at least one photoelectric slave unit to their lighting equipment. But the Bi-Slave is unique since it has no competitors on the market which can fire the mighty but tiny AG-1 flash bulb. (The “Bi” in the unit’s name is derived from two photoelectric cells which pick up the triggering light from the camera’s flash bulb.)

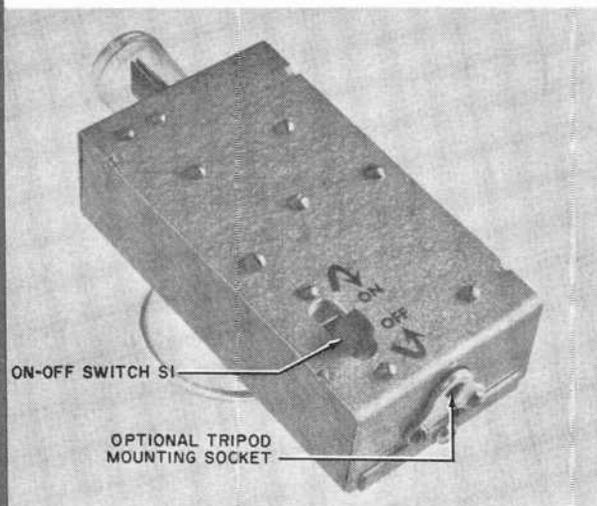
Costing less than \$16.00 to build, the Bi-Slave can be assembled in an evening.

In fact, building two or three at once adds only about one hour to the construction time because you save valuable workshop “tooling-up” time. If you make two Bi-Slaves and like to tote around a case of AG-1 bulbs (144), you’ll find that the total weight is only two pounds.

To use the Bi-Slave, you simply snap in an AG-1 flash bulb, set a switch (S1) to “on,” aim the reflector at the subject, then let the flash bulb on your camera do the rest. The Bi-Slave will



Compact design keeps slave's weight down to six ounces; reflector adaptor can be removed when slave is not used. "Open Flash" switch (S2) does not fire bulb unless S1 is set at "on."



synchronize up to 1/30th of a second on X and F and up to 1/125th of a second on M sync.

The brighter the room, the shorter the distance the unit must be from the triggering flash bulb. Tests made using the AG-1 as the triggering light determined that, in normal room illumination, the slave could be 12 feet away. In semi-dark rooms, it's possible to position the slave up to 20 feet away. But this distance can be increased by using #5 or larger type flash bulbs. (Electronic flash units will not trigger the Bi-Slave because the flash duration is normally too short to activate the photoelectric-relay circuit.)

Since the two photoelectric cells face out, the AG-1 Bi-Slave can be placed on either side of the camera. An added push-button switch (S2) permits the user to trigger the slave by hand whenever open flash shots are taken.

The circuit is simplicity itself. When the series-connected photoelectric cells (PC1 and PC2) sense a burst of light, their voltage output climbs suddenly, providing a positive pulse through C1 to the base of Q1. This causes Q1 to conduct heavily and energize the relay, K1.

As the contacts on K1 close, the charge stored in C2 is discharged through the flash bulb in socket S01.

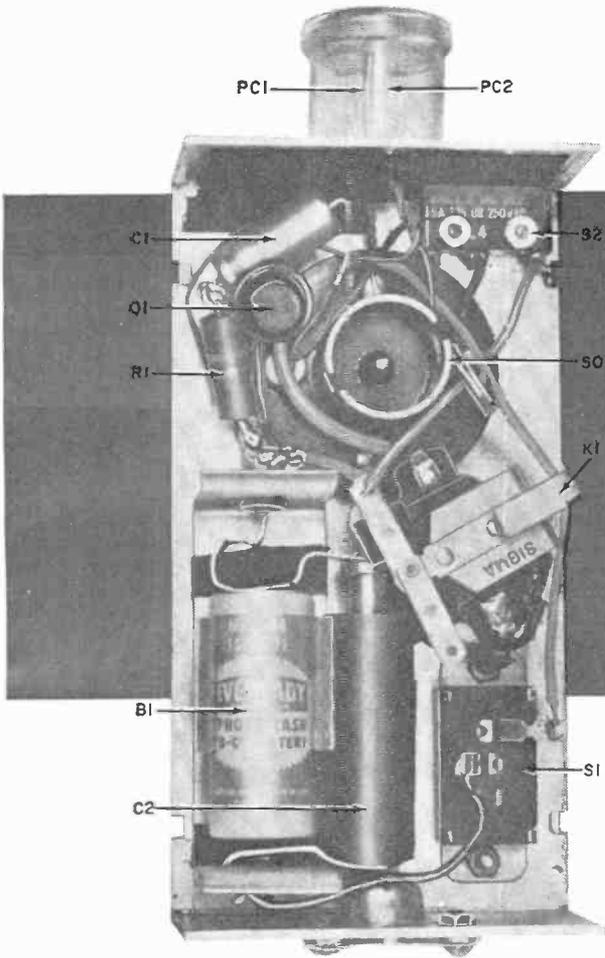
When the bulb fires, it opens C1's discharge path and B1 begins to recharge the capacitor. By the time the spent bulb is removed and a new unit installed, C1 is fully charged and set to fire again when the next pulse energizes the relay.

Mounting the parts is easy provided that you spend enough time positioning them and marking hole centers. Follow the parts layout the author used and you should have no trouble.

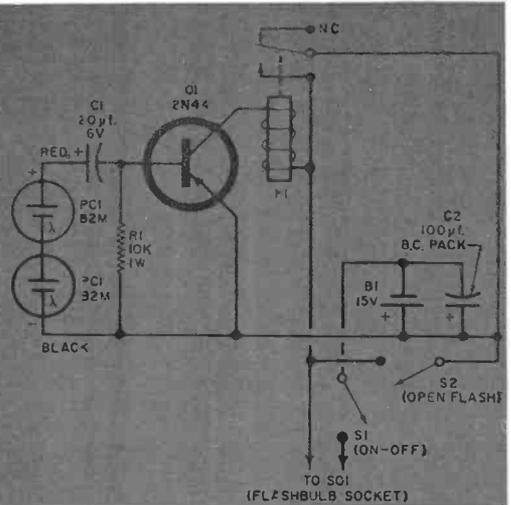
Punch a 3/4" hole for the reflector adaptor in the chassis box cover, centering it exactly over the location of bayonet socket S01. An off-centered hole will prevent you from mounting the reflector adaptor properly.

Mount the two B2M photoelectric cells on top of the unit, making sure that you face the glossy-coated surfaces on the cells out to the sides. A clear plastic tube, of the type that many drugstore items come in, is cemented over the cells to protect them from accidental knocks. An optional plate tapped for a 1/4-20 thread secured to the bottom of the unit serves as a tripod socket.

PC1 ← → PC2



Battery B1 snaps into holder springs of B.C. pack (C2) which, in turn, is mounted in the penlight cell holder. Metal shell connected to negative terminal of C2 must be taped to prevent shorts.



PARTS LIST

- B1—15-volt battery (Eveready #504 or equivalent)
- C1—20- μ f., 6-vol electrolytic capacitor
- C2—Kodak Midgt B.C. pack (100- μ f.)*
- K1—S.p.s.t. relaz., 100 Ω -ohm d.c. coil, 7-ma. pull-in (Sigma 11F-1030-G/SIL)
- PC1, PC2—Solar cell (International Rectifier B-2M Sun Battery)
- Q1—2N44 transistor
- R1—10,000-ohm, 1-watt resistor
- S1—S.p.s.t. slide switch
- S2—S.p.s.t. switch, normally-open push-button type (Switchcraft Tini-Switch 951 or equivalent)
- SO1—Single-contact bayonet candleabra socket (Allied Radio 52E857 or equivalent)
- I—Walz AG-1 reflector adaptor*
- I—Penlight dry-cell holder (mounts B1 and C2)
- I—4 $\frac{1}{4}$ x 2 $\frac{1}{4}$ x 1 $\frac{1}{4}$ chassis box (LMB 101 or equivalent)
- Misc.—Wire, solder, hardware, etc.

*Available from most photographic supply stores.

Wiring up the unit introduces no problems except at the transistor leads—grip each lead with a pair of long-nose pliers between the transistor and the solder joint to prevent the heat of the soldering iron from damaging the transistor. When the wiring is finished, be sure to tape the metal shell on the B.C. pack capacitor, C2, to prevent shorting. Also, a careful check should be made for other accidental shorts and wiring errors.

To test the unit, insert the battery and secure the cover on the chassis box. Snap the Walz AG-1 reflector adaptor into the bayonet socket and plug in an AG-1 flash bulb. Then set off a flash bulb about 10 feet away from the Bi-Slave, and POP!—the flash bulb in the slave should ignite. Use a new bulb and test the *Open Flash* button—it should fire the flash bulb only when S1 is “on.”

Your photographic supply dealer has nondestructive test lamps that you can use in place of the AG-1 flash bulbs during these tests if you wish.

Now you are all set to take some pictures. Incidentally, if you forget to turn the unit off, don't worry about it. The battery circuit will be disconnected until you remove the burned-out bulb and put a new flash bulb in the socket.

MEET THE WINNERS!

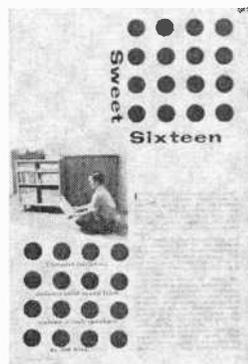
If you read POPULAR ELECTRONICS for December, 1960, carefully, you'll remember the "Bonus for Authors" awards we outlined at that time. Checks totaling \$625.00 are now in the hands of six authors whose articles were published during the first half of 1961. As promised, "bonus payments" equal to the original purchase price of their stories were made to three of these authors. In addition, consolation checks of \$50.00 each went to the three "runners-up."



BEST "ELECTRONIC NEWS" FEATURE ARTICLE

The winner of the bonus for the most outstanding "electronic news" article in any issue of POPULAR ELECTRONICS published between January and June, 1961, is Charles Fowler. His article, "The Noise That Banishes Pain" (January, page 47), told the story of audio analgesia, including results of tests and equipment designs that he had perfected. Hundreds of readers asked for more information—especially as to where the "white noise" phonograph records could be purchased. Mr. Fowler, now a freelance writer, is probably best remembered for his long tenure as the editor of High Fidelity magazine.

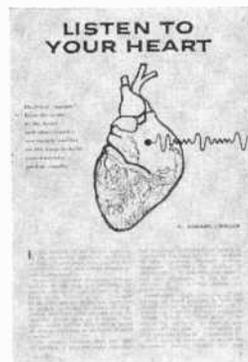
A close second in this category was Ken Gilmore's story "The Truth About the Danger of Radar Waves." Although not of as great immediate personal interest as Mr. Fowler's article, the radar story was recognized as a prime example of factual reporting. Appearing in the March issue (page 41), it has since been reprinted for the U.S. Air Force safety training program.



BEST HI-FI ARTICLE

There was never any serious competition for Jim Kyle's "Sweet Sixteen" story in the January issue (page 55). This story described the construction of a speaker system using 16 five-inch speakers wired in series-parallel. For months the author was deluged with mail, while manufacturers happily sold over 12,000 speakers for use in "Sweet Sixteen's." Jim's follow-up article in the April issue (page 55) elaborating on the design of this system augmented the downpour—whetting more appetites and further deluging the author with hundreds of postcards and letters.

Runner-up in this category was "Sinclair" for his humorous article called "On The Grid." This surprise-ending story, which appeared in our February issue (page 66), received much favorable comment.

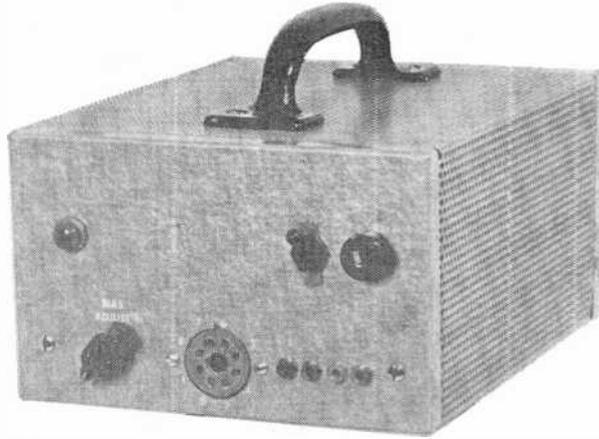


BEST ELECTRONIC CONSTRUCTION ARTICLE

Selecting the best article in this category was not an easy job. However, reader interest definitely favored the four-transistor cardiac monitor described and built by Edward Lininger ("Listen to Your Heart," June, page 47). This device picks up the minute voltages generated by muscular action and converts them to audible sounds. Scores of readers could not resist duplicating it for friends working in the field of medicine, and it has also turned out to be a great Science Fair project.

CB'ers cast their votes for Don Stoner's "Citizens Band Q-Multiplier" (March, page 76) in such great numbers that Don is the runner-up in this category. His device sharpens the selectivity of many CB transceivers.

Congratulations to all the winners—and thanks to all of our readers who told us about the stories they liked best



POWER A'PLENTY

Pick up your plate, screen, bias, and heater voltages from one compact supply

By **E. H. MARRINER**, W6BLZ

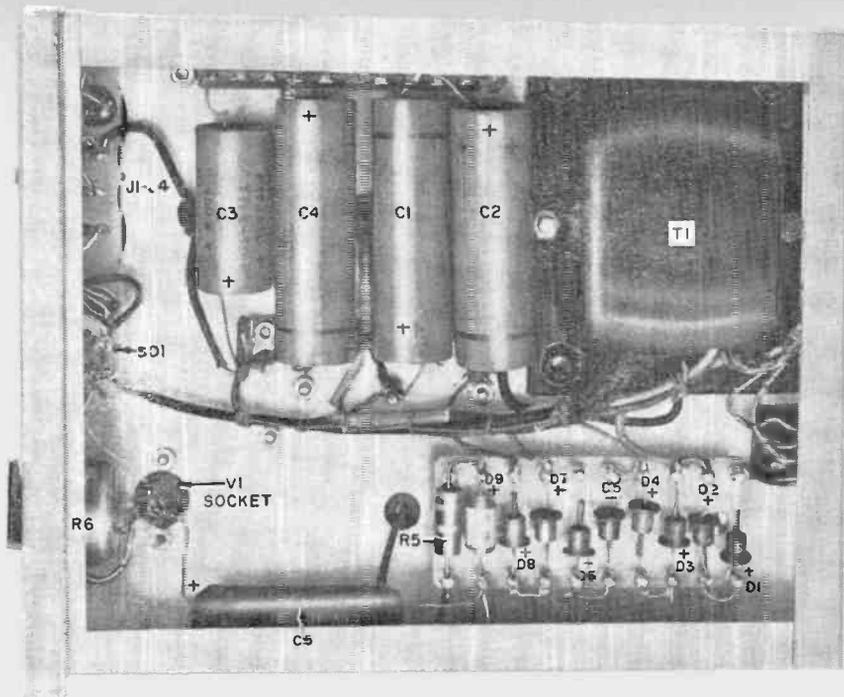
THIS VERSATILE bench supply is ideal for test-powering receivers, amplifiers, small transmitters, and a variety of other types of electronic gear. Designed around the now-familiar silicon diode rectifiers, it dispenses with the usual rectifier tubes and their associated filament transformers. The four d.c. outputs deliver 560 volts at 100 ma., 250 volts at 100 ma., 150 volts (regulated) at 15 ma., and 0-130 volts (negative) at 15 ma. An additional output provides 6.3 volts a.c. at 8.5 amperes.

About the Circuit. The high-voltage secondary of transformer *T1* is connected to a bridge rectifier circuit employing diodes *D1-D8*. Two 400-PIV diodes in series are used in each leg of the bridge, each diode pair being the equivalent of a single 800-PIV unit. Choke *L1* and capacitors *C1* and *C2* form a filter which smooths the pulsating d.c. from the rectifier circuit. The output of the filter is about 560 volts under a full load of

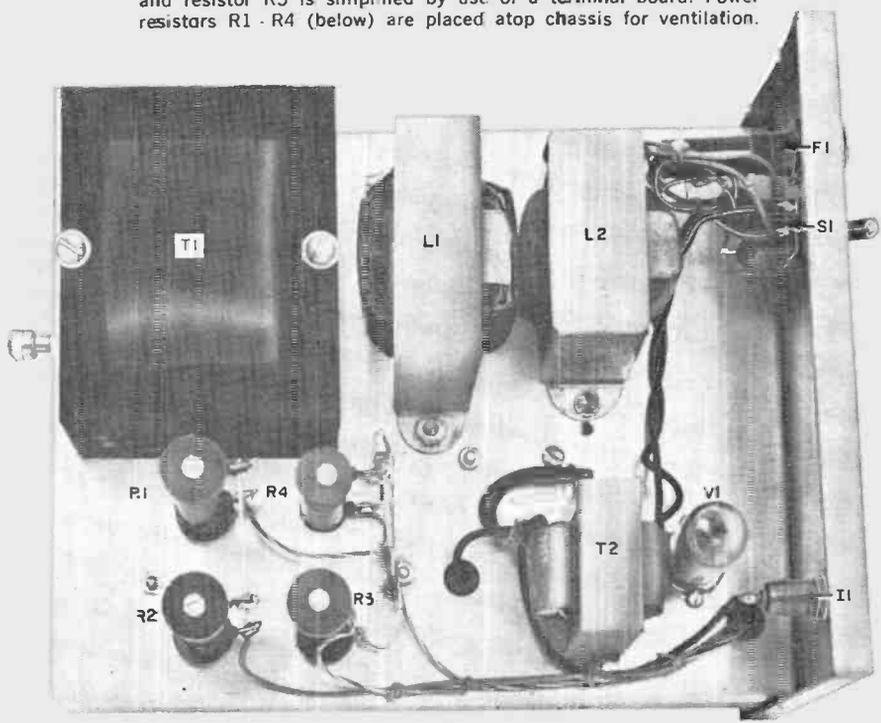
100 ma. Bleeder resistors *R1* and *R2* also act as a voltage-dividing network, insuring that the same voltage appears across each of the two filter capacitors.

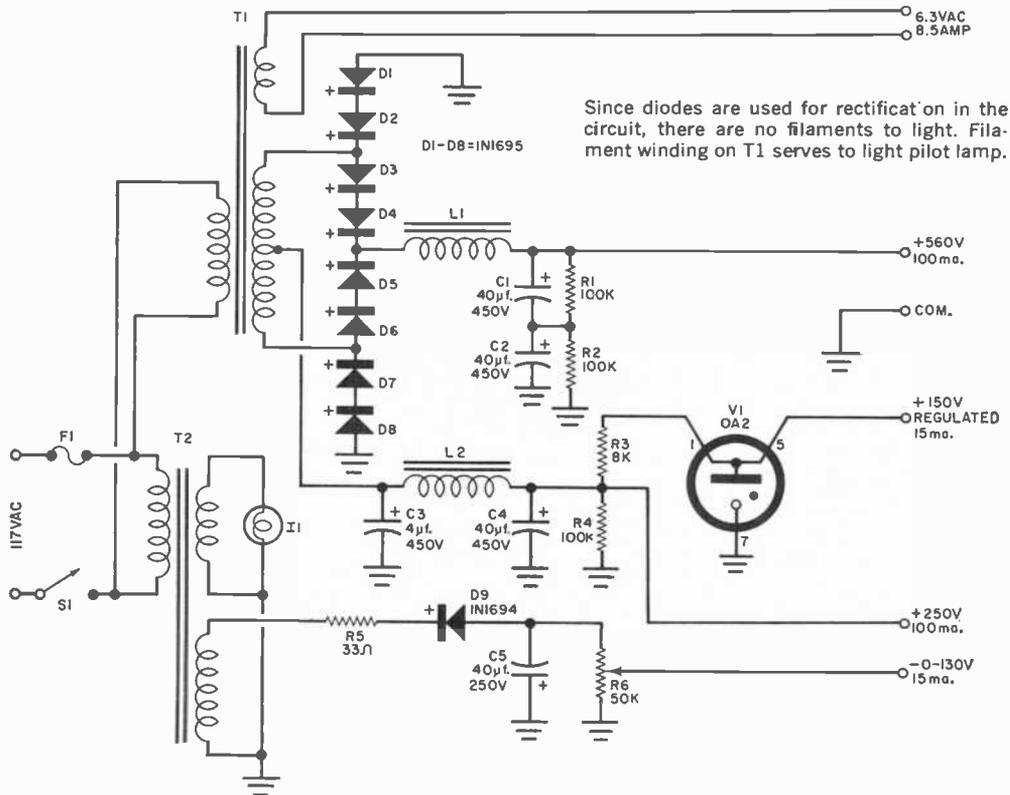
Transformer *T1*, incidentally, has a rating of 200 ma. But this assumes the use of a standard full-wave rectifier, which delivers only about half of the transformer secondary voltage (270 volts). With the bridge circuit actually used, almost the full 540-volt secondary r.m.s. voltage is available. The power capabilities of the transformer remain the same, however, so its current load must be cut in half.

