

How to Remote-Control Your Hi-Fi

POPULAR

FEBRUARY
1962

ELECTRONICS

35
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- ★ How To Choose Your Electronics Training
- ★ Transistorized Power Flash
- ★ Tunnel Diode Puts Milliwatt on 6



Capacity-Operated relay (p. 63)



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DIRECTOR OF EDUCATION, William F. Dunn, supervises lesson preparation, training equipment development, consultation services, lesson grading. He heads a full staff of instructors and advisors.



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

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



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

POPULAR ELECTRONICS



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in the Readers' Guide
to Periodical Literature

This month's cover photo by Joe Petrovec

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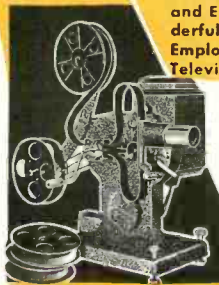


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Art Editor **JAMES A. ROTH**

Associate Editors **MARC E. FINKEL**

RICHARD A. FLANAGAN

MARGARET MAGNA

Draftsman **ANDRE DUZANT**

Editorial Assistant **MARY ANNE O'DEA**

Editorial Consultant **OLIVER READ, W4TWV**

Contributing Editors **H. BENNETT, W2PNA**

H. S. BRIER, W9EGQ

J. T. FRYE, W9EGV

L. E. GARNER, JR.

D. STRIPPEL, 2W1452

Advertising Manager **WILLIAM G. MCROY, 2W4144**

Advertising Service Manager **ARDYS C. MORAN**

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Midwestern and Circulation Office (Wabash 2-4911)

434 South Wabash Avenue, Chicago 5, Illinois

Midwestern Advertising Manager **JAMES WEAKLEY**

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WIRELESS ART TOURS—No longer will visitors to the Albert Landry Galleries in New York have to gape in ignorance at abstract paintings. By holding a slim plastic “magic wand” radio close to her ear, the young lassie at left—as well as other visitors—can listen to a pre-taped commentary on various works of art. The “magic wand” eliminates the bother of cumbersome earphones, headsets, and bulky over-the-shoulder equipment. Devised by Multitone Electronics, Ltd. of New York, the wireless guide system employs several wire-loop antennas concealed in the floor. Four transistorized transmitters broadcast different taped commentaries into selected areas and visitors simply twist a switch on the magic wand to obtain the desired program.



ELECTRONIC JUNGLE rising from the “breadboard” at left—engineer’s talk for “first working model”—eventually ended up as a miniature four-binary module held here by an engineer of the Bulova Research and Development Laboratories, Woodside, N. Y. The module embodies all the elements of resistance and capacitance contained in the “jungle” prototype. Bulova’s miniature packaging effort will rate an “A-Okay” when the module is used as a precise time interval device in control equipment destined for missiles and space vehicles.



ROOM PLEASE! If you drop by the Holiday Inn in Grand Rapids, Mich., and ask for a room, the pretty receptionist will put into action the “Call Boy”—an electronic nerve center produced by Call Boy Systems, Inc. A guest’s room number is immediately punched up at the reception desk, notifying the management and the housekeeper that the room is rented. The system automatically wakes guests at requested times and notifies them of mail or messages which have arrived for them. In addition, it organizes and keeps track of the maid service. Motel owners claim that the Call Boy cuts costs and improves services—but the automatic multi-signal system won’t replace the pretty receptionist.



AUDITORIUM SOUND SIMULATOR—The acoustics of an auditorium still in the blueprint stage can now be simulated and evaluated by Bell Telephone Laboratories scientists. All it takes is an electronic digital computer, an anechoic chamber, and a few high-fidelity systems. Starting with the architectural plan, calculations are made as to the time it will take sound waves to travel over various paths from source to listener, and this information is stored in the computer. The computer acts upon these “sounds” in the same manner the walls and other reflecting surfaces in the auditorium would. A listener’s test in the anechoic chamber—which adds no reverberation to the playback sound—rates the auditorium’s acoustics. Corrections in structural design at the blueprint stage insure good acoustics before the auditorium is built.

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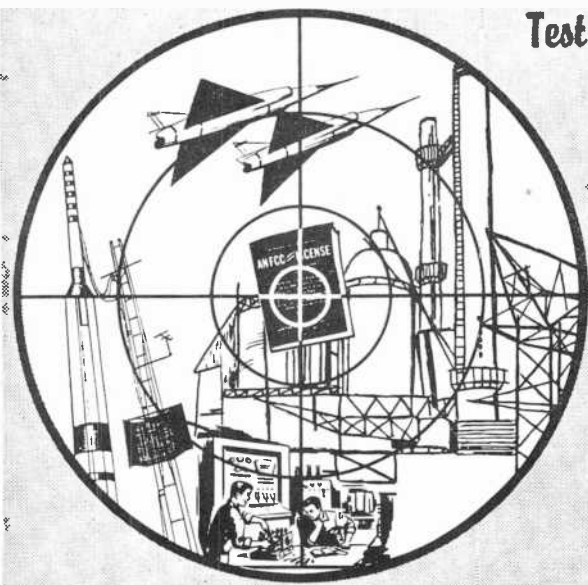
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- DO YOU want to get into ELECTRONICS?
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- Do you want the kind of training that will take you straight to this objective QUICKLY... without wasting valuable time on non-essentials?

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M. A. Dill, Jr., 29 Cherry St., Gardiner, Maine	1st	12
Bernhard G. Fokken, Route 2, Canby, Minn.	1st	12
Kenneth F. Foltz, Broad St., Middletown, Md.	1st	12
James C. Greer, Mound City, Kansas	1st	12

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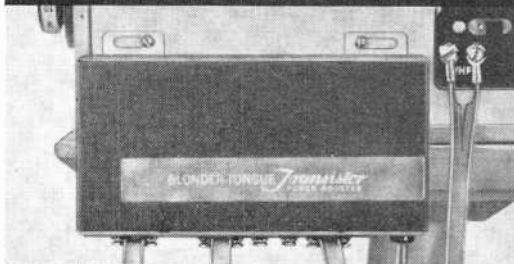
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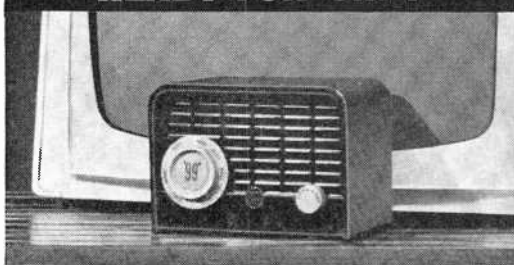
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MODEL	DESCRIPTION	GAIN AVERAGE	AMPLIFIER	MOUNTING	LIST PRICE
BTA	Home VHF/FM booster for single set.	8