The center-tap of transformer *T1* would not be used if the full secondary voltage were all that was desired. Available at the center-tap, though, is half of the bridge rectifier's output. Feeding this output through another filter system (capacitors *C3* and *C4*, choke *L2*) gives us a 250-volt, 100-ma. source. Part of this voltage is dropped, through resistor



Photographs of bottom and top of the power supply chassis clearly show parts layout and most wiring details. Capacitors C1 - C4 (above) are mounted on terminal strips. Wiring of diodes D1 - D9 and resistor R5 is simplified by use of a terminal board. Power resistors R1 - R4 (below) are placed atop chassis for ventilation.





Since diodes are used for rectification in the circuit, there are no filaments to light. Filament winding on T1 serves to light pilot lamp.

PARTS LIST

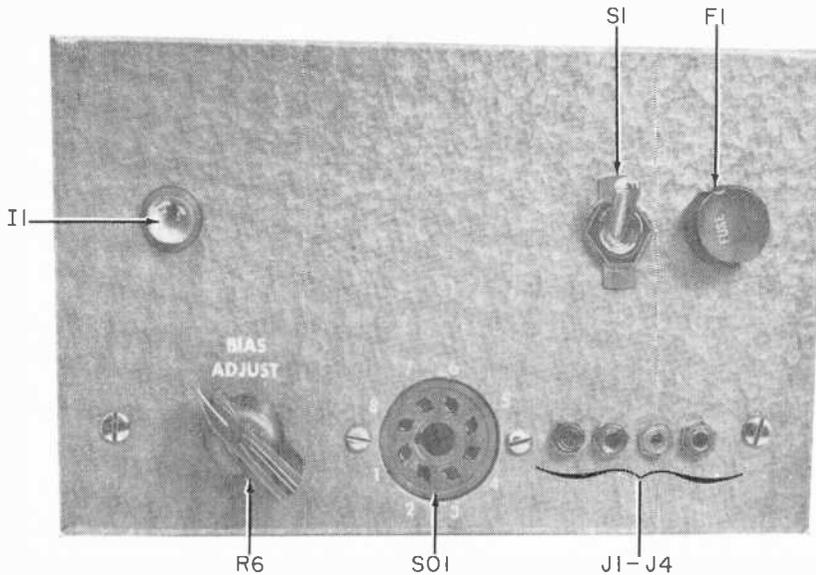
- C1, C2, C4—40- μ f., 450-volt electrolytic capacitor
 C3—4- μ f., 450-volt electrolytic capacitor
 C5—40- μ f., 250-volt electrolytic capacitor
 D1 - D8—1N1695 diode or equivalent
 D9—1N1694 diode or equivalent
 F1—3-ampere, 3AG fuse
 I1—6-volt pilot lamp (G.E. Type 47 or equivalent)
 J1, J2, J3, J4—Insulated tip jack
 L1—2.3-henry, 150-ma. filter choke (Stancor C2304 or equivalent)
 L2—8-henry, 100-ma. filter choke (Thordarson 20C53 or equivalent)
 R1, R2, R4—100,000-ohm, 20-watt, wire-wound resistor
 R3—8000-ohm, 5-watt, wire-wound resistor
 R5—33-ohm, 2-watt resistor
 R6—50,000-ohm, 1-watt potentiometer
 S1—S.p.s.t. toggle switch
 SO1—Octal socket
 T1—Television replacement power transformer; primary, 117 volts; secondaries, 540 volts CT @ 200 ma., 5 volts @ 3 amperes (not used), 6.3 volts @ 8.5 amperes (Stancor P-8172 or equivalent—see text)
 T2—Power transformer; primary, 117 volts; secondaries, 125 volts @ 15 ma., 6.3 volts @ 0.6 amperes (Stancor PS-8415 or equivalent)
 V1—0A2 tube
 1—Chassis-cabinet combination (California Chassis LTC-463 or equivalent—see text)
 Misc.—Binding post, fuse holder, pilot light assembly, terminal strips, terminal board, grommets, solder lugs, line cord and plug, insulating washers for R1 - R4, etc.

R3, across an 0A2 regulator tube (V1), providing a 150-volt, 15-ma., regulated output. Resistor R4, of course, is a bleeder for the filter system.

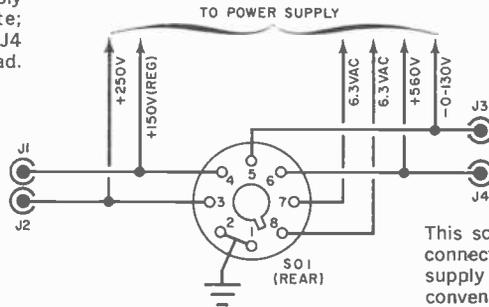
It should be kept in mind that the 560-volt, 250-volt, and 150-volt outputs are all drawn from the same power transformer (T1). To avoid overloading T1, the combined loads on these outputs should not exceed about 100 ma.

A separate transformer (T2) is the basis of an independent bias supply delivering 0-130 volts (negative) at 15 ma. Diode D9 (protected by current-limiting resistor R5) and capacitor C5 do the rectifying and filtering. Potentiometer R6 controls the voltage. The 6.3-volt winding on transformer T2 powers pilot light I1, and is not used for anything else.

All of the outputs from both transformers are brought to an octal socket (SO1) located on the front panel. In addition, the four d.c. outputs are connected to monitoring jacks (J1 - J4), so that voltages may be measured while a load is plugged into SO1. A grounded



Front panel of power supply is simple, yet complete; SO1 is output socket, J1-J4 allow metering under load.



This schematic shows how author connected SO1 and J1-J4 to power supply outputs, but any other convenient arrangement will do.

binding post for use with the monitoring jacks is on the rear lip of the chassis.

Construction. The author housed the power supply in a chassis-cabinet combination (Model LTC-463) available from the California Chassis Co., 5445 E. Century Blvd., Lynwood, Calif. The chassis measures $1\frac{1}{2}$ " x $6\frac{1}{16}$ " x $8\frac{1}{16}$ " and the $4\frac{1}{2}$ " x $7\frac{3}{16}$ " x $9\frac{3}{16}$ " perforated cabinet is fitted with a $4\frac{1}{2}$ " x $7\frac{1}{4}$ " front panel. (Any similar unit may be used.)

Switch *S1*, the fuse holder, and pilot light *I1* occupy the upper half of the front panel. Potentiometer *R6*, socket *SO1*, and jacks *J1-J4* are mounted through matching holes in the chassis front and lower front panel.

On top of the chassis are transformers *T1* and *T2*, chokes *L1* and *L2*, tube *V1* and resistors *R1-R4*. (Transformer *T1* in the author's model is a Philco 32-8673 TV replacement unit which was purchased at a surplus sale; an exact Stan-

cor equivalent is indicated in the Parts List.) It may be necessary to remove *T1*'s top cover to provide clearance for the chassis to slide into the cabinet. Resistors *R1-R4* are held down with long machine screws passed through their centers—insulating washers on the ends of the resistors prevent shorts to the screw heads and the chassis.

The rest of the components are mounted beneath the chassis. Diodes *D1-D9* and resistor *R5* are wired to an insulated terminal strip. Capacitors *C1-C4* are fastened to a system of terminal strips and solder lugs bolted to the chassis.

To make a neater looking job, the author cabled most of his wiring. This is not necessary, however, and the leads may be routed in the most convenient manner. Be sure, though, to use rubber grommets to protect all leads passing through the chassis.

-50-

On the Citizens Band

By DICK STRIPPEL, 2W1452



ALONG ABOUT the end of this year, Citizens Band licensees should pass the quarter-million mark: applications have been pouring into the FCC at the rate of better than 10,000 per month. And with all this activity on the band, many users have been giving serious thought to possible ways of reducing or eliminating interference.

Back in June, 1961, mention was made in this column of an inexpensive "scrambler" that was being developed for CB use. Since then, we have heard of another such device being readied for the market.

It's possible that enterprising CB'ers with the required electronics knowledge will be building adapters for their sets that will trip a squelch control when a certain coded signal is received. The use of tone signals to establish voice communication is permitted by the FCC, so perhaps we could borrow a page from the radio control boys and come up with something of this sort.

Here are two other "blue sky" ideas for gadgets which might stimulate some thinking among our readers who have construction experience:

- an adapter which would not only "open" the receiver when a certain signal was received, but would also indicate, perhaps by a flashing light, when the channel was in use by other parties.

- a device, possibly using a telephone dial, which could single out one of a group of mobile units, or permit a call from one mobile station to the base station without other mobiles hearing it.

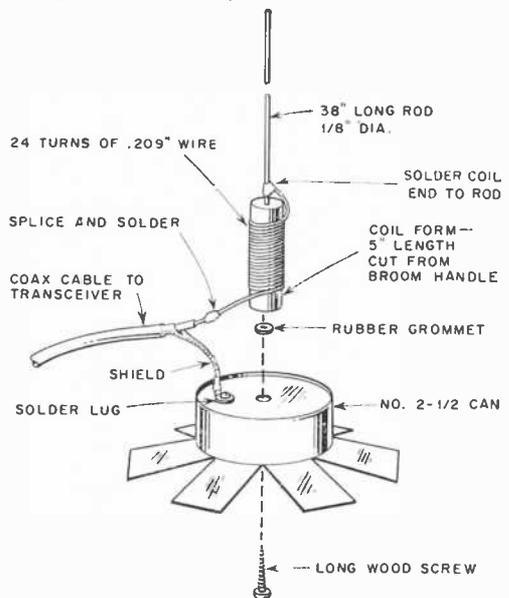
If foolproof units of this nature could be developed, which the average electronics hobbyist could build from readily obtainable parts, your CB Editor would like to be one of the first to know.

Tech Notes. From Almon Hyrum Clegg of Provo, Utah, comes this idea for a base-loaded mobile antenna. He says that it cost him about \$2.00 and

has given excellent results through snow, rain and hot sun.

The loading coil is wound on a 5" length of broom handle or dowel stock with .209" galvanized wire, and has 24 turns; leave 3 1/2" leads on the coil. Drill a 1/8" hole to a depth of 1 1/2" in one end of the coil form and insert a 38" length of spring steel wire. Then wrap the coil end around the wire whip and solder securely.

Mount the coil and whip on the end of a No. 2 1/2 can (soup can), using a long wood screw, and insert a rubber



grommet between the top of the can and the bottom of the coil for a shock absorber. With tin snips, cut the sides of the can to within one inch of the top and "flange out" the strips thus formed. Attach the center conductor of a length of coaxial cable to the free lead from the loading coil, and connect the coax braid—with a solder lug—to the can.

Now mount the antenna on the auto-
(Continued on page 112)

How to talk to Non-Hams

By FRED E. EBEL, W9PXA

IT HAPPENED during one of those awkward conversational vacuums abhorred by party hosts. My host, an up-and-coming insurance man, suddenly turned to me and said, "I understand you're a radio ham."

I produced one of those it's-really-nothing type of smiles. But secretly I was flattered. All eyes were on me, including those of three beautiful young ladies. And then came the question that must come to all hams at one time or another.

"What do hams talk about?"

My interrogator was a platinum blonde. When our eyes met, it was like an a.f.c. locking circuit. We resonated.

"Well," I began, "take that QSO—that means talk—I had with a ham in India the other day. He—"

"I know, I know!" broke in a bearded chap who had just recited some weird poetry while tapping a bongo rhythm on his knees. "This fellow had just been bitten by a king cobra. Your message made it possible to fly in antitoxin in the nick of time."

"No, this ham lives in the Himalayan country—"

The blonde squealed. "The home of the

man-eating tiger. The tiger had attacked a native and was roaming the village for its next victim. The ham wanted you to send in professional hunters."

I winced. "No, no, no! This ham was just an ordinary postal clerk. He gave me an S9 report and said my modulation was tremendous."

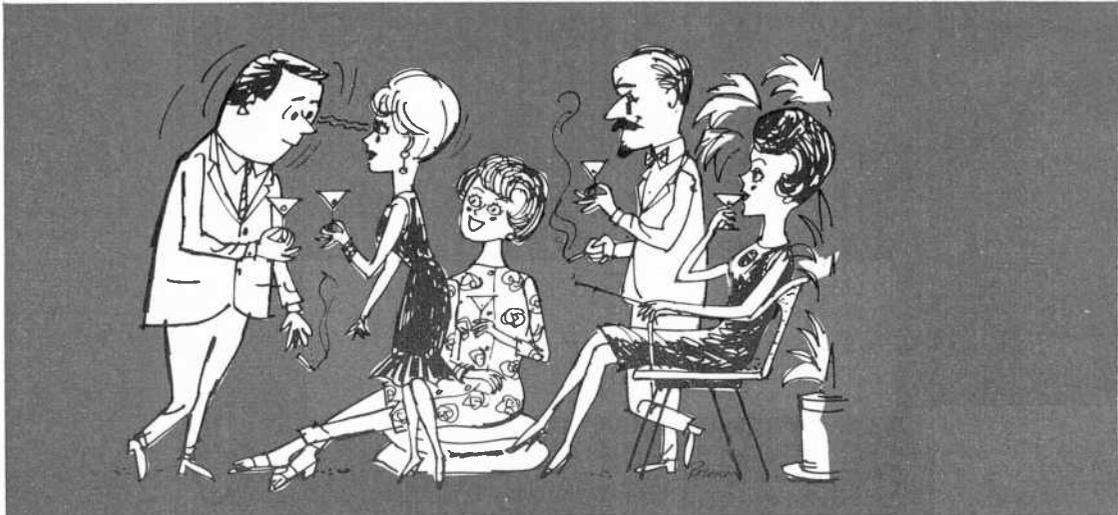
I had delivered this information with considerable heat. But all I saw were blank expressions. Perhaps they didn't understand. I cleared my throat. "You see, this ham was on the other side of the world, yet he gave me that wonderful S9 report. It meant I was really barreling in."

Another of those vacuums resulted. My host smiled through clenched teeth. His words would have made good battery acid. "How *very* interesting. Please tell us more."

"Yes," a pretty redhead said, "tell us, what do hams *really* talk about?"

I searched my brain for a typical example. I had it. A very interesting QSO during which my DX contact had successfully made two transmissions, though his antenna had fallen to the deck of the ship.

I managed a smile, then: "I once



talked to a ham who was the radio operator on a tramp schooner that was crossing the South China Sea, and here's the interesting part—

"The ship was caught in a typhoon, sinking fast. But thanks to your quick action, port authorities were notified and a rescue ship got there just in time," said the redhead, beaming like a quiz kid.

I wiped my brow, counted down from x minus nine to zero before I answered. "No, the interesting part was that the antenna wasn't in the air. It was lying on—" But I got no further.

"I know," blurted a shiny-eyed guest. "Mutiny had broken out on the ship. The captain already was bound to the mast and the crew of cutthroats was trying to get to the radio operator!"

The circuits in my brain shorted out. I jumped to my feet and ran out as I screamed: "Yes, that was it. Mutiny! The crew had gone berserk. The typhoon had ripped open the cages of the wild-animal cargo. Three gorillas, two tigers, an elephant, and five cobras were loose. The boiler had just exploded, and—and—" But the rest of my words were lost in the wind as I raced home, hat-and coat-less.

HOW LONG I stood behind the closed door of my apartment having visions of two men in white coats coming to get me, I don't know. But finally, letting out a huge sigh of relief, I sank into an easy

chair, after automatically switching on the TV set. It was time to review the past events with analytic calm. What had happened? What had caused me to blow my top?

Breaking into my thoughts came an excited voice . . . "CQ emergency! CQ emergency."

I looked up. There on the television screen, parka-clad and kneeling next to a dog sled, was a man speaking into the microphone of an emergency transceiver.

Then a cut to the radio shack of a young operator. "Read you loud and clear, old man. What is your message?"

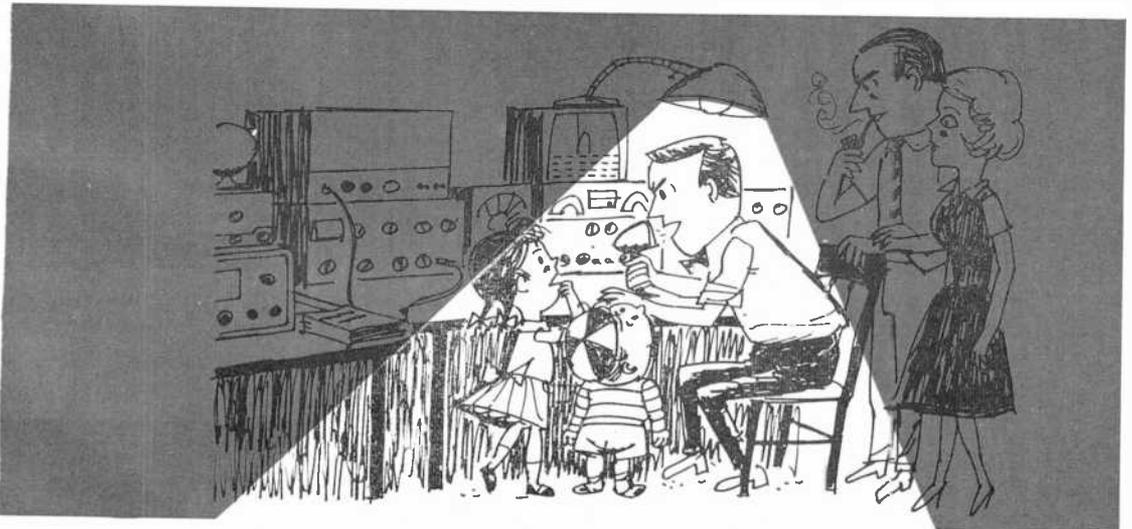
Cut back to the frozen north. "Dogs broke loose, partner broke legs in crevasse fall, wolves closing in. Need immediate help! Our position is—"

I switched off the TV, smiled. Of course, that was it. The public is conditioned to make-believe hams who have exciting adventures. For them, no talk about weather or technical stuff. These fictional hams are men of action, their conversation laced with "Medical help on the way" . . . "Stand by for instructions on emergency appendix operation. . ."

An idea played around in the back of my head. Why not give my friends a show? They wanted drama. I would give them drama. Hama-drama!

I immediately wrote a dramatic sketch of exciting, imaginative ham adventures and put it on tape. Being a mimic, I had

(Continued on page 122)



STEREO-itis[®] STEREO

as it affects *Cullen*



"I'm sorry to report that your living stereo . . . has died."



"I'd like to try that anesthesia by stereo, but all I have are Desi Arnaz records."



"It's about my husband and that damn stereo, Doctor."



"With three women in the house, I don't think I could stand stereo."



Across the Ham Bands

By
HERB S. BRIER
W9EGQ

DX'ING AND THE SUN

THE MOST EXCITING PART of ham radio for many old-timers and newcomers alike is working distant places (DX'ing). But, according to some of the stories heard on the ham bands lately (quoting or misquoting various authorities), the days of good DX conditions are gone for the next 5 to 50 years. These reports are based upon the decline of the present 11-year sunspot cycle and predictions that solar activity in the next few cycles will be low.

Actually, such pessimism is not justified. While the 10- and 15-meter ham bands are gradually becoming less reliable for regular long-distance work (say 700 to 12,000 miles), they will improve again in a few years. More important, DX conditions on the 40-, 80-, and 160-meter ham bands are good right now, and are getting better.

As we enter the 1961-62 DX season, 15 meters is livelier during the day than it was a few weeks ago, and even 10 meters occasionally shows some signs of life. In general, though, 20 meters remains the best daytime DX band. As day turns into night, however, these bands usually go dead, leaving only 40, 80, and 160 meters useful for regular DX work. Fortunately, static is now low on these bands, and nighttime signals from remote points are plentiful.

Ionization Effects. High-frequency radio waves, like light waves, travel in straight lines. Therefore, the curvature of the earth would limit our communications range to line-of-sight distances if these waves could not be 'bent' in some manner. Obviously, they can be . . . and this is where the sun comes in.

As the sun's rays beat down towards the earth, they ionize the atoms in the "ionosphere," a region located between about 45 and 300 miles above the earth.

These ionized particles gather together in layers, called the D, E, F1, and F2 layers, located at average heights of 45, 70, 140, and 200 miles, respectively, above the earth. At night, the D and E layers usually disappear completely, and the two F layers combine in a single layer approximately 175 miles high.

If the ionization is intense enough and the frequency is not too high, radio signals striking these layers are gradually bent, or refracted, back towards the earth. The D and E layers, being the

Novice Station of the Month

Danny Weatherman, KN9ZGQ, Waveland, Indiana, submitted the winning photo in this month's contest. Danny has worked 22 states so far with his Johnson "Adventurer" transmitter and Hallicrafters SX-43 receiver. His paper route and neighborhood odd jobs pay for his ham equipment, and he's saving now for a new transmitter to go with his General Class license—which is on the way.

Danny will receive a 1-year free subscrip-



tion 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.

farthest from the sun, are the least highly ionized. Frequencies above 7 mc. usually blast right through them. On good days, however, frequencies up to about 30 mc. are "fielded" by the F2 layer and reflected back to earth.

"Skip" Conditions. The distance between the transmitter and the point where the signal returns to the earth is called the "skip distance." Depending upon the height of the reflecting layer and the angle at which the signal strikes it, the skip distance varies from as little as zero miles on 80 meters in the daytime to over 500 miles at night. On 40 meters, daytime "skip" is currently over 500 miles, increasing to over 1000 miles at night;

during periods of intense sunspot activity. Since the sun is actually closer to the earth in winter, daytime m.u.f.'s are higher in winter than in summer. Winter days are short, however, and the m.u.f. starts decreasing as the sun sets—therefore, winter night m.u.f.'s are low.

Other Effects. Unpredictable solar explosions and magnetic storms (the latter often accompanied by visible *aurora borealis* displays) may blank out all DX signals for days at a time. On the other side of the ledger, intensely ionized patches often suddenly appear, near the height of the E layer, at any hour of the day or night, summer or winter. They will reflect signals, over distances up to

"Ike" Kisilevich, PJ2CR, P.O. Box 533, Curaçao, Dutch West Indies, spends most of his time on 15 meters. He's trying to work all states with his screen-modulated Globe Chief De Luxe—he QSL's 100%. More details on PJ2CR appeared in last month's "News and Views."



and on 20 and 15 meters, minimum "skip" is currently around 1000 and 1500 miles, respectively.

The maximum distance that can be covered in a single hop is approximately 2500 miles, representing a signal transmitted on a tangent to the earth and reflected by the F2 layer. Actual "one-hop" distances are usually less than this ideal figure, but the signal is not restricted to a single hop. It may bounce between the earth and the ionosphere several times, vastly increasing the transmitting range.

The highest frequency that can be used for "skip" communication between two specified areas is called the maximum usable frequency (m.u.f.). The m.u.f., depending as it does on the degree of ionization in the ionosphere, is highest

1400 miles, on frequencies up to 70 mc. Scientists call this phenomenon "sporadic-E propagation." Hams call it "short skip."

The sun also agitates the molecules in the "D region," the lowest of the ionized layers. The only effect of the D region seems to be to absorb low-frequency radio signals. Fortunately, it dissipates rapidly with the setting sun, which is why 80 meters improves so rapidly as dusk arrives.

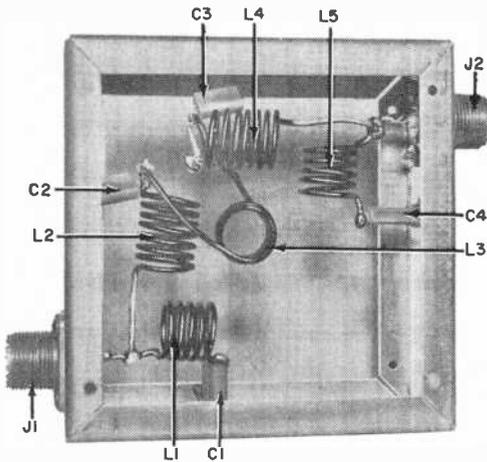
LOW-PASS FILTER REDUCES TVI

If your transmitter is reasonably well shielded, yet still radiates v.h.f. harmonics which interfere with your own or your neighbor's TV receiver, a low-pass filter may be the answer to your problems. The 50-ohm unit described here

works on all ham bands up to and including 10 meters. It also covers the 11-meter Citizens Band.

A model of this filter was connected to a 150-watt transmitter which had been seriously interfering with a TV set located five feet away. It reduced the TVI to a negligible amount—and a \$17.00 commercial low-pass filter, connected to the same rig, did no better. The unit is easy to put together and, if built according to instructions, requires no adjustment after completion.

Construction. The low-pass filter shown here is built in a 4" x 4" x 2" aluminum utility cabinet. The input and output connectors (*J1* and *J2*) are mounted on

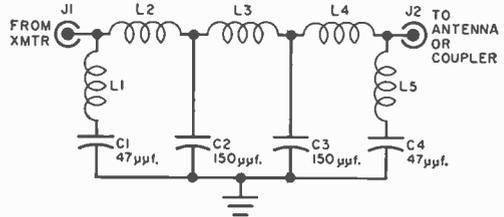


diagonally opposite sides of the box, approximately $\frac{3}{4}$ " in from the corners. Next, four holes are drilled, one on each 2" side of the box, to accommodate 6-32 screws for fastening the solder lugs to which the silver mica capacitors (*C1*, *C2*, *C3* and *C4*) are grounded. The lugs for grounding *C1* and *C4* are positioned approximately $1\frac{1}{2}$ " away from *J1* and *J2* respectively; those for grounding *C2* and *C3* are positioned approximately $2\frac{1}{2}$ " away (see photo).

After winding the five coils (see data in Parts List), carefully scrape and tin their leads. Also scrape the capacitor leads clean. These preparations permit rapid soldering of the connections, so the values of the capacitors will not be changed by excessive heat. Position the coils as shown in the photo to minimize

coupling between them, and cut the capacitor leads as short as possible.

Installation. Screw the covers on the box and, for best results, bolt the unit directly to the transmitter case. Use the minimum practical length of coaxial cable between the output connector of the transmitter and the input connector of the filter. You may be able to get



Low-pass filter circuit is quite simple, but parts placement and lead length are critical. If you use the layout shown and follow the instructions carefully, the filter should require no adjustment after it has been completed.

PARTS LIST

- C1, C4*—47- μ f., 5% silver mica capacitor (Cornell-Dubilier Series 22R or equivalent)
- C2, C3*—150- μ f., 5% silver mica capacitor (Cornell-Dubilier Series 22R or equivalent)
- J1, J2*—Chassis-type coaxial receptacle (Amphenol 83-1R or equivalent)
- L1, L5*—5 turns { wound from #14 enameled
- L2, L4*—7 turns { wire, $\frac{1}{2}$ " inside diam-
- L3*—8 turns { eter, 8 turns per inch
- 1—4" x 4" x 2" aluminum utility cabinet (Bud AU-1083 or equivalent)
- Misc.—Solder lugs, screws, nuts, etc.

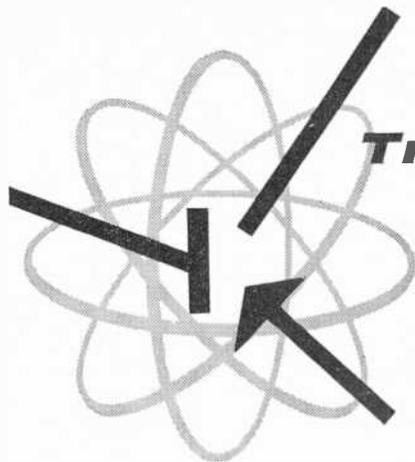
away without any cable at all by using an appropriate combination of coax fittings. Connect the coaxial line from the antenna or antenna coupler to the output connector of the filter.

The filter is designed to work with 52-ohm coaxial cable such as RG-8/U or RG-58/U. If the SWR on the line is low (under 2:1), the unit will safely handle 50 watts on 10 meters, over 100 watts on 15 meters, and over 200 watts on 20 meters or lower. Although tests were made at 150 watts input on 10 meters for short periods of time, regular operation at this power level would probably have resulted in blown capacitors.

(Continued on page 115)

Transistor Topics

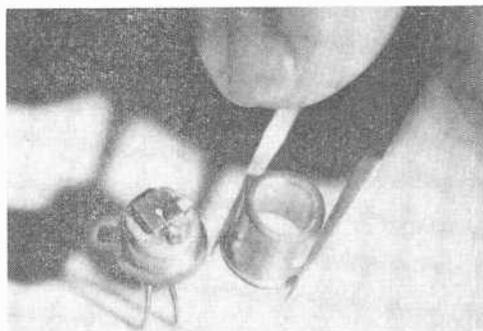
By LOU GARNER



NEW photoelectric semiconductor devices have been announced by two manufacturers: Philco (Lansdale, Pa.) and Solid State Products (1 Pingree St., Salem, Mass.). The Philco GAU-401 is a gallium arsenide photovoltaic detector with greater sensitivity than related devices such as photomultiplier tubes and silicon photodiodes, while the Solid State Products' "Photran" is basically a *pnpn* semiconductor switch that can be triggered by light energy instead of (or in addition to) an electrical signal.

Philco's GAU-401, shown in Fig. 1, provides high sensitivity for both visible and near-infrared radiation and, unlike conventional photodiodes, does not suffer a loss of sensitivity when exposed to daylight. In addition, it can be used at operating temperatures up to 120°C with no loss of sensitivity. The detector crystal itself is mounted in a standard

Fig. 1. Philco's GAU-401 photovoltaic detector uses standard TO-18 case modified to pass light.



TO-18 transistor case, modified by the addition of a small glass window.

Not yet in full production, the GAU-401 carries a price tag of \$100.00 (each) in small quantities. As with other semiconductor devices, this price will probably drop considerably when mass production is started.

In contrast to the GAU-401, which is essentially a photovoltaic cell, the "Photran" is roughly analogous to a light-controlled thyatron. Before light strikes its sensitive area, it is in a high-impedance (over 10 megohms) "off" state. When a light impulse is applied, it switches rapidly to a low-impedance (under 10 ohms) "on" condition and will remain "on" indefinitely until turned off electrically. The light signal used to trigger the Photran need only be a momentary pulse. In some respects, the operation of the Photran is similar to that of the "Dynaquad" discussed in the September column, except that light rather than a base current impulse provides the initial triggering signal.

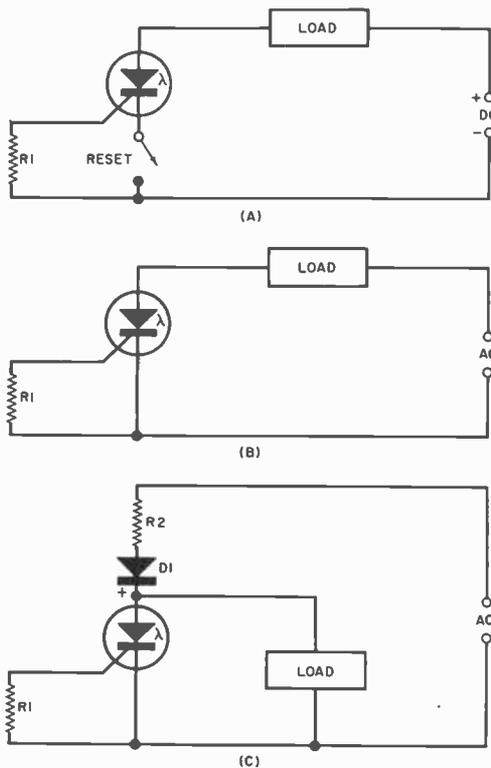
Typical Photran circuit arrangements are given in Fig. 2. Component values are not shown, since they will vary with the type of Photran, the supply voltage, the sensitivity desired, and the nature of the load. In Fig. 2(A), a d.c. power source is used, and the Photran acts as a light-actuated latching relay. When light strikes the device, power is applied to the load. Since the Photran continues to conduct even when the light is removed, an s.p.s.t. "reset" switch is provided to turn load power "off."

On the other hand, if an a.c. power source is used, as shown in Fig. 2(B), the Photran will provide half-wave rectified d.c. to the load when light is applied and no power when the light is removed. The Photran itself will not conduct during negative half-cycles whether or not light is applied; this means that it is

turned "off" automatically on alternate half-cycles, eliminating the need for a special "reset" switch.

A variation of the a.c. control circuit is shown in Fig. 2(C); here, power is applied to the load *only* when there is *no*

Fig. 2. Three typical circuits incorporating Solid State Products' "Photran." See text for details.



light on the Photran, and is removed when light strikes the unit.

As of this writing, prices range from \$14.00 for a 15-volt Type 3P15 Photran to \$46.00 for a 200-volt Type 3P200. In all types, the maximum continuous forward current (d.c.) is 300 ma., but 8-millisecond pulses of up to 5 amperes can be handled.

Both the GAU-401 and the Photran have potential applications in light sensing and measuring instruments, in automatic controls, in burglar alarms, and in some types of computers. As far as the hobbyist is concerned, these new units might be used in such items as automatic door openers, annunciators, automatic

light dimmers for automobiles, automatic light switches for the home, special types of light meters for photography, and . . . whatever an active mind can devise.

Reader's Circuit. The majority of low- to medium-priced commercial transistor testers are designed to make *static* tests, i.e., checks of the transistor's basic *d.c. characteristics*. In general, leakage is checked by applying a d.c. voltage to one pair of electrodes and noting current, while gain (or *beta*) is determined by applying a fixed d.c. base bias and comparing it to the corresponding collector current. A *dynamic* tester, on the other hand, checks the transistor's *a.c. characteristics*, i.e., its ability to amplify a small a.c. signal. Most dynamic testers are relatively expensive and are designed primarily for precision laboratory tests.

Seeking a simple technique for performing dynamic tests in his own workshop, reader E. S. Millman, W3WNE (5700 Ogontz Ave., Philadelphia 41, Pa.), has devised an interesting dual-purpose instrument: an easy-to-build and inexpensive transistor checker that can "double in brass" as a code practice oscillator. The circuit he used is shown in Fig. 3.

Assuming that a transistor is connected to the base (*B*), emitter (*E*), and collector (*C*) leads, we see that the unit is basically a modified Colpitts-type audio oscillator. Base bias is provided by voltage divider *R1-R2*, while *R3* serves to

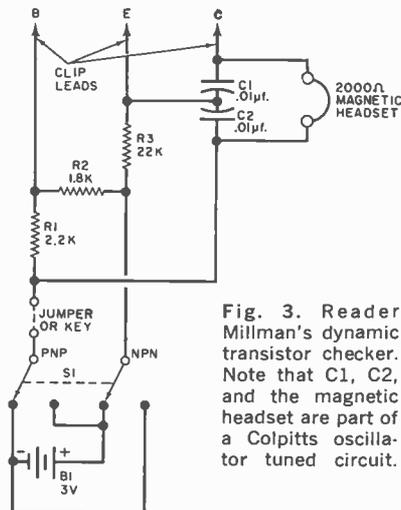


Fig. 3. Reader Millman's dynamic transistor checker. Note that *C1*, *C2*, and the magnetic headset are part of a Colpitts oscillator tuned circuit.

isolate the emitter electrode and to stabilize operation. The feedback necessary to start and maintain oscillation is furnished by a "tapped" capacitor made up of two units, *C1* and *C2*, in series; *C1* and *C2* form a resonant circuit with the inductance of the magnetic headphones used as a collector load. Operating power

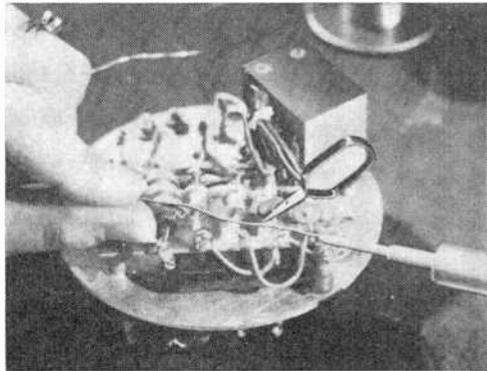
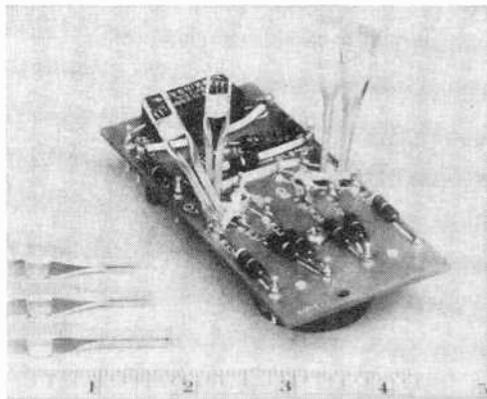


Fig. 4. Hunter Tools' miniature clip-on heat sink.

Fig. 5. MacDonald & Company's "Little Joe" units.



is furnished by a 3-volt battery, *B1*, through a polarity reversing switch, *S1*, to permit checks of both *pnp* and *nnp* types.

A duplicate instrument can be assembled in a single evening without trouble. All components are readily available and neither layout nor lead dress should be critical. Resistors *R1*, *R2* and *R3* are half-watt units; capacitors *C1* and *C2* are small paper or ceramic types, working voltage non-critical; and switch *S1* is a d.p.d.t. toggle, slide or rotary switch. The power supply is made up of

two penlight or flashlight cells connected in series (*B1*). Short, flexible leads terminated with miniature alligator clips are provided as transistor connectors, but a socket may be employed if you prefer. Standard 2000-ohm magnetic headphones are used.

In operation, the jumper is installed and *S1* is preset for the basic type of transistor to be checked. The test leads are connected to the transistor. If the transistor is "good," the circuit will oscillate and a tone can be heard in the earphones. If the transistor is excessively leaky or has low gain (or both) . . . or is shorted or open . . . the circuit will not oscillate. The instrument can be used as a CPO by installing a "good" transistor and replacing the jumper with a standard handkey.

Although W3WNE's dynamic tester is fairly reliable, it is not completely fool-proof. For best results, both static and dynamic tests should be made.

Product News. Recognizing that excessive heat while soldering can play havoc with semiconductors, two firms have recently introduced low-cost clip-on heat sinks. Hunter Tools (9851 Alburton Ave., Santa Fe Springs, Calif.) is producing miniature units made of BERYLCO 10 alloy and equipped with plastic-covered handles; illustrated in Fig. 4, these units carry stock number 51G. And MacDonald & Company (Glendale 6, Calif.) is offering a series of "Little Joe" aluminum units in three different sizes—see Fig. 5.

Radio Corporation of America (Semiconductor Division, Somerville, N. J.) has announced a new line of high-voltage silicon rectifiers having peak inverse voltage ratings from 1200 to 10,000 volts and average current ratings from 550 to 825 ma. at 60°C. These rectifiers are made up of a series of hermetically sealed diffused-junction rectifier cells shunted by RC voltage equalizing networks, and molded into a rugged case of insulating material.

Most of the large mail order supply houses have issued their 1962 catalogs, and the number of transistor items offered is amazing. Glancing through the new catalog put out by Radio Shack (730 Commonwealth Ave., Boston 17, Mass.), yours truly spotted such items

(Continued on page 110)

Three-Hand Soldering

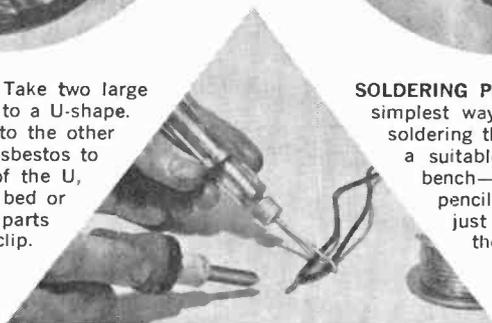
Suggested by **JOHN A. COMSTOCK**
(who has only two hands)



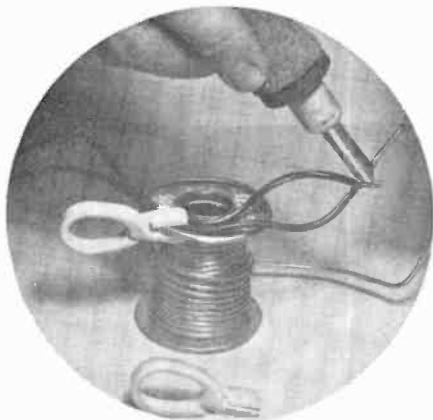
SOLDERING TABLE CLIP. Take two large tin can lids and bend one to a U-shape. Solder the ends of the U to the other lid. Now glue a piece of asbestos to the flattened-out bottom of the U, and use it as a soldering bed or table—you can hold small parts in place with an alligator clip.



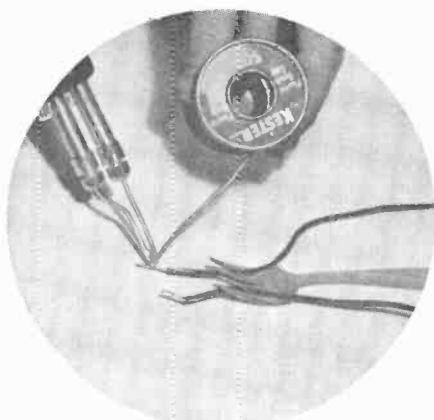
SOLDERING PENCIL WEDGE. One of the simplest ways to get a third hand for soldering those difficult jobs is to drill a suitable-sized hole in your workbench—then wedge the soldering pencil into the hole. Make the hole just big enough to squeeze in the cork barrel and line cord.



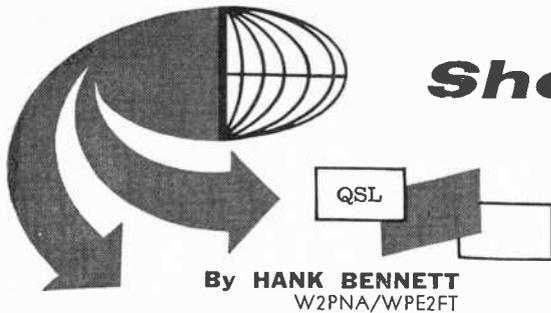
SCREWDRIVER THIRD HAND. To convert the handle of one of those interchangeable screwdriver sets into a soldering tool, cut off a 5" length of solder, loop it, and chuck it in the handle. Slip the loop over wires to hold them in place.



PLASTIC CLIP CLAMP. Keep a couple of those plastic curtain or drapery clips on your workbench, and the next time a three-hand soldering job is called for—clamp the work to your roll of solder.



SECOND-HAND FORK IS THIRD HAND. When your wife isn't looking, raid the kitchen and grab one of her old stainless steel forks for your workshop. You can use the tines to steady wires for tinning.



Short-Wave Report

By **HANK BENNETT**
W2PNA/WPE2FT

MORE QUESTIONS AND ANSWERS

IN JULY of this year, your Short-Wave Editor answered in print several questions that were being asked most frequently by the readers of this column. Judging from the mail since then, this question-and-answer format was well received, and many readers have asked that we do it again. As before, the questions listed below are typical ones.

Q: You have mentioned IRC's from time to time in connection with sending reports. What is an IRC? Where can they be obtained, how much do they cost, and what is their purpose?

A: International Reply Coupons (IRC's) are obtainable at post offices for 15 cents each. They are used when it is necessary to send postage to a foreign country. Needless to say, stations in foreign countries cannot use U.S. postage stamps on verifications sent into this country. However, if you furnish an IRC with your report, a foreign-country station can redeem it at the local post office for the postage needed to send you a reply by surface mail. If you would like to have an airmail

reply, you should include several IRC's with your report. Check with *your* local post office for airmail rates into the U.S.A. from other areas.

Q: Where can I obtain a general listing of amateur stations?

A: While this question is not really in the s.w. broadcast category, it is frequently asked. You can purchase the *Radio Amateur Callbook* (two volumes; one covering the U.S.A., the other listing foreign stations) from Callbook Magazine, 4844 West Fullerton Ave., Chicago 39, Ill., or from many of the wholesale radio parts shops. The American Edition, which costs \$5.00, is published in March, June, September and December, while the Foreign Edition (\$3.00) comes out in March and September.

Q: What can you tell me about radio clubs I might join?

A: We have a free leaflet available which lists several clubs: "Leaflet H—Clubs and Publications," and you can obtain
(Continued on page 88)

Clarence C. Huff, WPE6BL, Los Angeles, Calif., has been DX'ing on the medium waves since the 1920's. Four years ago he turned to short-wave DX'ing, with a Hallicrafters SX-100 receiver (shown) and a S-20R Sky Champion (not shown) as a standby.

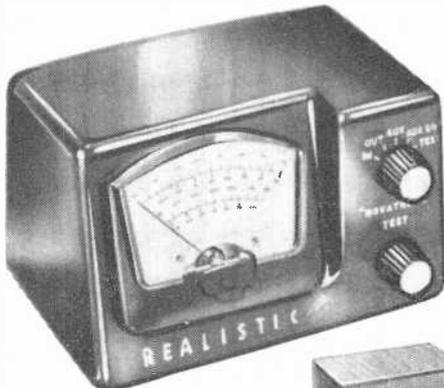
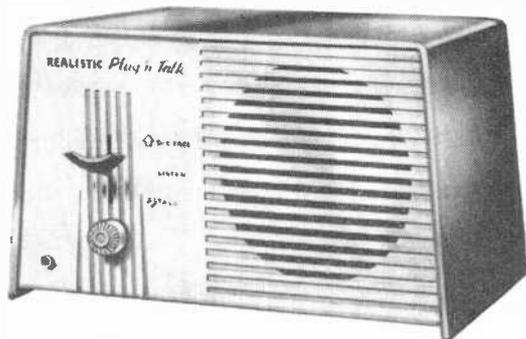


NOW! A FULL LINE OF FAMOUS **REALISTIC** ELECTRONIC KITS AT RADIO SHACK

- Easy to assemble—enjoy the pride of craftsmanship with very little effort.
- Save up to 42%! Put your savings into quality.
- Look like professionally assembled equipment and last as long.
- Widest assortment of designs to choose from

Radio Shack's whole new family of audio and test equipment kits employs the most advanced designs and engineering concepts known today! They meet the most exacting requirements in performance and appearance. They're easy and fun to build! Critical areas are pre-wired, factory-aligned. Even a novice can follow the simplified assembly manuals. And they're easy to own on No Money Down credit terms. Every kit backed by a money-back guarantee. We show here six kits newly introduced in our exciting 1962 Catalog.

Plug 'n Talk Intercom Kit—Beautifully styled by Realistic! New completely wireless 2-station Intercom System—easy to build yourself. Operates over 1 mile! 3-position switch: talk, listen, permanent. "B" speaker for good voice reception. Rear panel squelch control. Front panel volume. Use it in kitchen, bedroom, sickroom—ideal as a baby-sitter. 117-V power line circuit operates anywhere. 90LX844—\$29.50



Realistic "Novatherm" Kit—the one and only professional-type electronic thermometer for the home! Compact, supremely accurate! Use in refrigerator, freezer, fish aquarium, lab. At flip of switch reads 2 temperatures in 2 different locations. Instantaneous readings from -20°F . to 120°F . Portable, uses 13c battery. Has "accessory probe"—use in freezer, liquid, even acid. Thermister type. Meter— $0-200\mu\text{a}$ D'Arsonval movement. All 1% resistors. 94LX095—\$19.95

Radio Shack's 1962 Line of Kits Includes All These:

- Stereophonic Preamplifier Kit
- Stereo 140W Basic Amplifier Kit
- 40 Watt Stereo Amplifier Kit
- Complete Stereo System Kits
- Universal Multiplex Adapter Kit
- Hi-Fi 12 Watt Amplifier Kit
- FM Adapter Kit
- Stereo Balance Meter Kit
- Wireless Intercom Kits
- Deluxe Signal Generator Kit
- Deluxe VTVM Kit
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a copy of it for return postage. In the near future, your Short-Wave Editor plans to run a complete listing of clubs in this column, and all of the presently operating clubs are invited to write in. We would like to know the club name, dues and membership requirements, type and frequency of publication (if any), how long the club has been in existence, total number of members, type of organization (one man or full board), and future plans. Any awards program that might be in effect would also be of interest. Although we need all of this information, we will be glad to withhold certain items if requested (such as the total number of members, for instance).

Q: Why is it that I am unable to tune in many (or any!) of those so-called rare stations that you list? Others seem to hear them.

A: If we could all hear those rare stations, my friend, we wouldn't be able to refer to them as "rare," would we? To log the real rough ones, you must have (1) an infinite quantity of patience and (2) good ears. A "hot" receiver with a good antenna/ground system will also help. Some of the rare stations are only heard by the experts at infrequent intervals—one a month, perhaps—but those fellows will park on one frequency night after night and continually tune and listen.

(Continued on page 125)

CROSSWORD PUZZLE

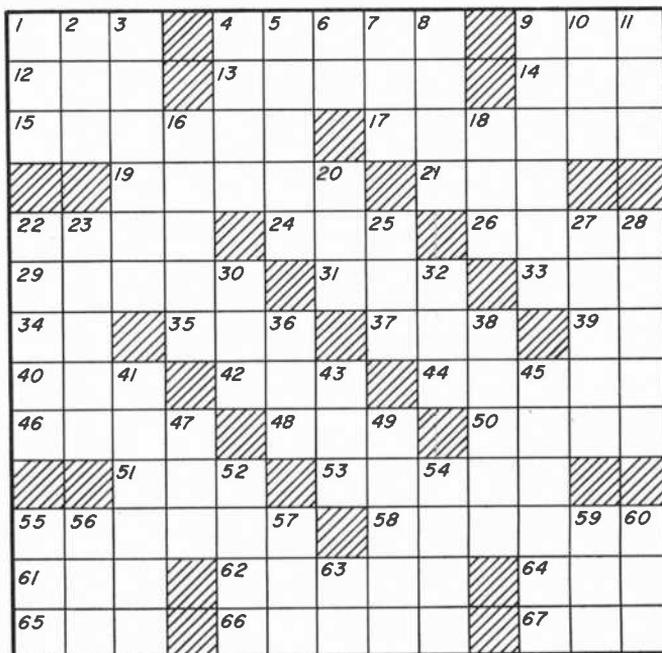
By Thomas Windser

ACROSS

- 1 Rotating part found in analog computers.
- 4 Part of a circuit having one function.
- 9 Street: German abbrev.
- 12 _____ Khan.
- 13 Planet path.
- 14 It disappears when you stand up.
- 15 Type of lever switch.
- 17 Element used in the coating of vacuum-tube cathodes.
- 19 Standing waves have them.
- 21 Boy.
- 22 Length times width.
- 24 Single-cotton-covered: abbrev.
- 26 One of equal rank.
- 29 Units of electrical power.
- 31 Unit of work.
- 33 Electronics corporation: abbrev.
- 34 Preposition.
- 35 Distress call.
- 37 Rowing implement.
- 39 High frequency: abbrev.
- 40 Rhode Island Academy: abbrev.
- 42 _____ generator used on color TV sets.
- 44 Common use for No. 47 bulb.
- 46 Ages.
- 48 _____ cell uses liquid electrolyte.
- 50 Girl.
- 51 Eight: combining form.
- 53 Titled.
- 55 Lead coming from the side of a component.
- 58 Small capacitor in series with main tuning capacitor.
- 61 Suffix used in chemistry.
- 62 Loudspeaker diaphragms.
- 64 Ohm's law: abbrev.
- 65 Found inside thyratrons.
- 66 Potentiometer networks used in audio distributing circuits.
- 67 Notes in music.

DOWN

- 1 _____ whisker.
- 2 In the past.
- 3 Used to attract iron.
- 4 Made a sale.
- 5 Sometimes suitable for supporting an antenna.
- 6 Type of battery pack used in portables.



- 7 A plate machined to hold other parts in place.
- 8 Latin phrase meaning "and others."
- 9 Moving part in potentiometer.
- 10 Greek letter.
- 11 Dial calibration used in tachometers.
- 16 Some believe they eat tin cans.
- 18 Light blow.
- 20 Single-cotton-enameled: abbrev.
- 22 Conscious of.
- 23 Type of FM detector circuit.
- 25 Cathode-ray oscilloscope: abbrev.
- 27 Seen on radar screens.
- 28 Floating platforms.
- 30 Soil.
- 32 Spark-_____ transmitter.
- 36 Plant seeds.
- 38 Vexed.
- 41 Diodes have them.
- 43 _____ calls used by CB'ers.
- 45 Adjustable attenuator network.
- 47 Science: abbrev.
- 49 Sounds are _____ at recording studios.
- 52 Diplomacy.
- 54 Matter has _____.
- 55 Slang for station equipment.
- 56 Collection of information.
- 57 Cut off.
- 59 Electronic industry association: abbrev.
- 60 Railroads: abbrev.
- 63 Continent: abbrev.

(Answers on page 114)

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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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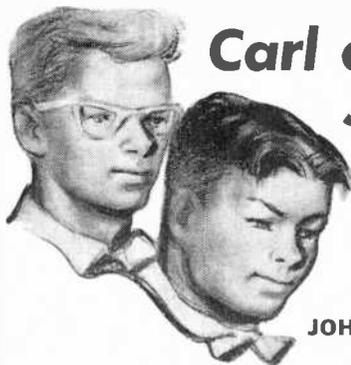
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Carl and Jerry

By
JOHN T. FRYE
W9EGV

SUBSTITUTE SANDMAN

SELDOM were Carl and Jerry separated for long, but this weekend Jerry had gone home from the university to attend the wedding of a cousin while Carl remained at school to do some studying. It was now Sunday evening, and Carl drifted into his and Jerry's room for the umpteenth time to see if his pal had returned. Bruce, a fat boy from across the hall, tagged along.

Carl pushed open the door to discover Jerry speakingly slowly and distinctly into the microphone of a tape recorder sitting on the desk before him:

"The derivative of a quotient of two functions is the denominator times the derivative of the numerator minus the numerator times the derivative of the denominator, all divided by the square of the denominator. . . the derivative of the product of two functions is—, oh, hi there, Carl; hi, Bruce."

"Hah! You finally flipped and started talking to yourself!" Bruce exclaimed with a loud laugh. "I knew that math would get you."

"Not quite yet," Jerry answered with a good-natured grin, stopping the moving tape. "I just decided to do a little experimenting with 'sleep learning.'"

"You mean you put material you want to memorize on tape and play it back to yourself while you're asleep? I've heard of that. It's a lot of hogwash," Bruce sneered as he flung himself on his back on Carl's bed.

A frown crossed Carl's face, but he turned to his friend and said quietly, "Tell me about it, Jerry."

"I've wanted to try it for a long time. My curiosity was aroused when I saw a *You Asked For It* program on which a

student, under test conditions, learned conversational French while asleep in seven days time, and then demonstrated his ability to a French language authority in front of the camera. After that I saw an Art Linkletter program on



which Art talked to some sort of Chinese government official, speaking to him in Mandarin Chinese, one of the world's most difficult languages. Art learned his Mandarin in ten nights of sleep learn-

ing, and the Chinese gentleman said Art could travel in China and make himself understood by anyone who spoke the Mandarin dialect.

"Candidly, I don't know if the method works or not; but the military forces used it during the war to speed up the learning of code and languages. Many medical authorities, however, scoff at the idea that the brain can learn anything while it is asleep and resting. Others, on the other hand, maintain that the brain never really rests; and they prove it with electroencephalograph waves."

"I didn't think anyone believed what they saw on TV any more," Bruce scoffed.

"Oh, I don't know," Carl retorted, getting a little red in the face. "Ignorance comes in several flavors. It's just as stupid to deny a truth as it is to believe a lie. Our English teacher says education is the process by which a person moves from cocksure ignorance to thoughtful uncertainty. Some folks are hard to move."

(Continued on page 94)

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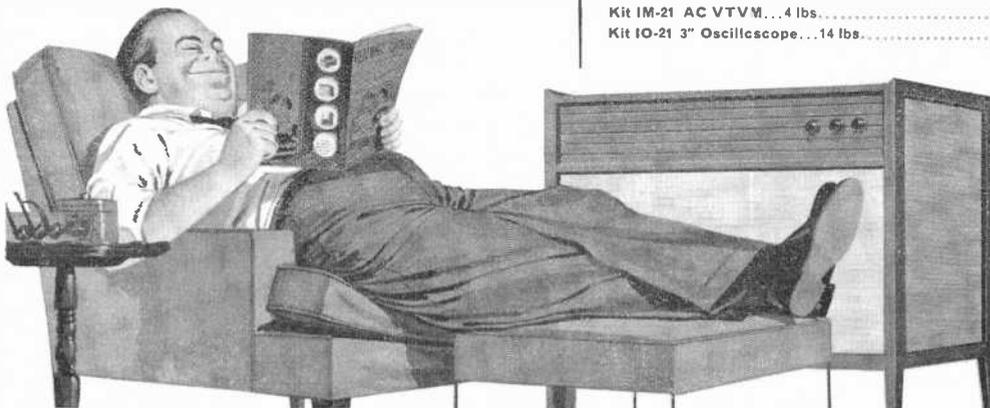


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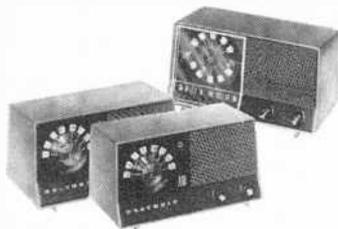


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Jerry hastily broke in, "The output of the recorder is fed into this under-the-pillow speaker so I can hear the material I want to memorize without the sound disturbing anyone else in the room—namely you, Carl. The tape recorder is controlled by this clock-timer salvaged from a clock-radio. The 'sleep switch' will keep the recorder running for better than an hour after I go to bed, and the turn-on mechanism will start the recorder again about an hour before I expect to awaken. These two periods, at the beginning and end of a night's rest, are supposed to be the best for implanting material in the memory. The recording, of course, is on an endless loop of tape so that it will repeat over and over."

"This doesn't look like an endless loop of tape to me. It looks more like a tape cartridge of some sort," Carl observed as he looked closely at the small roll of tape nesting inside the round, clear plastic case.

"It's a Cousino 'Audio Vendor,'" Jerry explained. "It was originally designed to repeat an advertising message over

and over; hence, the name. Here's how it works.

"Inside the case is a 225-foot roll of special, friction-free tape. The inside end of the roll is brought out at a small angle through this slit in the top of the case and is fed past the record and playback heads into the tape-pulling mechanism. As the end comes out from between the capstan and pinch-roller, it's spliced to the outside end of the roll of tape. The roll turns freely on a spool inside the case, so that the tape which is pulled from the inside of the roll is constantly fed back on the outside. Since no tension is put on the tape, it doesn't wind tightly; and the whole thing works very smoothly. The cartridge is placed on the supply roll spindle simply for support at the proper level. Turning of the supply or take-up spindles has nothing to do with the operation."

"How long does it play?" Carl asked.

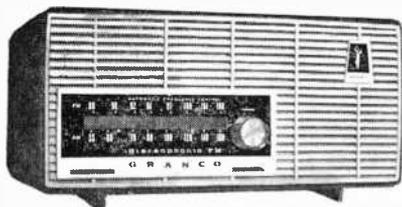
"At 3 3/4 ips, it runs for about twelve minutes; but I've put a Möbius loop in the tape to make it run twice that long."

"Hold it!" Carl interrupted. "Don't give me that Möbius loop jazz. A Mö-

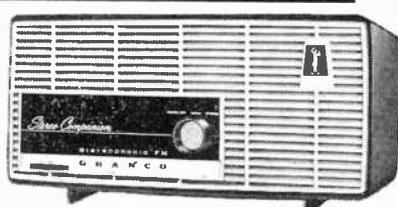
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Phone: OXford 1-5331

ONE OF THE LARGEST INVENTORIES IN THE COUNTRY

ELECTRONIC MARKET 1 YEAR GUARANTEED RADIO-TV TUBES

All tubes not necessarily new, but may be electronically perfect factors. Tubes of used, each clearly marked. All tubes individually boxed and numbered. Partial listing only—thousands more tubes in stock.

001	354	6A8	6AT7	6C4	6C6	6C8	6D6	6E6	6F6	6H6	6J6	6K6	6L6	6M6	6N6	6P6	6Q6	6R6	6S6	6T6	6U6	6V6	6W6	6X6	6Y6	6Z6	7A6	7B6	7C6	7D6	7E6	7F6	7G6	7H6	7J6	7K6	7L6	7M6	7N6	7P6	7Q6	7R6	7S6	7T6	7U6	7V6	7W6	7X6	7Y6	7Z6	8A6	8B6	8C6	8D6	8E6	8F6	8G6	8H6	8J6	8K6	8L6	8M6	8N6	8P6	8Q6	8R6	8S6	8T6	8U6	8V6	8W6	8X6	8Y6	8Z6	9A6	9B6	9C6	9D6	9E6	9F6	9G6	9H6	9J6	9K6	9L6	9M6	9N6	9P6	9Q6	9R6	9S6	9T6	9U6	9V6	9W6	9X6	9Y6	9Z6	0A6	0B6	0C6	0D6	0E6	0F6	0G6	0H6	0J6	0K6	0L6	0M6	0N6	0P6	0Q6	0R6	0S6	0T6	0U6	0V6	0W6	0X6	0Y6	0Z6	1A6	1B6	1C6	1D6	1E6	1F6	1G6	1H6	1J6	1K6	1L6	1M6	1N6	1P6	1Q6	1R6	1S6	1T6	1U6	1V6	1W6	1X6	1Y6	1Z6	2A6	2B6	2C6	2D6	2E6	2F6	2G6	2H6	2J6	2K6	2L6	2M6	2N6	2P6	2Q6	2R6	2S6	2T6	2U6	2V6	2W6	2X6	2Y6	2Z6	3A6	3B6	3C6	3D6	3E6	3F6	3G6	3H6	3J6	3K6	3L6	3M6	3N6	3P6	3Q6	3R6	3S6	3T6	3U6	3V6	3W6	3X6	3Y6	3Z6	4A6	4B6	4C6	4D6	4E6	4F6	4G6	4H6	4J6	4K6	4L6	4M6	4N6	4P6	4Q6	4R6	4S6	4T6	4U6	4V6	4W6	4X6	4Y6	4Z6	5A6	5B6	5C6	5D6	5E6	5F6	5G6	5H6	5J6	5K6	5L6	5M6	5N6	5P6	5Q6	5R6	5S6	5T6	5U6	5V6	5W6	5X6	5Y6	5Z6	6A6	6B6	6C6	6D6	6E6	6F6	6G6	6H6	6J6	6K6	6L6	6M6	6N6	6P6	6Q6	6R6	6S6	6T6	6U6	6V6	6W6	6X6	6Y6	6Z6	7A6	7B6	7C6	7D6	7E6	7F6	7G6	7H6	7J6	7K6	7L6	7M6	7N6	7P6	7Q6	7R6	7S6	7T6	7U6	7V6	7W6	7X6	7Y6	7Z6	8A6	8B6	8C6	8D6	8E6	8F6	8G6	8H6	8J6	8K6	8L6	8M6	8N6	8P6	8Q6	8R6	8S6	8T6	8U6	8V6	8W6	8X6	8Y6	8Z6	9A6	9B6	9C6	9D6	9E6	9F6	9G6	9H6	9J6	9K6	9L6	9M6	9N6	9P6	9Q6	9R6	9S6	9T6	9U6	9V6	9W6	9X6	9Y6	9Z6	0A6	0B6	0C6	0D6	0E6	0F6	0G6	0H6	0J6	0K6	0L6	0M6	0N6	0P6	0Q6	0R6	0S6	0T6	0U6	0V6	0W6	0X6	0Y6	0Z6	1A6	1B6	1C6	1D6	1E6	1F6	1G6	1H6	1J6	1K6	1L6	1M6	1N6	1P6	1Q6	1R6	1S6	1T6	1U6	1V6	1W6	1X6	1Y6	1Z6	2A6	2B6	2C6	2D6	2E6	2F6	2G6	2H6	2J6	2K6	2L6	2M6	2N6	2P6	2Q6	2R6	2S6	2T6	2U6	2V6	2W6	2X6	2Y6	2Z6	3A6	3B6	3C6	3D6	3E6	3F6	3G6	3H6	3J6	3K6	3L6	3M6	3N6	3P6	3Q6	3R6	3S6	3T6	3U6	3V6	3W6	3X6	3Y6	3Z6	4A6	4B6	4C6	4D6	4E6	4F6	4G6	4H6	4J6	4K6	4L6	4M6	4N6	4P6	4Q6	4R6	4S6	4T6	4U6	4V6	4W6	4X6	4Y6	4Z6	5A6	5B6	5C6	5D6	5E6	5F6	5G6	5H6	5J6	5K6	5L6	5M6	5N6	5P6	5Q6	5R6	5S6	5T6	5U6	5V6	5W6	5X6	5Y6	5Z6	6A6	6B6	6C6	6D6	6E6	6F6	6G6	6H6	6J6	6K6	6L6	6M6	6N6	6P6	6Q6	6R6	6S6	6T6	6U6	6V6	6W6	6X6	6Y6	6Z6	7A6	7B6	7C6	7D6	7E6	7F6	7G6	7H6	7J6	7K6	7L6	7M6	7N6	7P6	7Q6	7R6	7S6	7T6	7U6	7V6	7W6	7X6	7Y6	7Z6	8A6	8B6	8C6	8D6	8E6	8F6	8G6	8H6	8J6	8K6	8L6	8M6	8N6	8P6	8Q6	8R6	8S6	8T6	8U6	8V6	8W6	8X6	8Y6	8Z6	9A6	9B6	9C6	9D6	9E6	9F6	9G6	9H6	9J6	9K6	9L6	9M6	9N6	9P6	9Q6	9R6	9S6	9T6	9U6	9V6	9W6	9X6	9Y6	9Z6	0A6	0B6	0C6	0D6	0E6	0F6	0G6	0H6	0J6	0K6	0L6	0M6	0N6	0P6	0Q6	0R6	0S6	0T6	0U6	0V6	0W6	0X6	0Y6	0Z6	1A6	1B6	1C6	1D6	1E6	1F6	1G6	1H6	1J6	1K6	1L6	1M6	1N6	1P6	1Q6	1R6	1S6	1T6	1U6	1V6	1W6	1X6	1Y6	1Z6	2A6	2B6	2C6	2D6	2E6	2F6	2G6	2H6	2J6	2K6	2L6	2M6	2N6	2P6	2Q6	2R6	2S6	2T6	2U6	2V6	2W6	2X6	2Y6	2Z6	3A6	3B6	3C6	3D6	3E6	3F6	3G6	3H6	3J6	3K6	3L6	3M6	3N6	3P6	3Q6	3R6	3S6	3T6	3U6	3V6	3W6	3X6	3Y6	3Z6	4A6	4B6	4C6	4D6	4E6	4F6	4G6	4H6	4J6	4K6	4L6	4M6	4N6	4P6	4Q6	4R6	4S6	4T6	4U6	4V6	4W6	4X6	4Y6	4Z6	5A6	5B6	5C6	5D6	5E6	5F6	5G6	5H6	5J6	5K6	5L6	5M6	5N6	5P6	5Q6	5R6	5S6	5T6	5U6	5V6	5W6	5X6	5Y6	5Z6	6A6	6B6	6C6	6D6	6E6	6F6	6G6	6H6	6J6	6K6	6L6	6M6	6N6	6P6	6Q6	6R6	6S6	6T6	6U6	6V6	6W6	6X6	6Y6	6Z6	7A6	7B6	7C6	7D6	7E6	7F6	7G6	7H6	7J6	7K6	7L6	7M6	7N6	7P6	7Q6	7R6	7S6	7T6	7U6	7V6	7W6	7X6	7Y6	7Z6	8A6	8B6	8C6	8D6	8E6	8F6	8G6	8H6	8J6	8K6	8L6	8M6	8N6	8P6	8Q6	8R6	8S6	8T6	8U6	8V6	8W6	8X6	8Y6	8Z6	9A6	9B6	9C6	9D6	9E6	9F6	9G6	9H6	9J6	9K6	9L6	9M6	9N6	9P6	9Q6	9R6	9S6	9T6	9U6	9V6	9W6	9X6	9Y6	9Z6	0A6	0B6	0C6	0D6	0E6	0F6	0G6	0H6	0J6	0K6	0L6	0M6	0N6	0P6	0Q6	0R6	0S6	0T6	0U6	0V6	0W6	0X6	0Y6	0Z6	1A6	1B6	1C6	1D6	1E6	1F6	1G6	1H6	1J6	1K6	1L6	1M6	1N6	1P6	1Q6	1R6	1S6	1T6	1U6	1V6	1W6	1X6	1Y6	1Z6	2A6	2B6	2C6	2D6	2E6	2F6	2G6	2H6	2J6	2K6	2L6	2M6	2N6	2P6	2Q6	2R6	2S6	2T6	2U6	2V6	2W6	2X6	2Y6	2Z6	3A6	3B6	3C6	3D6	3E6	3F6	3G6	3H6	3J6	3K6	3L6	3M6	3N6	3P6	3Q6	3R6	3S6	3T6	3U6	3V6	3W6	3X6	3Y6	3Z6	4A6	4B6	4C6	4D6	4E6	4F6	4G6	4H6	4J6	4K6	4L6	4M6	4N6	4P6	4Q6	4R6	4S6	4T6	4U6	4V6	4W6	4X6	4Y6	4Z6	5A6	5B6	5C6	5D6	5E6	5F6	5G6	5H6	5J6	5K6	5L6	5M6	5N6	5P6	5Q6	5R6	5S6	5T6	5U6	5V6	5W6	5X6	5Y6	5Z6	6A6	6B6	6C6	6D6	6E6	6F6	6G6	6H6	6J6	6K6	6L6	6M6	6N6	6P6	6Q6	6R6	6S6	6T6	6U6	6V6	6W6	6X6	6Y6	6Z6	7A6	7B6	7C6	7D6	7E6	7F6	7G6	7H6	7J6	7K6	7L6	7M6	7N6	7P6	7Q6	7R6	7S6	7T6	7U6	7V6	7W6	7X6	7Y6	7Z6	8A6	8B6	8C6	8D6	8E6	8F6	8G6	8H6	8J6	8K6	8L6	8M6	8N6	8P6	8Q6	8R6	8S6	8T6	8U6	8V6	8W6	8X6	8Y6	8Z6	9A6	9B6	9C6	9D6	9E6	9F6	9G6	9H6	9J6	9K6	9L6	9M6	9N6	9P6	9Q6	9R6	9S6	9T6	9U6	9V6	9W6	9X6	9Y6	9Z6	0A6	0B6	0C6	0D6	0E6	0F6	0G6	0H6	0J6	0K6	0L6	0M6	0N6	0P6	0Q6	0R6	0S6	0T6	0U6	0V6	0W6	0X6	0Y6	0Z6	1A6	1B6	1C6	1D6	1E6	1F6	1G6	1H6	1J6	1K6	1L6	1M6	1N6	1P6	1Q6	1R6	1S6	1T6	1U6	1V6	1W6	1X6	1Y6	1Z6	2A6	2B6	2C6	2D6	2E6	2F6	2G6	2H6	2J6	2K6	2L6	2M6	2N6	2P6	2Q6	2R6	2S6	2T6	2U6	2V6	2W6	2X6	2Y6	2Z6	3A6	3B6	3C6	3D6	3E6	3F6	3G6	3H6	3J6	3K6	3L6	3M6	3N6	3P6	3Q6	3R6	3S6	3T6	3U6	3V6	3W6	3X6	3Y6	3Z6	4A6	4B6	4C6	4D6	4E6	4F6	4G6	4H6	4J6	4K6	4L6	4M6	4N6	4P6	4Q6	4R6	4S6	4T6	4U6	4V6	4W6	4X6	4Y6	4Z6	5A6	5B6	5C6	5D6	5E6	5F6	5G6	5H6	5J6	5K6	5L6	5M6	5N6	5P6	5Q6	5R6	5S6	5T6	5U6	5V6	5W6	5X6	5Y6	5Z6	6A6	6B6	6C6	6D6	6E6	6F6	6G6	6H6	6J6	6K6	6L6	6M6	6N6	6P6	6Q6	6R6	6S6	6T6	6U6	6V6	6W6	6X6	6Y6	6Z6	7A6	7B6	7C6	7D6	7E6	7F6	7G6	7H6	7J6	7K6	7L6	7M6	7N6	7P6	7Q6	7R6	7S6	7T6	7U6	7V6	7W6	7X6	7Y6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bis loop is formed by cutting a loop of tape, twisting one end through 180 degrees, and splicing the ends back together, right?"

"Right," Jerry answered with an amused smile.

"So, okay! One time around, the coated side is pressed against the heads and you get a normal recording; the next revolution, the plastic backing is against the heads and you have a very weak and unnatural recording, even with 1/2-mil Mylar which places the minimum space between the magnetic coating and the heads. A Möbius loop is fine to insert a space between repeats of the message recorded on the coated side, but it's strictly blah as far as doubling the playing time is concerned."

"That's true with ordinary tape," Jerry commented; "but remember I said this tape was special. It's coated on *both* sides. One side is red and the other black, but you can see under a microscope that both sides are covered with magnetic particles. Naturally a Möbius loop of this stuff gives you a continuous recording for two complete revolutions of the loop."

"Why fool around with that?" Bruce asked as he heaved himself to a sitting position. "Let me hypnotize you into remembering the derivative formulas. Carl will tell you that I can put you under."

Carl answered Jerry's questioning look. "He can hypnotize a person, all right. Just before you got back a bunch of us were watching him hypnotize Mike Garrick down the hall. He had Mike doing all sorts of kookie things. Bruce claims he learned to hypnotize out of a book."

"Guess I'll skip the offer and stick to my sleep learning," Jerry said firmly. "I don't know much about hypnotism, but I never thought it was a toy to be played with. No one is going to hypnotize me unless he has respect for his powers."

Bruce's small blue eyes glinted with anger. He suddenly got to his feet, lumbered over to the tape recorder, started the tape moving, and chanted:

*D of x, g of x, dielectric K,
Latera recta, operator j;
Secant, asymptote, coordinate pair,
Old Jerry is a root-mean-square!*

November, 1961

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"Knock it off, Bruce," Carl said sharply.

Bruce laughed mockingly, but he swaggered out the door Carl suggestively held open for him.

"What a character!" Jerry mused as he backed up the tape and erased the doggerel. "As soon as I dictate a few more formulas I'll take you over to the Co-Rec Gym and give you a couple of lessons in badminton."

IT WAS a couple of hours later when the boys returned to their room and got ready for bed. Jerry set his timer clock and reached over to turn on the recorder. "Hm-m-m, that's funny," he muttered. "The recorder is still warm. It must have gotten pretty hot when I was recording."

The lights went out, and Carl could hear the faint whirring of the recorder. Before long, Jerry's rhythmic breathing indicated he was asleep, and Carl was not far behind. When Carl awoke the next morning, the sleep-learner was already up and had switched off the tape recorder.

"Well," Carl asked as he picked up a towel and headed for the shower, "do you feel any smarter?"

"No, I can't say I do," Jerry admitted; "but at least the playing of the tape didn't keep me awake. I don't remember hearing more than the first five minutes of it."

The boys had no time to discuss the matter further. Their busy schedule kept them on the hop until finally Bruce, Carl, and Jerry met in math, the final class of the day. The period was about half over when Mr. Carney, the instructor, mentioned the word "derivative." As soon as he heard this, Jerry jumped to his feet and began to recite in a loud sing-song:

*D of x, g of x, dielectric K,
Latera recta, operator j;
Secant, asymptote, coordinate pair,
Old Jerry is a root-mean-square!*

The shocked silence that followed was finally broken by Mr. Carney. "You may sit down, Mr. Bishop," he remarked acidly; "and may I suggest that there might be a better time and place for you to rehearse your football cheers, or whatever they are?"

Jerry, red to the tips of his ears,

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slumped down in his seat while his classmates, including Carl, stared at him in wonder. Across the room, Bruce grinned broadly at Jerry's obvious discomfiture.

Nothing else happened until the very end of the class, when Mr. Carney was giving the assignment and again used the word "derivative." Instantly Jerry was on his feet repeating the ridiculous poem. He broke off in the middle of it and bolted from the room with Carl right behind him.

"What's the matter with you?" Carl demanded of his white-faced chum as



they walked through the gathering dusk toward the residence hall.

"I don't know; I simply don't know!" Jerry admitted miserably. "All at once I had an uncontrollable urge to stand up and say that stupid verse. I wanted to stop but I couldn't. It was like a nightmare."

"The word 'derivative' seemed to touch you off," Carl mused. "Do you suppose messing around with this sleep-learning thing may have unhinged you just a little?"

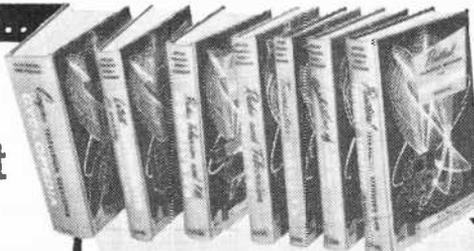
"Naw, it's not that—I don't think. What beats me is how I had that verse down so pat after only hearing it once. Ordinarily I'm not too good at memorizing, but I didn't hesitate a bit when I was reciting the thing."

"Come on," Carl said as he broke into a trot. "You've given me an idea. Perhaps you heard that verse more than once. I want to listen to that sleep-tape of yours."

A FEW MINUTES LATER the boys were in their room playing the tape. The whole first half of it had obviously

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been prepared at home, for it was given over to a background of organ music against which Jerry spoke slowly and soothingly of the vanishing cares of the day, of muscles relaxing, of nerves quieting, of the body sinking down, down, down into sweet and restful slumber, and of the mind being prepared to accept effortlessly but to hold firmly the material soon to be offered it.

Carl started yawning just listening to it, but he snapped wide awake as the voice suddenly changed. It was unmistakably Bruce's voice now coming from the recorder:

"You will not awaken, Jerry. Instead you will sink deeper and deeper into sleep. Now you are *really* asleep. You cannot awaken until I tell you to. You are asleep; yet you can hear everything I say. You will do what I tell you to do. Tomorrow, in math class, whenever you hear the word 'derivative,' you will stand up immediately and recite this beautiful poem:

*D of x, g of x, dielectric K,
Latere recta, operator j;*

*Secant, asymptote, coordinate pair,
Old Jerry is a root-mean-square!*

All who hear you will admire you for being able to memorize and recite so well. When you wake up in the morning, you will feel rested and refreshed. You will remember nothing of this, but you *will* recite the poem when you hear the word 'derivative.'"

"Just as I suspected," Carl said as he switched off the recorder. "That hood sneaked in here while we were over at the gym last night and recorded that post-hypnotic suggestion over the top of your derivative formulas. No wonder you remembered the poem after having it drilled into your subconscious for about two hours! You said he wasn't going to hypnotize you; he was determined to show you he could—hey, where you going?"

Jerry, a grim look on his face, was headed for the door. "I'm thinking that our playful friend, Bruce, ought to add phrenology to his study of the occult sciences," he grated. "I'm going to give him some bumps to practice on!" -50-

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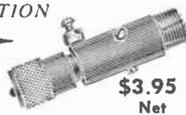
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Tips and Techniques

NEON NIGHT-LIGHT

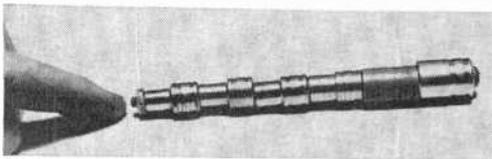
The relatively new high-current neon lamps now on the market are bright enough to serve as useful night-lights. The unit pictured here incorporates an NE-51H, the high-current counterpart of the NE-51. To construct it, solder one lead of a 25,000-ohm, ¼-watt resistor to one lamp contact and a short piece of wire to the other—then slip the whole assembly into the neck of a rubber plug. Finish the job by wiring the free ends of the resistor and wire to the prongs of the plug. A careful check for shorts should be made before you finally attempt to plug in the night-light.



—R. L. Winklepleck

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—Homer L. Davidson

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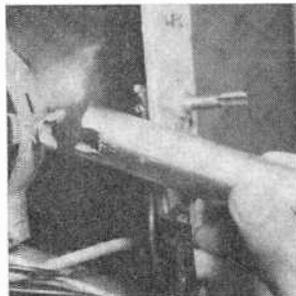
(Continued from page 99)

mounting it by cutting off the closed end and enlarging the hole in the other end to take a small screw. These cartridges can also be used for insulated pacraders, stand-offs, or shaft extensions.

—David Keller

WRENCH FOR WING NUTS

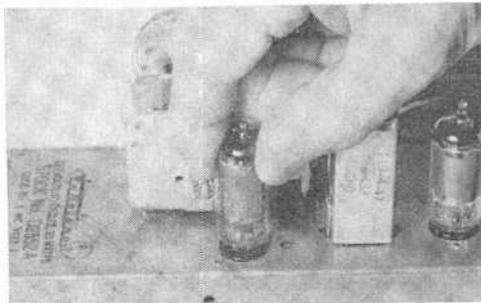
Antenna installers and other electronics workers know that tightening wing nuts is apt to be tough on the fingers. Pliers aren't really fitted for the job either—it's hard to get a good grip and the nut is often marred or bent. A wrench made from a 5"-length of broom handle is the answer. Just saw a 1"-deep slot in one end, making it wide enough to fit over the largest nut apt to be encountered.



—John A. Comstock

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When a radio is noisy, erratic, or intermittent, sometimes the only trouble is that corrosion has spoiled the connection between tube pins and their contacts. This condition is usually found in sets that have been operated for years without a change of tubes. To check for it, rock each tube in its socket with a circular motion. If you find a noisy connection, grasp the guilty tube firmly and move it straight up and down in



its socket several times—the friction should clean both pins and contacts. If the corrosion is especially bad, try scraping the pins and using a commercial contact cleaner.

—Carl Dunant

(Continued on page 103)



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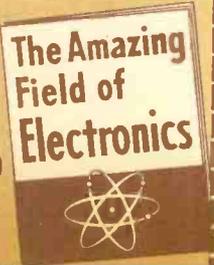
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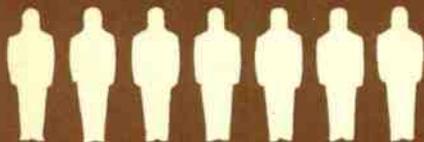
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"THE FINEST JOB I EVER HAD" is what Thomas Bilak, Jr., Cayuga, N. Y., says of his position with the G. E. Advanced Electronic Center at Cornell University. He writes, "Thanks to NRI, I have a job which I enjoy and which also pays well."



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."



FROM FACTORY LABORER TO HIS OWN BUSINESS that rang up sales of \$158,000 in one year. That's the success William F. Kline of Cincinnati, Ohio, has had since taking NRI training. "The course got me started on the road," he says.

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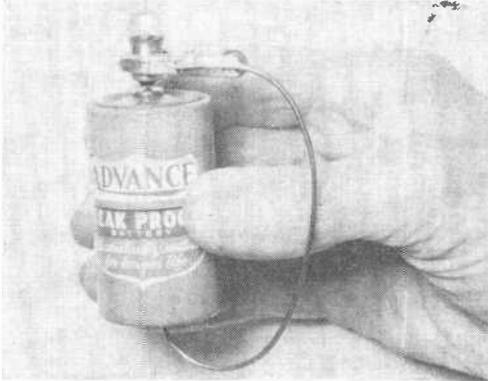
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Tips

(Continued from page 100)

BULB AND CELL TESTER

A simple device for checking flashlight batteries or bulbs can be made from a 6" length of No. 12 or No. 14 wire and an alligator clip. Form the wire as shown in the photo, sharpen one end, and solder the other

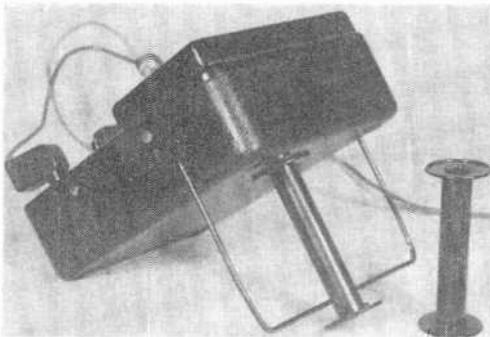


end to the alligator clip. The jaws of the clip are bent slightly for a better grip on bulb bases. To use the tester, just slip a bulb into the alligator clip and bridge it across the ends of the cell. If you use a No. 112 bulb (1.2 volts) and let it burn for a while, you'll be able to judge the condition of the cell; doubtful cells might be strong at first, then die down.

—Art Trauffer

SPOOL PROPS MULTIMETER

If your multimeter has a wire handle, you can easily make a prop to hold the instrument in a convenient viewing position. Sim-



ply saw a slot in one end of a film spool and fit it over the handle as shown. Get a plastic spool if possible—you'll find that it's easier to saw than a metal one.

—Jerome Cunningham

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- 40 2-Watt Resistors \$1
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- 35 POWER RESISTORS Asst. to 50 W to 10,000 ohms. Worth \$12.
- CRYSTAL PHONE \$1 Sens: test. / cord & plug.
- 60 COILS & CHOKES RF. ant. osc. slug-tuned. \$1 I.F. Worth \$16.
- 10 "POLY" BOXES Snap-top covers; sizes to \$1 4". Worth \$3.
- 70 TERMINAL STRIPS 1 to 10 tie points. Worth \$1 85.
- \$25 SURPRISE PAK Wide variety of usable radio-TV-hobby parts. \$1
- 65 Condenser Special Incl: discs, ceramic, molded, mica. Worth \$12.
- 60 Tubular Condensers Papers, molded, oils, etc. \$1 ramiel to 1 mf to 600V. Worth \$16.
- 300-FT. HOOKUP WIRE Asst. covers, insulation. \$1 sizes. Worth \$10.
- 10 Transistor Sockets Fit all types of transistors. \$1 and mini tubes, too.
- 50 Disc Condensers Asst. .0001 to .01 to \$1 1000V. Worth \$10.
- CRYSTAL MIKE mini 1 1/2" sq. 100-7000 cps. \$1
- 1 1/2 LBS. HARDWARE Nuts, bolts, etc. Wide variety. Handy shop asst.
- 15 AC-DC LINE CORDS 2-cond. rubber, w/molded plugs, short lengths.
- 2000 OHM PHONE With cord & plug, ear loop. Worth \$3.
- 15 ROTARY SWITCHES Asst. gangs, contacts; for slow circuit changing. Worth \$17.
- 10 Electrolytic Cnd'm's Incl: can, paper types. \$1 Duals too! Worth \$12.
- 35 SILVER MICAS 1 & 5% asst. values. Finest mica made. Worth \$8
- 60 MICA CONDENSERS Incl: silver tool. .00025 to \$1 .01 to 600V. Worth \$30.
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- 100 Ceramic Condensers Incl: discs too! Worth \$10. \$1
- 60 RADIO 'N' TV KNOBS Asst: colors, sizes, shapes! \$1 some worth \$1 ea.
- 10 PANEL SWITCHES Micros, power, rotary types. \$1 Exc. variety. Worth \$10.
- 10 VOLUME CONTROLS Asst. to 1 meg. Some with switch. Worth \$18.
- 10 GERMANIUM DIODES Glass-sealed, like 1N34. \$1
- 2 SUN BATTERIES \$1 Lite sensitive CR5, 2x1 1/2"
- 65 RESISTOR SPECIAL Carbon, precisions, W.W. \$1 to 50W, 1% to 10W.
- 10 115V AC SWITCHES Toggle type, SPST, DIP, etc. A shop must, 115V AC.
- 30 PRINTED CIRCUITS Resistors & condenser net-works.
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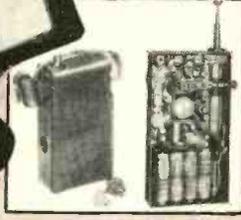


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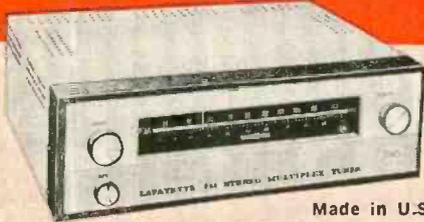
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Ready for Stereo and no Adapter Needed . . . opening a new era in stereo, the new Lafayette Criterion FM Stereo Multiplex Tuner is entirely self contained with its own built-in multiplex facilities. Capable of achieving the highest Laboratory Standards, its exceptional selectivity and sensitivity together with drift-free AFC performance insures effective reception of even the weakest multiplex or monaural FM signals.



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KT-250A **74.50** in Kit Form LA-250A **99.50** Completely Wired

- Separate Bass & Treble Controls
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- Response: 15-40,000 cps \pm .5db (at normal listening level)
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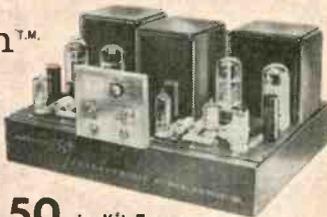
Pacesetter quality, performance and design. Features include: unique "Blend" control for continuously variable channel separation—from full monaural to full stereo, 4-position Selector, Mode, Loudness and Phase switches. Individual bias and balance controls. Harmonic distortion, less than 0.25%. IM distortion, less than .5%. Hum and noise 77db below full output.

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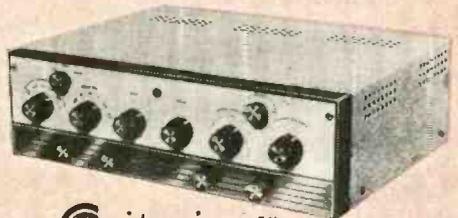


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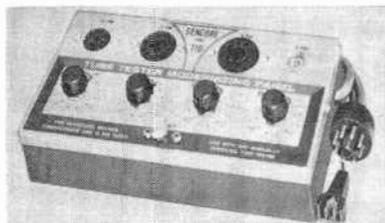
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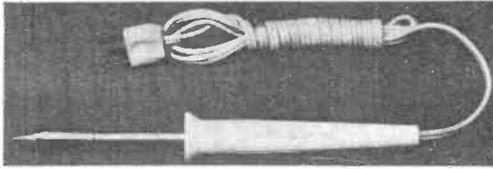
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close control of output voltage. Sweep width is continuously variable (from 0 to over 20 mc. on high-frequency ranges). Internal blanking eliminates the return trace and provides a zero voltage reference line. The marker pips indicate spot frequencies on the displayed waveform without distorting its shape. Selling price of the G-32 in kit form is \$85.95, \$119.95 completely wired and tested. (Paco Electronics Co., Inc., 70-31 84th St., Glendale 27, N.Y.)

CRT REJUVENATOR/TESTER

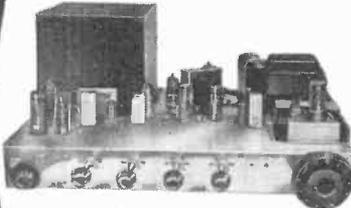
Specifically designed for TV service technicians, the Model TE-19 CRT rejuvenator/



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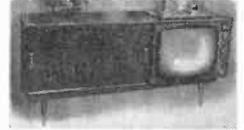
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Here's the firm grounding you need, for what makes computers and data processors tick. Study this book: it gives bed-rock principles rather than the gadgets that go so quickly out of date. Study this, and you'll soon be able to talk the computer language. Most of the book goes from theory to basic building blocks, then on to showing how these blocks combine into computers. Capstone of the book: the description of the making of a specimen computer. 1961. 403 pages. \$8.50.

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products.

(Continued from page 107)

removal from the set. The TE-19 checks for emission, shorts and leakage; repairs interelement shorts and open circuits. Each gun of a color tube is checked and corrected separately. The unit, including tube socket adapters to accommodate 110° tubes, is priced at \$32.50. (*Lafayette Radio Electronics Corp.*, 165-08 Liberty Ave., Jamaica 33, N.Y.)

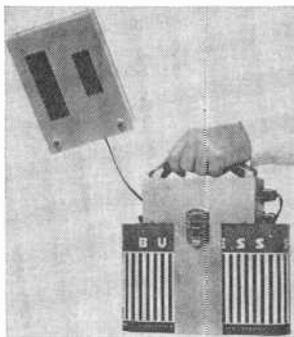
ALL-PURPOSE VTVM

A versatile and rugged all-purpose VTVM for radio, TV, and experimental work is offered by the *Precision Apparatus Co., Inc.*, Glendale 27, L.I. The Model 48 employs a balanced vacuum-tube bridge circuit for all voltage and resistance measurements. It provides 7 d.c. voltmeter ranges (7 1/8 megohms/volt sensitivity on the 1.5-volt range), 7 a.c. voltmeter ranges (peak to peak and r.m.s.), 7 decibel ranges, and 7 ohmmeter ranges. A 3-way probe permits rapid, accurate testing. Price, \$55.95.



ULTRAVIOLET KIT

The hobbyist or young scientist needs only a screwdriver to assemble the "Mineralight Gemini" ultraviolet kit.



Equipped with both long- and short-wave lamps, it can be used for fluorescent analysis, mineral exploration, and gem identification. The lamps operate from a wall plug or, with the aid of the "Mineralight

Power Pack" adapter, from a 6-volt battery (illustrated). The kit costs \$19.95, the adapter, \$14.95. (*Ultra-Violet Products, Inc.*, 5114 Walnut Grove Ave., San Gabriel, Calif.)

SUBMINIATURE UTILITY LAMP

Small in size but high in intensity, the Tensor Model 5979 subminiature all-purpose utility lamp can easily be carried in an overnight bag. The lamp, which measures only 3" x 2" x 7" when folded, gives more than adequate light for hobby work, reading or shaving. Available in a variety of colors, the Model 5979 is priced at \$14.95. (Tensor Electric Development Co., Inc., 1873 Eastern Parkway, Brooklyn 33, N. Y.)



velopment Co., Inc., 1873 Eastern Parkway, Brooklyn 33, N. Y.)

BATTERY ELIMINATOR/CHARGER

The EICO Model 1064 extra-low ripple battery eliminator and charger provides the undistorted d.c. necessary for servicing transistorized equipment or for any other application where ripple must be held to a minimum. Its two ranges (0-8 volts @ 10 amperes, continuous, and 0-16 volts @ 6 amperes, continuous) are controlled by a variable transformer and monitored by a voltmeter and dual-range ammeter. More than enough current is available for battery charging, and all parts are operated well below their stated voltage and current ratings. The Model 1064 sells for \$43.95 in kit form, \$52.95 wired. (EICO Electronic Instrument Co., Inc., 33-00 Northern Blvd., L.I. City 1, N.Y.)



RADIO CONTROL RECEIVER

A new ruggedized, single-channel receiver has been released by Gyro Electronics Co., 36 Walker St., New York 13, N. Y. Said to be the best available for proportional control, the "Tone King" has a tuning range of 26.995 to 27.255 mc. and is actuated by a 400-800 cycle tone. Use of a vacuum-tube detector and 2-stage transistor amplifier in-

dures maximum sensitivity and temperature stability. The relay is a standard 5K Gem. Power requirements: 1½ volts "A" and 22½ volts "B"; weight, 2.2 oz.; size, 1" x 1½" x 2". The unit is priced at \$24.95.

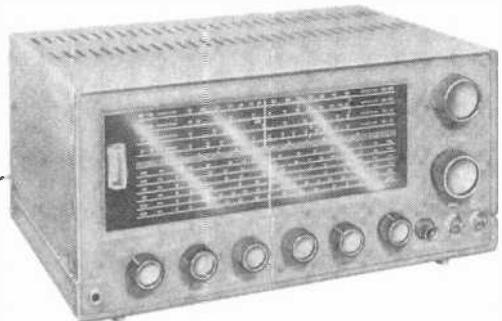
VERSATILE TUBE TESTER

Claimed to be obsolescence-proof, the Model 700 dynamic mutual conductance tube tester checks both old and new TV and radio tubes, including Nuvistors, 10-pin tubes, and 12-pin Compactrons. European hi-fi tubes, voltage regulators, and most industrial types are also accommodated. A multiple-socket section provides a quick check for most standard tubes, and other types are tested in a simplified switch section. The tester, which automatically compensates for line voltage variations, sells for \$169.95. (B&K Manufacturing Co., 1801 W. Belle Plaine Ave., Chicago 13, Ill.)



HAM COMMUNICATIONS RECEIVER

Lafayette Radio's Model HE-30, a 0.55-30 mc. communications receiver, is just the thing for today's crowded ham bands. Its illuminated slide-rule dial has markings every 5 kc. on 80 and 40 meters, every 20 kc. on 20 and 15 meters, and every 50 kc. on 10 meters. The receiver's sensitivity is 1.0 microvolt with a 10-db signal-to-noise ratio, and there is a built-in Q-multiplier for better selectivity. Among the HE-30's other features are an automatic noise limiter, an adjustable BFO, and a transformer-



powered full-wave rectifier circuit. Price, \$99.95; an additional \$7.95 will buy you a matching Model HE-11 external speaker. (Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.)

Transistor Topics

(Continued from page 84)

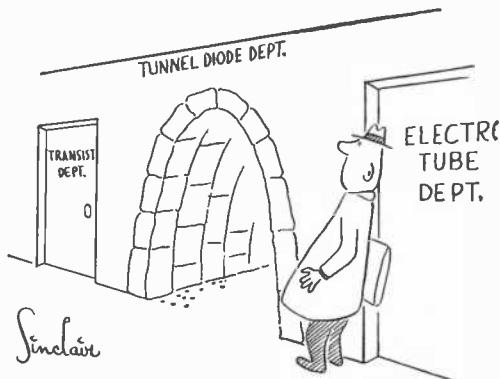
as: a 50-watt stereo amplifier; a transistorized thermometer; a 10-transistor portable radio; a 5-band portable receiver; a number of hearing aids, including eyeglass styles; miniature tape recorders, power megaphones, intercoms; transistorized CB equipment; and a variety of kit and component bargains, including high-frequency transistors for \$1.65 and "packs" of four *pnp* or *npn* transistors for 98 cents.

Specs Got You Down? The interpretation of semiconductor data sheets can be a real chore. Even experienced design engineers run into trouble on occasion. One reason for the difficulty is the many different ways in which a basic characteristic can be specified, depending on individual manufacturer preferences. High-frequency characteristics, for example, may be specified as *alpha* cutoff, *beta* cutoff, figure of merit, gain-bandwidth product, or, in the case of switching units, as switching speed in microseconds. Another reason is that "maximum" ratings must be correlated with circuit conditions.

Motorola has taken a giant step toward eliminating the mystery of data sheets with the publication of a useful little booklet entitled "How To Get More Value Out of a Transistor Data Sheet." For your *free* copy, write to Motorola Semiconductor Products, Inc., 5005 East McDowell Road, Phoenix 8, Arizona, and request Bulletin No. PX-104.

That does it for now. We'll have more info and news in December.

—Lou



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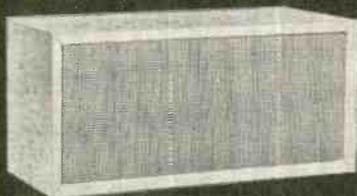
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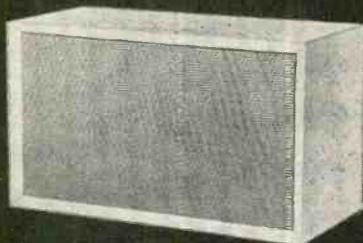


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These units also available in Lafayette Radio Stores or through Lafayette's mail order division.

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*Your Account Number appears directly above your name on the mailing label.)

On the Citizens Band

(Continued from page 75)

mobile roof with plastic tape applied in long strips. (Tape placed on the can's sharp edges will protect your car's finish.) Then run the coax to your transceiver through a window. Note that no holes need be drilled and the antenna can be removed with no after-effects.

Cut Thermal Drift. With the cold weather coming upon us in many parts of the nation, CB'ers using tunable receivers in their cars might notice what they consider to be excessive warm-up drift. Temperature compensation is a difficult thing to accomplish to perfection when you consider that the range of temperature in a mobile unit might be from below zero (if the car is parked outside overnight) to above 100 degrees when the set warms up.

If you do park your car out-of-doors during the winter, don't turn your transceiver on until your car heater is going strong. You'll cut thermal drift in the receiver and lessen the chance of cracking the glass on a tube or two when the tubes warm up.

New CB Products. In line with the idea of selective calling and communications, the Martin Development Company has announced the availability of a CB-



BEEPER. A transistorized 1000-cycle tone generator designed for use with any transceiver, the BEEPER measures only 2" x 3" x 4" and is finished in attractive antique black and gray hammertone.

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WORLD WIDE COMPANY
1212 TOWNE WAY DRIVE EL MONTE, CALIFORNIA

Two models are available, a de luxe self-powered unit, and a unit which takes its power either from the transceiver or a separate source. The manufacturer states that transceiver connections are easily made. For further details, write to P. O. Box 82, San Antonio, Texas.

An interesting adaptation of an antenna technique used on jets and guided missiles is represented by the new General Electromagnetics Corp. "Omni-Slot Boundary Antenna." The manufacturer of this broadband vehicular antenna



claims that the device has the same gain as a full $\frac{1}{4}$ -wave vertical antenna, yet its circular design places it only two inches above the car roof. Three models are being made, one maintaining full efficiency over CB frequencies plus the amateur 10- and 6-meter bands. Fading and blind spots are said to be eliminated, and full gain at high vehicular speeds is claimed. Contact this company at 11719 East Washington Blvd., Whittier, Calif., for further information.

"CB News and Views." That's the name of an outstanding publication in "Chicagoland," and the official voice of the Citizens Radio League (Box 28, Northlake, Ill.). Each month's issue spotlights a club member as "Personality of the Month," and other items tell of the various activities of the club and its members. Although this is only a two-sheet publication, it's printed by offset and runs some excellent-quality photographs.

Two items in a recent issue of "CB News and Views" especially caught our eye, since they are subjects which probably concern CB'ers everywhere. The first item, headed "No Exclusive Channels," dealt with the problem of who has the prior right to the use of a particular channel—a Civil Defense Net or a private individual. The club paper

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pointed out that regulations provide for the shared use of all CB channels. In the event that a private party wants to use a channel on which a CB drill is being held, he can request the CD net to stand by. The only possible exception would be if the net were actually handling emergency traffic, but in this situation all other civilian communications would probably be closed down anyway.

The second item concerned a cross-country "Mayday." A CB'er aboard his boat was in distress on Lake Superior. Two operators, one in Chicago and another in Duluth, Minn., heard his call and telephoned the Coast Guard. Meanwhile, skip signals from Texas were booming in. But when the Texas operators were informed of the emergency, they stood by.

The channel on which this little drama took place? Of all the ones to choose, Channel 11! While we do offer a hearty "well done" to all those stations who participated, even if it was only by *not* transmitting, the implications behind this incident should be clear. In every call area, Channel 11 is over-crowded, while many others, including Channel 13, are empty.

We'd like to make a strong plea for the organized monitoring of Channel 13 in areas where boating is popular, and for a continuous "watch" by motels, restaurants, etc., of Channel 15, the semi-official "national travel channel." -30-

Solution to Crossword Puzzle

(Puzzle appears on page 88)

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

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Across the Ham Bands

(Continued from page 81)

News and Views

Gary Yantis, KØBHM, 10809 Johnson Dr., Shawnee, Kansas, whose Novice station photo was the July contest winner, brings us up to date on his activities. Gary now has his General Class ticket, and has become a DX and contest man. "If there is a big 'pile up' after a rare DX station, look for me at the bottom of the pile," he reports. Gary has earned the following certificates so far: WAC, WAS, WAK, WWC, CP-20, and RCC. He is also very close to DXCC. WAC is "Worked All Continents," WAS is "Worked All States," CP-20 stands for "Code Proficiency 20 WPM," RCC is "Rag Chewers' Club," and DXCC is "DX Century Club," but I have no idea what the other two are. . . .

"Ken," KN3OEO, 909 Blunston St., Columbia, Pa., offers to help you obtain your Novice license. He operates on 40 meters with a Knight T-50 transmitter and a Knight R-100 receiver. . . .

Ron Pavlucik, KN1REN, 87 Clover St., Stratford, Conn., worked 10 states in two months on 80 meters with his Heathkit DX-60 feeding a 65' end-fed antenna. Then he tried 15 meters and worked three new states in two days. Ron receives on a National NC-54.

Tim Wright, KNØBFR, Hamburg, Iowa, has worked 33 states, Canada, and Puerto Rico

in seven months on the air, operating on 40 and 15 meters. He also earned a 15-wpm code-proficiency certificate. . . .

Art Kobres, K4FWJ, 3904 San Juan St., Tampa, Fla., worked 20 states the first two days after getting his Novice ticket. It took another five months to work the other 30 states. Art also worked all continents as a Novice. He used a Knight T-50 transmitter feeding a great variety of antennas from "long wires" to Cubical Quads, and a Hallicrafters S-53A aided by a Q-multiplier in running up this record. As a General, Art is now using a Heathkit DX-100B transmitter and a Hammarlund HQ-110C receiver.

Bob Hough, WN4JF, 3824 Cambria St., Lynchburg, Va., receives on a National HRO-7, which he says was original equipment on Noah's Ark. With it and his EICO 720 transmitter feeding a dipole and a couple of long-wire antennas—not all at once—he worked 21 states his first month on the air. He spends most of his time on 80 and 40 meters, dipping into 15 meters for an occasional contact. . . .

Cary Africk, WV2SYD, 3739 Neptune Ave., Brooklyn 24, N. Y., only has room for a 15-meter dipole, which is just 10' high; but in five days on the air, he made 22 contacts in four states. An EICO 720 transmitter generates his r.f., and an old Hallicrafters S-20R, plus a Heathkit Q-Multiplier, draws in the signals.

Ira Reed Moore reports that his boss and "pardner," **W4TRQ**, Orlando, Fla., who also operates "portable-7" in Salt Lake City, Utah, at 1281 Hyland Lake Drive, is **Karl von Mueller**, the writer, treasure hunter, and ad-

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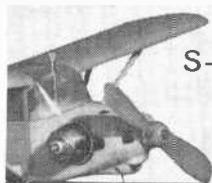
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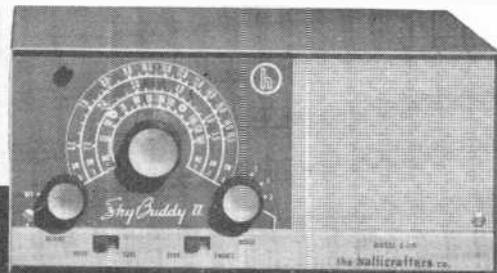
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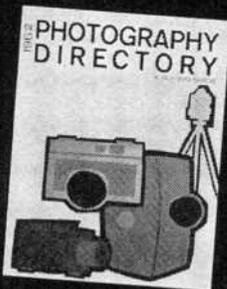
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J. E. Brazee, KNØCWW, Sumner, Nebr., worked 26 states in his first 5 months on the air—not bad for a 34-year-old "beginner." His transmitter is an EICO 720, his receiver a Hammarlund HQ-145.

venturer. If you make a solid contact with Karl and follow it up with a QSL card, you will get a return QSL with a \$500.00 bill attached. Of course, the bill is Confederate money. Look for W4TRQ, fixed, portable, or mobile, on 20 and 40 meters. He uses a Multi-Elmac AF-68 transmitter and a PMR-8 receiver. When not in the car, the antenna is a vertical. In the car, it is a Mosley MA-3 "Mobileer." . . . Lyle "Shortie" Murphy, KN5KJY, 8174 Crestview Drive, Houston 28, Texas, has been on the air for about 10 weeks. Working 40 meters almost exclusively, he has worked over 100 stations in 16 states. A Johnson Adventurer running 50 watts generates the r.f. that his ½-wave dipole antenna bounces off the ionosphere. A Hallicrafters SX-101 and an S-38E do the receiving. . . . Mark Alan Rowland, W4UCZ, checked with the FCC about what type of calls the WN4's now on the air would receive when they get their Generals. The answer was "WA4," not "W4." The FCC did not issue WV4 calls in the southern states, since "WV4" was already reserved for Novices in the Virgin Islands.

Larry Aldrich, KN8ZZW/K8ZZW, Maple Rapids, Mich., likes 80 and 15 meters. He has a dipole for 80 and a "1-element beam" for 15. An EICO 720 does the transmitting, and a Hammarlund HQ-110C does the receiving. In two months on the air, he has made 110 contacts, 69 of them confirmed. Alaska is his best DX. Larry's General license is on the way, so his Novice career is going to be a short one. . . . Dave Edger, KN5JBW, 4006 N. Elgin Ave., Tulsa 6, Okla., would like to work Alaska and Hawaii, but he does not think he is the only Novice with that wish. If you want to work Oklahoma, Dave is your boy. He's on 40 and 15 meters, with 40 being his best band. His Globe Chief De luxe transmitter excites a Mosley V-4-6 vertical antenna, and his receiver is a Hammarlund HQ-129X. Thirty-four states, 30 confirmed, and 250 contacts make up his record. Dave does his best to paper the walls of other ham shacks by QSL'ing 100%.

Send all your material for "Across the Ham Bands" to: Herb S. Brier, W9EGQ, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana. Until next month, 73,

Herb, W9EGQ

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.....		
Type of Antenna Used			
.....			
Signature		Date	
.....		



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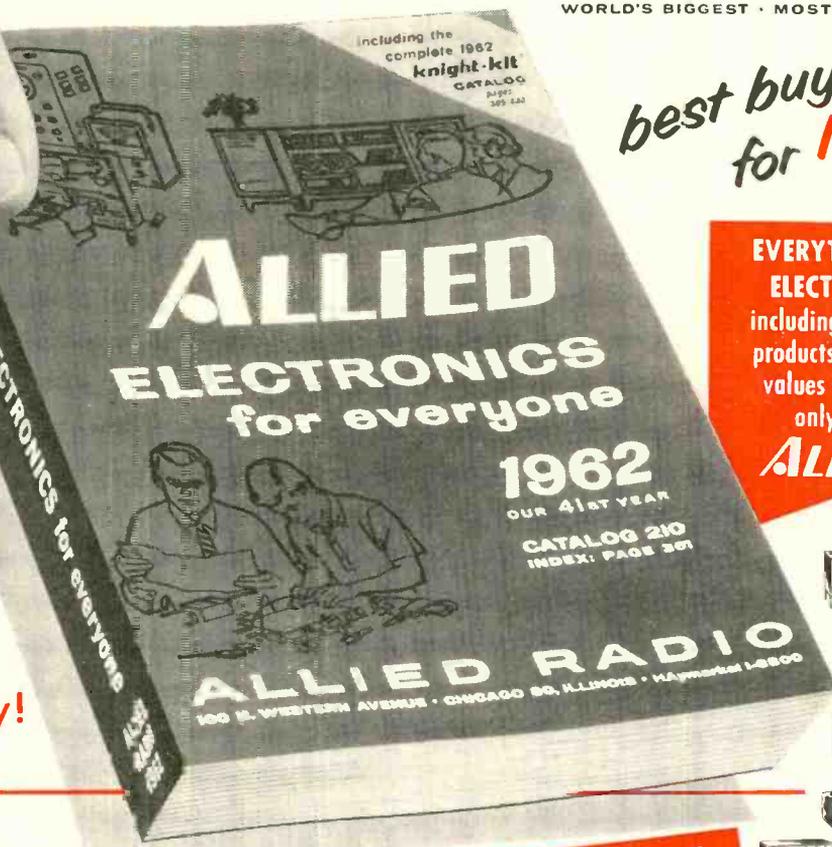
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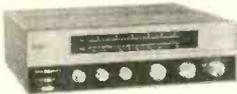
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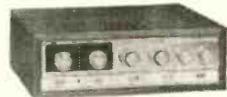
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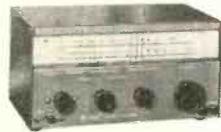
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How to Talk to Non-Hams

(Continued from page 77)

no trouble taking off three different voices, representative of hams from three different parts of the world. I even inserted sound effects, teletype and fast code—who ever heard a re-broadcast of a short-wave transmission without those dah-dit-dahs?

The big job in taping the playlet was synchronizing the voices so that my live voice would track with what my characters said. I arranged to have a relay in the transmitter actuate the recorder hidden in a closet, and I used my regular receiver speaker to heighten believability.

How does it work? Wonderfully! My public relations are the very best. Guests in the ham shack no longer suppress yawns—they're on tenterhooks waiting for the next thrilling installment.

CONSIDER the demonstration I gave last Sunday to a new neighbor and his family—including two kids. After seating my guests comfortably, I put on the show—with a warm-up period first.

The warm-up feature is actually an audio-visual aid as I fuss over ancient ham gear—a spiral-wound oscillation transformer, rotary spark gap, huge capacitors, and loose couplers. It's junk, but the effect is terrific. My modern transmitter and receiver don't even get a glance—how could anything so small, compact and silent be effective?

With my audience properly primed, I started the main event by giving the globe a twirl, stroking my chin, and then muttering: "Hmmm, suppose we contact this part of the earth."

My neighbor gulped. "You can talk—anywhere?"

My smile was indulgent, as I nodded in the affirmative, my finger stopping the globe at the Arctic Zone. "I haven't talked to the top of the world for some time. I wonder what Professor Schloggenfloober's doing. He's the scientist, you know, who's heading that project to determine what lies at the bottom of the ice cap."

Open-mouthed heads nodded as I grabbed the dead mike to intone: "CQ, CQ, CQ Schloggenfloober expedition!"

After an appropriate time, I switched

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on the tape recorder, and from the speaker came what I like to think of as a pretty good imitation of a German scientist. . . "Dis iss Professor Schloggenfloober shpeaking from de Nort Pole. Ve are haffing a heat vave here—sixty degrees below zero."

"Thanks for coming back, Professor. What's new in Santa Claus land?"

This was for the benefit of the children, who leaned forward to catch every word.

Chuckling came through static—I didn't forget to throw in some static on the sound track. "Tell the sshildren that ve got a pet walrus. Ve call him Blubber Boy unt ride him every day. Oh, unt annuder ding, ve found a mastodon at the two-hundred foot level in a vunderful state of preservation. Dose mastodon steaks go good vit canned mushrooms."

"Boy, a pet walrus. Wish I had one," said Junior.

I signed off with the professor, then purposely yawned as if I were bored.

"I'll try to raise something more interesting," I said, noticing through the corner of an eye the amazement on the faces of my guests. "Suppose we point the beam in the direction of the South Pacific Ocean."

Again, after a suitable pause, we heard a voice (mine, of course), this time the voice of an excited British radio operator of a steamship. . . "This is the S. S. *Glugkloop* (I had put my hand in front of my mouth) . . . Can you take a message? Very urgent! Very urgent!"

My neighbor poked his wife in the ribs. "Did you hear that—*very urgent!*"

"Go ahead," I said, reaching for a pencil and pad of paper.

"Here's the message." The voice was almost a scream, as though some awful thing were impending. "Just sighted strange sea animal with huge serpent-like head. Body length estimated one hundred feet with ten loops breaking water. Crossed bow some fifty feet ahead, creating wave estimated six feet high. Position—mid-Pacific near Ogre Island. Relay message to the Society for the Investigation of Unusual Sea Life. The address is . . ." Here the voice rises to a blood-curdling scream, and a sound effect as of wood splintering is heard.

Naturally I make a valiant effort to learn what has happened. But only static



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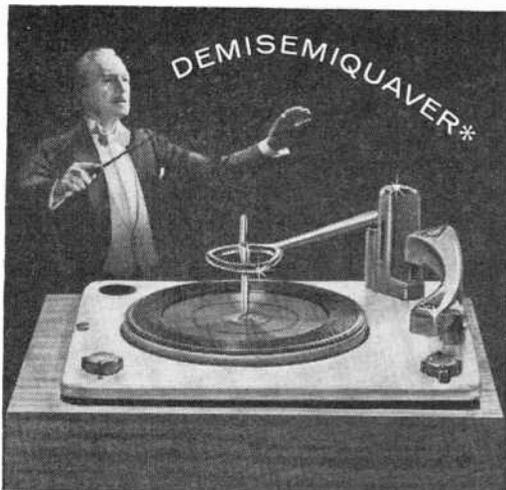
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comes through. I turn to my white-faced guests, say: "I—I wonder what happened?"

But I know that, in their mind's eye, they know what happened. They see the huge head of a sea serpent landing on the ship's cabin, spike-like fangs ripping the wood asunder. . . .

LATER THAT EVENING, I turned on the last installment, which is a harrowing account of an explorer in a Burma jungle making an urgent request for penicillin.

How do I feel about these hama-dramas? Like a kindly Santa Claus who wouldn't tell the kids for all the money in the world that the beard isn't real. My guests get quite a kick out of these mythical adventures.

So do I. So much so that a strange and somewhat frightening thing is happening. Instead of going on the air and having real QSO's with real hams, I find myself writing and recording new adventures and talking to myself. Maybe those two men in the white coats will get me yet!

Electronic Analogy Quiz Answers

(Quiz appears on page 59)

CIRCUIT ANALOGY

- Low-pass filter** F. Tunnel
A low-pass filter "clips off" signals above a certain frequency; a tunnel "clips off" objects above a certain height.
- Zener diode regulator** D. Centrifugal governor
A zener diode "resists" changes in voltage; a governor resists changes in speed.
- Push-pull circuit** H. Two-man saw
A signal is alternately "pushed" and "pulled" in a push-pull circuit; a two-man saw is alternately "pushed" and "pulled" by its operators.
- Wave trap** A. Drain trap
A wave trap removes unwanted signals; a drain trap "removes" unwanted odors.
- Smoothing filter** C. Coil spring suspension
A filter "absorbs" signal "peaks" before they reach the associated circuits; a spring "absorbs" vibration "peaks" before they reach the associated chassis.
- Diode clipper** E. Hedge clipper
A diode clipper "clips" off "peaks" in a signal; a hedge clipper "clips" off "peaks" in a hedge.
- High-pass filter** G. Mountains
A high-pass filter obstructs the passage of signals below a certain frequency; a mountain obstructs the passage of objects below a certain height.
- A.C. rectifier** B. Ratchet-and-pawl
An a.c. rectifier allows current to flow in one direction; a ratchet-and-pawl allows a shaft to turn in one direction.

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Short-Wave Report

(Continued from page 88)

There are all sorts of interference that can add to the problem but, by golly, those rare stations WILL and DO come through just when you might least expect them to do so.

Q: I hear numerous stations that seem to do nothing but continually announce as being "... for circuit adjustment purposes. ..." What kind of stations are they?

A: The large majority of such stations belong to telephone companies in foreign countries. When not engaged in actual overseas telephone conversations, these stations broadcast a form of "running marker" which gives their general location and, at times, the name of the telephone company operating the station. There are a great many of these stations on the air, but although they are on shortwave frequencies, they are not included in the broadcast category. Even at rare



Edward S. Light, WPE2FBT, New York, N. Y., does his DX'ing with a Hallicrafters S-120 receiver aided by a Heath HD-20 100-kc. crystal calibrator.

times when they are used for broadcast relaying, they cannot be declared to be broadcasters in the sense of the word as we know it. Many of them will verify, however.

Q: I would like to have my photograph published in your column. How should I go about it?

A: Photographs for reproduction in this column should in general be at least 5" x 7" although, at times, good

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1H5GT	5AN8	6AQ5	6BE6	6CG7	6J7	6U5	7C7
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1V2	5T8	6AU4GT	6BK7	6CN7	6S8GT	6X8	7C7
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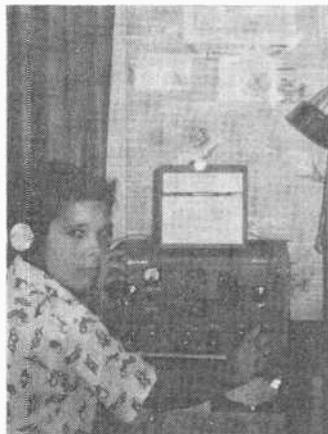
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Victor Penan, WPE1CKZ, Fitchburg, Mass., uses a Lafayette HE-10 and a 40-meter dipole antenna. To date, he has 38 countries logged, 11 veries.

well as color negatives, do not reproduce well. Some types of Polaroid shots do not seem to reproduce well either. Make sure that the photo of you and your station is good and sharp, back it up so that it will not bend, and send it to P. O. Box 254, Haddonfield, N. J., together with a list of all the equipment which appears in the photo. We'll do the rest.

Monitor Certificates

Applications for Monitor Certificates have been piling up again, but as a rule they are processed within two weeks of receipt. Julian Sienkiewicz, WPE2FY, reports that most of the delay in handling is due to the fact that correspondence is often tucked in with the applications. If you want to receive your certificate without delay, simply follow the instructions on page 117. And be sure to enclose a stamped, self-addressed envelope with your application. A business-size envelope (about 9 1/2" x 4") is the best type to use—smaller ones require many folds in the certificate.

Short-wave monitors, both newcomers and old-timers alike, are commenting fa-

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vorably on the new two-color certificates which are now being issued. Old-timers who would like to obtain a new certificate, but also want to keep the old station identification sign, may do so—just print your present call right after your name on the application form, fill in the rest of the data, and send in the form along with a dime.

Incidentally, many Canadians have been enclosing two IRC's with their applications (as is required of all other non-U. S. residents). However, it is permissible (and less costly) to send 15 cents in Canadian coins.

Current Station Reports

Here is a resume of the current station reports. All times shown are Eastern Standard and the 24-hour system is used. 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. Please send your reports to P. O. Box 254, Haddonfield, N. J., in time to reach your Short-Wave Editor by the eighth of each month.

Afghanistan—A verification from M. N. Ghayan states that the 1400 Eng. program has been discontinued. (WPE1BM)

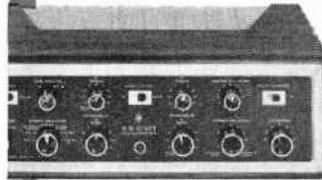
Albania—R. Tirana has been noted on 7090 kc. at 1735-1759 with Eng. to Europe; talks, commentaries, very little music. The power is 25 kw. This station is also heard on 9700 kc. daily at 1930-2000 and in Eng. daily at 1730-1800 on 6950 kc. (WPE3CEF, WPE0VB)

Andorra—R. Andorra International, a new station, is said to be operating on 6195 kc. in Spanish, French, Eng., and German. Reports go to Post Box 1, Principality of Andorra. The exact schedule is not known as yet and, to date, no broadcasts have actually been heard. (GM2PE1L)

Angola—A rarely heard station is CR6RK, R. Clube Do Sul Angola, Lobita, on 3603 kc. The schedule is 0500-0700 and 1130-1600 daily, in Portuguese, and the IS is four guitar notes of the tune "Maria de Fonte." (VE7PE2M)

Belgium—Brussels is currently scheduled in Eng. at 1515-1550 daily on 17,840, 15,335, and 15,435 kc. to Africa; at 1900-2000 daily except

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1H5GT	5AV8	6C6	12AU7	35C5
1L4	5AW4	6C8	12AV6	35L6GT
1L6	5BK7	6C86	12AV7	35W4
1N5GT	5J6	6CD6G	12AX4GT	35Y4
1Q5GT	5T8		12AX7	35Z5GT
	5U4G	7A4/XXL		
	5U8	7A5	19BG6G	39/44
2A3		7A6	19J6	42
2AF4		7A7	19T8	43
3BC5	6A7	7A8	19T8	44
3BN6	6A8	7B4	24A	45
3BZ6	6AB4	7B5	25AV5	50A5
3CB6	6AC7	7B6	25BQ6	78
3CF6	6AF4	7B7	25DN6	80
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Mondays and Fridays on 9705 and 11,850 kc. to Africa and on 11,805 kc. to N.A.; at 1945-2000 (news) on Mondays and Fridays to Africa and N.A. on the same channels. (WPE2FNV, WPE4DKG, WPE8CXT, WPE9AGB)

Bolivia—A recently opened station is *R. Indoamerica*, Potosi, 6202 kc. Commercials are noted around 2100; a time check at 2105; non-stop music to 2125; then local news. Broadcasts are all-Spanish, and the signal may be very weak. (PY2PE1C)

Bulgaria—Sofia has Eng. to N.A. daily at 2000-2030 and 2300-2330 on 9700 kc., and a daily concert at 1835-1900 on 9700 and 11,850 kc. There is a DX program every Friday and a mailbag every Thursday and Sunday. (WPE1DAD, WPE2CYY, WPE2DVO, WPE2FSI, WPE8DIA)

Burma—Rangoon is testing on 17,870 kc. at 1030-1115 with announcements in Eng. and French. (WPE8CTN, GMPE1L)

Canary Islands—A verification (which took 11 months to arrive) gives a new QTH as *R. Clube Tenerife*, Apartado de Correos 560, Santa Cruz. The listed schedule is 1200-1300 and 1630-1700 (it may run to 1800) daily on 7295 kc. (WPE1BM)

Chile—CE970, *R. La Cooperativa Vitalicia*, Santiago, 9700 kc., was tuned at 2125-2130 with L.A. music; ID and IS at 2130 (IS is "Pomp and Circumstance"); talks to 2140; classical music until 2155 fade-out. Power is rated at 10 kw. (WPE9CIS)

Cuba—*R. Havana's* schedule as given over the air is 2200-2300 to North, Central and South America on 11,770 kc., 2300-2340 on 11,875 kc. to the same areas. English is followed by French from 2340. Programs

SHORT-WAVE ABBREVIATIONS

Eng.—English	N.A.—North America
ID—Identification	QSL—Verification
IRC—International	QTH—Address
Reply Coupon	R.—Radio
IS—Interval signal	s/off—Sign-off
kc.—Kilocycles	s/on—Sign-on
kw.—Kilowatts	xmsn—Transmission
L.A.—Latin America	xmtr—Transmitter

consist mostly of news but there is some music. A new channel, dual to 11,700 kc., is 15,305 kc. (it varies from 15,300 to 15,310 kc.) noted at 1330-1415 and 1530-1615 in Spanish; Eng. at 1245-1319; then French to 1330. A European xmsn in Eng., Spanish and French is given daily at 1200-1400 on 21,630 kc. Reports on all channels should go to P. O. Box 7026, Havana, Cuba. (WPE1APS, WPE1BDE, WPE2D TO, WPE2FRM, WPE2FUJ, WPE3EX, WPE3PV, WPE4BC, WPE4BQU, WPE4DED, WPE4DLT, WPE6BLV, WPE6BPN, WPE7KY, WPE8CES, WPE8FV, WPE9AGB, WPE9CXW, WPE0AE, WPE0BOQ, VE1PE2U, DG, DH, JM, and many others).

Dominican Republic—A clandestine station believed to be located in this country has been noted on 13,998 kc. at 1900-1945 and 2200-2245 with the ID *La Voz De La Libertad*, and all-Spanish talks, little music. This station may not operate regularly, for it has been noted

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as being off the air for several days at a time. (WPE6BPN, KP4PE1G)

Ecuador—HCXZ, *Radiodifusora Nacional del Ecuador*, Apartado Postal 1316, Quito, operates on 4940 kc. with 10 kw. at 0630-0000 (Sundays at 0830-2330) with music, news, feature programs, dramas, and transcriptions from numerous other stations and organizations, all in Spanish. There is an Eng. lesson at 1645 on Mondays, Wednesdays and Saturdays, and French lessons at the same time on Tuesdays and Thursdays. This station is usually heard well. (WPE0ATE)

Falkland Islands—Port Stanley verified by letter in nine months after two reports, a follow-up letter, and some IRC's. The latest schedule reads: 1745-2015 (Saturdays at 1630-2100, Sundays at 1500-2030) on 3958 kc. (PY2PE1C)

Finland—English is broadcast from Pori to Europe on 15,190, 11,805, and 9555 kc. on Mondays and Fridays at 1100-1130 (also at 1600-1630 on Fridays on 6120 kc.). "Around The World" is heard on the first and third Friday of the month, "Musical Mailbag" on alternate Fridays. A repeat program for Europe on 11,805 and 9555 kc., and for N.A. on 15,190 kc. is given at 1530-1600 Mondays and Fridays (May 7 to Sept. 6) and at 0630-0700 Tuesdays and Saturdays (Sept. 7 to May 6). (WPE9DAG)

Germany—R. Bremen is tuned on 6190 kc. in German from 0005 to 0020 fade-out. They have a new QSL card. (WPE0JJ)

Ghana—The latest schedule from Accra reads: National Service at 0030-0300 and 1130-1715 (Saturdays to 1800) on 3366 kc., at 0030-0300 and 0700-1715 (Saturdays to 1800) on 4915 kc., at 0700-1715 (Saturdays to 1800) on 7295 kc., and at 0700-1100 on 9640 kc.; Special Service to Ghanaian Forces in the Congo at 0700-1315 on 17,865 and at 1345-1715 (Saturdays to 1800) on 15,210 kc.; External Service at 1000-1500 on 9545 kc., at 1330-1500 on 15,285 kc., and at 1000-1030 on 17,740 kc. The former schedule for 15,285 kc. was 0700-1100 and 1430-1715. (WPE1BM, WPE2FGX, WPE4ADS, WPE4BNA, WPE4CKH, WPE5AG, WPE8AQZ, WPE8CTN, WPE9AGB)

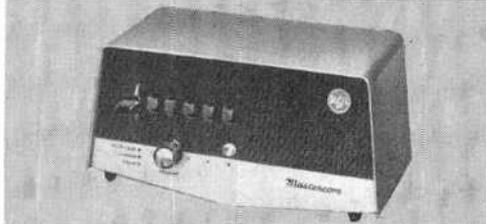
Goa—A recent letter from Director Cap. Jose de Carvalho Figueira at *Emissora de Goa* states that the African beam at 1130-1330 has returned to 17,835 kc. Broadcasts are planned for Europe, Middle and Far East areas. Reports are welcomed. (WPE1BM, WPE2CRX)

Grand Cayman Island—This small Caribbean island has no broadcast outlet but you might try for it via the airline channels. It has been noted working Miami on 6567 kc. between 1923 and 1940 in connection with a regular Friday night flight. (AD)

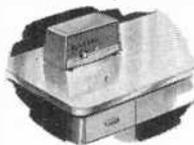
Indonesia—Two rarely heard stations are YDU, Singaradja, 4840 kc. (300 watts), and YDT, Sao Siu, West Irian Province, 3960 kc. Station YDU is scheduled at 2237-0200 in a home service relay, YDT at 2027-0130 in Indonesian. (VE7PE2M)

Ireland—There are conflicting reports on the Irish Signal Corps xmsns to the Forces in the Congo. Some reports say 1100-1115, 1145-1200, and 1230-1245 on 17,845 kc.; others give

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the frequency as 17,800 kc. One listener in Norway has heard this station at 1200 on 17,544 kc. with news, sports, and taped greetings. Reports go to Irish Defense, Dublin, Ireland. (WPE1BUF, WPE2FSY, WPE4DJK, LA1PE1R)

Japan—Here is the schedule for *R. Japan* (abbreviations for languages used are *A* for Arabic, *E* for English, *F* for French, *G* for German, *I* for Italian, *J* for Japanese, *R* for Russian, *Sp* for Spanish, *Sw* for Swedish): to N.A. at 1930-2030 on 17,725, 15,135, and 21,520 kc. (*E, J*); to North and Latin America at 2200-0000 on 11,800, 15,135, 17,725, and 21,520 kc. (*E, Sp, J*); to Hawaii at 0030-0200 on 17,725 and 15,235 kc. (*E, J*); to Europe (*I*) at 0230-0330 on 17,725, 15,135, and 21,610 kc. (*E, J*); to Europe (*II*) at 1400-1600 on 11,800, 15,135 and 9675 kc. (*R, G, F, E, I, Sw, J*); to Middle East and Northern Africa at 1145-1345 on 11,800, 15,135, and 9525 kc. (*A, E, F, J*); African Service at 1430-1530 on 11,705 and 9525 kc. (*E, F, J*) to Australia, at 0430-0530 on 11,875 and 15,235 kc. to New Zealand (*E*). The General Service (*E, J*) is given at 1000-1030 on 11,815 kc. (and/or 11,780, 15,235 kc.); at 1930-2030, 2100-2130, 2200-2230, 2300-2330, 0000-0030 on 15,115 kc. (and/or 17,795, 21,610 kc.); at 0100-0200, 0300-0330, and 0400-0430 on 11,815 kc. (and/or 15,105, 17,755 kc.); at 0500-0530 on 11,815 kc. (and/or 17,755 kc.); and at 0600-0630, 0700-0730, and 0800-0900 on 11,815 kc. (and/or 11,780, 15,235 kc.). (WPE2EPC, WPE4CMJ, *R. Japan*)

Liberia—ELWA, Monrovia, operates on Tuesdays to N.A., opening at 2000 with drums.

The announced frequency is 11,825 kc., but they are actually on 11,973 kc. The Mid-East service runs to 1430 in Eng. on 15,155 kc., then reopens to North Africa at 1430 on 15,133 kc. Both channels are good. (WPE1BM, WPE2EPC)

Navassa Island—A new anti-Castro station is reported being planned by an American organization. Two xmtrs will be utilized, one 50-kw. unit, the other 20 kw.; frequencies were not given. This island is near Cuba in the Caribbean. (*R. Sweden*)

Peru—OAX5U, *R. Huancavelica*, Casilla No. 86, Huancavelica, is a new station on 4995 kc. (although they announce as being on 4815 kc.) with 2000 watts. On Mondays and Fridays they have music from 2205 to 2258. S/off time varies from 0005 to 0105. All-Spanish programs. (PY2PE1C)

Portugal—The Eng. Service from Lisbon is aired at 0815-0900 on 21,495 kc. (to S.E. Asia); and at 1315-1430 on 17,895 kc. (W. Africa), 15,380 kc. (S. and S.E. Asia), and 6025 kc. (Europe). These xmsns replace the previously scheduled broadcasts at 1315-1430 on 15,380 kc. to S. and S.E. Asia and on 15,125 kc. to Europe and W. Africa. (WPE1COV, WPE1PJ, WPE2EFF, WPE2FIY, WPE4BUJ, WPE8CIO, WPE8MS, WPE9DN, RC)

Sierra Leone—Freetown has been heard recently on 3316 kc. from 0100 s/on with a religious program. News in Eng. is given at 0155 (local) and at 0200 (London relay). (WPE8MS)

Singapore—*R. Singapore* is presently scheduled as follows: Eng. on 7250 kc. Mon-

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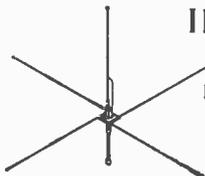
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Chinese on 4820 kc. daily at 1730-2030 (Sundays at 1730-1130), 2230-0230 (Saturdays at 2230-1130), and 0330-1100. (WPE8FV)

Spanish Guinea—R. Santa Isabel, 6231 kc., s/on 0129 with a march number and ID in Spanish at 0130. Non-stop music runs to 0155. This station was heard on Monday and Wednesday, not on Thursday. The only ID given was at the beginning of each broadcast. (PY2PE1C)

Switzerland—Recent changes in Berne's schedule include the deletion of 15,315 kc. with Eng. to the Middle East at 1145-1330. French, German, and Italian programs beamed to Africa are now carried on 15,305 kc. at 0045-0145 weekdays (0115-0200 on Sundays) and at 1230-1645 daily. (WPE1AXH, WPE5AWM, VP5PE1D, RR, R. Switzerland)

Thailand—A letter from R. Thailand gives this schedule: to N.A. at 2315-0015 in Eng.; to Thai Forces in Korea, Vietnam, and Cambodia at 0430-0520 in Thai, Cambodian, and Vietnamese; General Overseas Service at 0525-0657 in Eng. (mostly), Malay, and Chinese; and the Home Service relay in Thai at 0800-0900. All broadcasts are on 11,910 kc. All correct reports will be verified and return postage is not required. (WPE2DTO, WPE8CUS)

Turkey—Agricultural Land Produce Radio, Ankara, now operates on 7651 kc. with Turkish and western music and talks. S/off is at 1430. (R. Sweden)

United Arab Republic—Cairo has been observed with two xmsns on 17,835 kc. as follows: at 1100-1332 with Eng. at 1245-1330 and the ID *This is the Voice of Africa from Cairo*, and at 1342-1545 with French at 1345-1445 (news at 1400) and the French ID *Ici la Voix d'Afrique*. (WPE1KO, WPE4BC, WPE5BFU, WPE8CXT, WPE8MS, WPE9DN, WPE0VB, VE2PE3W)

Venezuela—YVQA, Ondas Portenas, Puerto la Cruz, 4790 kc., has an Eng. newscast at 2225-2230. (WPE1BM)

Yugoslavia—The latest scheduled broadcasts in English are at 1030-1100 on 15,240,

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(*WPE1BM, WPE2FGX*)

Unidentified—A station has been noted in
Azerbaijani at 2240-2330 on 11,695 kc., mostly
with talks but with some patches of music.
(*WPE6BPN*)

50

SHORT-WAVE CONTRIBUTORS

Tom Carten (*WPE1APS*), Stratford, Conn.
Frank Fulchiero (*WPE1AXH*), Niantic, Conn.
Roger Demers (*WPE1BDE*), Springfield, Vt.
Jerry Berg (*WPE1BM*), W. Hartford, Conn.
William Lyons (*WPE1BUF*), Fitchburg, Mass.
Albert Shumilla (*WPE1COV*), Dorchester, Mass.
Joseph Cagnina (*WPE1DAD*), Woburn, Mass.
Edward Bowker (*WPE1KO*), Keene, N. H.
Dennis Bourassa (*WPE1PJ*), Bridgeport, Conn.
Joseph Russo (*WPE2CRX*), Toms River, N. J.
Don Gross (*WPE2CYY*), Brooklyn, N. Y.
Konnie Brieger (*WPE2DTC*), Englewood, N. J.
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Richard Dubriske (*WPE2EFF*), Mt. Vernon, N. Y.
Michael Biel (*WPE2EPC*), Teaneck, N. J.
Dave Listort (*WPE2FGX*), Elmont, N. Y.
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George Bremner (*WPE2FNV*), Niagara Falls, N. Y.
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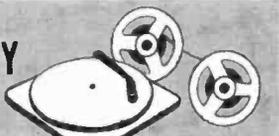
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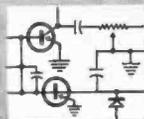
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6BJ6	.62	6X4	.39	12FX8	.85			
6BJ7	.79	6X5GT	.53	12G06	1.06			
6BK7	.85	6X8	.80	12I8	.84			
6BL7	1.00	6Y6G	.65	12K5	.65			
6BN4	.57	7A8	.68	12L6	.58			
6BN6	.74	7AU7	.61	12S8	.62			
6BD5	.65	7B6	.69	12SA7	.92			
6BQ6	1.05	7EY6	.73	12SF5	.50			
6BQ7	1.00	7F8	.90	12SF7	.69			
6BR8	.78	7Y4	.69	12SH7	.49			
6BS8	.90	8AU8	.83	12S17	.67			
6BU8	.70	8AW8	.93	12SK7	.74			
6BX7	1.02	8BH8	.90	12SL7	.80			
6BY5	1.15	8BN8	.75	12SN7	.67			
6BY6	.54	8B05	.60	12SQ7	.78			
6BY8	.66	8C07	.62	12T17	.62			
6BZ6	.55	8CM7	.68	12V6	.53			
6BZ7	1.01	8CN7	.97	12W6	.69			
6BZ8	1.09	8CS7	.74	12X4	.38			
6C4	.43	8CX8	.93	17AX4	.67			
6C8	.90	8EB8	.94	17BQ6	1.09			
6CB6	.55	8SN7	.66	17D4	.69			
6CD6	1.42	9CL8	.79	17DQ6	1.06			
6CE5	.57	11CV7	.75	17L6	.58			
6CF6	.64	12A4	.60	17W6	.70			
6CG7	.61	12AR5	.55	18FW6	.49			
6CG8	.77	12AC6	.49	18FX6	.53			
6CK4	.70	12AD6	.57	18FY6	.50			
6CL8	.79	12AE6	.43	19AU4	.83			
6CM6	.64	12AE7	.94	19BG6	1.39			
6CM7	.66	12AF3	.73	19T8	.60			
6CM8	.90	12AF6	.46	19U8	.79			
6CN7	.65	12AJ6	.66	21EX6	1.49			
6C08	.84	12AL5	.45	25AV5	.83			
6CS6	.51	12AL8	.95	25AX4	.70			
6CC6	.57	12A05	.60	25BK5	.91			
6CS7	.69	12AT6	.43	25BQ6	1.11			
6CU5	.58	12AT7	.76	25C5	.53			
6CU6	1.08	12AU6	.51	25CA5	.59			
6CY5	.70	12AU7	.60	25CD6	1.44			
6CY7	.71	12AV6	.41	25CU6	1.11			
6DA4	.68	12AV7	.75	25DN6	1.42			
6DB5	.69	12AX4	.67	25EH5	.55			
6DB6	.51	12AX7	.63	25L6	.37			
6DE6	.58	12AY7	1.44	25W4	.68			
6DD6	.59	12AZ7	.86	25Z6	.66			
6DN6	.59	12B4	.63	32E75	.55			
6DN6	1.55	12BA6	.50	32L7	.90			
6DQ6	1.10	12BA7	.84	35B5	.60			
6DT6	.53	12BD6	.50	35C5	.51			
6D78	.79	12BE6	.53	35L6	.57			
6E48	.79	12BF6	.44	35W4	.42			
6E85	.72	12BH7	.77	35Z5	.60			
6E88	.94	12BK5	1.00	36AM3	.36			
6EM5	.76	12BL6	.56	50B5	.60			
6EM7	.82	12BQ6	1.06	50C5	.53			
6E08	.79	12BY7	.77	50EH5	.55			
6E66	.57	12BZ7	.75	50L6	.61			
6EY6	.75	12C5	.56	5763	1.00			
6F5GT	.39	12CN5	.56	70L7	.97			
6F6	.69	12CR6	.54	70Z5	.69			
6GK6	.79	12CU5	.58	84/GZ4	.46			
6GN7	.94	12CU6	1.06	807	.70			
6HG	.58	12CX6	.54	117Z3	.61			
6J5GT	.51							

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Superior's
New Model
TW-11

STANDARD PROFESSIONAL TUBE TESTER



Model TW-11—Tube Tester
Total Price \$47.50
Terms: \$11.50 after 10 day trial,
then \$6.00 monthly for 6 months
if satisfactory. Otherwise re-
turn, no explanation necessary.

- Tests all tubes, including 4, 5, 6, 7, Octal, Lockin, Hearing Aid, Thyatron, Miniatures, Sub-miniatures, Novals, Subminars, Proximity Fuse Types, etc.

- Uses the new self-cleaning Lever Action Switches for individual element testing. All elements are numbered according to pin-number in the RMA base numbering system. Model TW-11 does not use combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

- Free-moving built-in roll chart provides complete data for all tubes. Printed in large easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE
SEPARATE SCALE FOR LOW-CURRENT TUBES Previously, an emission-type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types.

Housed in handsome, Saddle-
Stitched Texon case. Only **\$47.50**



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METER... Total Price ... \$42.50
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Superior's
New
Model 77

VACUUM TUBE VOLTMETER WITH NEW 6" FULL-VIEW METER

Compare it to any peak-to-peak V. T. V. M. made by any other manufacturer at any price!

- Extra large meter scale enables us to print all calibrations in large easy-to-read type.
- Employs a 12AU7 as D. C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability. • Meter is virtually burn-out proof. The sensitive 400

AS A DC VOLTMETER: The Model 77 is indispensable in Hi-Fi Amplifier servicing and a must for Black and White and color TV Receiver servicing where circuit loading cannot be tolerated.

AS AN ELECTRONIC OHMMETER: Because of its wide range of measurement leaky capacitors show up glaringly. Because of its sensitivity and low loading, Intermittents are easily found, isolated and repaired.

AS AN AC VOLTMETER: Measures RMS values if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers are easily read.

micro-ampere meter is isolated from the measuring circuit by a balanced push-pull amplifier. • Uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

SPECIFICATIONS

- DC VOLTS—0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance.
- AC VOLTS (RMS)—0 to 3/15/75/150/300/750/1,500 volts. • AC VOLTS (Peak to Peak)—0 to 8/40/200/400/800/2,000 volts.
- ELECTRONIC OHMMETER—0 to 1,000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms. • DECIBELS: -10 db to +18 db, +10 db to +38 db, +30 db to +58 db. All based on 0 db = .006 watts (6 mw) into a 500 ohm line (1.73v). • ZERO CENTER METER—For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

Comes complete with operating instructions, probe leads, and stream-lined carrying case. Operates on 110-120 volt 60 cycle. Only **\$42.50**

We invite you to try before you buy any of the models described on this page and the following page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

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Dept. D-907 3849 Tenth Ave., New York 34, N. Y.

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\$11.50 within 10 days. Balance
\$6.00 monthly for 6 months.

Model TW-11 Total Price \$47.50
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monthly for 6 months.

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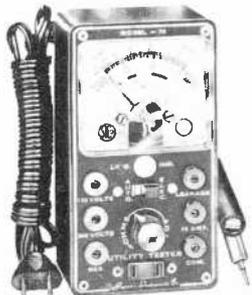
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FOR REPAIRING ALL ELECTRICAL APPLIANCES and AUTOMOBILE CIRCUITS



As an electrical trouble shooter the Model 70:

- Will test Toasters, Irons, Brollers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorescents, Switches, Thermostats, etc.
- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakages, etc.
- Will measure current consumption while the appliance under test is in operation.
- Incorporates a sensitive direct-reading resistance range which will measure all resistances commonly used in electrical appliances, motors, etc.
- Leakage detecting circuit will indicate continuity from zero ohms to 5 megohms (5,000,000 ohms).

As an Automotive Tester the Model 70 will test:

- Both 6 Volt and 12 Volt Storage Batteries • Generators • Starters • Distributors • Ignition Coils • Regulators • Relays • Circuit Breakers • Cigarette Lighters • Stop Lights • Condensers • Directional Signal Systems • All Lamps and Bulbs • Fuses • Heating Systems • Horns • Also will locate poor grounds, breaks in wiring, poor connections, etc.

INCLUDED FREE This 64-page book—practically a condensed course in electricity. Learn by doing.



Just read the following partial list of contents: What is electricity? • Simplified version of Ohms Law • What is wattage? • Simplified wattage charts • How to measure voltage, current, resistance and leakage • How to test all electrical appliances and motors using a simplified trouble-shooting technique • How to trace trouble in the electrical circuits and parts in automobiles and trucks.

Model 70 comes complete with 64 page book and test leads

\$15⁸⁵
Only

Model 70—UTILITY TESTER
Total Price...\$15.85—
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Superior's New Model TV-50A

GENOMETER

7 Signal Generators in One!

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- ✓ R.F. Signal Generator for F.M.
- ✓ Audio Frequency Generator
- ✓ Marker Generator
- ✓ Bar Generator
- ✓ Color Dot Pattern Generator
- ✓ Cross Hatch Generator

This Versatile All-Inclusive GENERATOR Provides ALL the Outputs for Servicing:

- A.M. RADIO • F.M. RADIO • AMPLIFIERS • BLACK AND WHITE TV • COLOR TV

R. F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

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BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.

DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50A will enable you to adjust for proper color convergence.

CROSS HATCH GENERATOR: The pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

Complete with shielded leads **\$47⁵⁰** Net

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NO INTEREST OR FINANCE CHARGES ADDED!

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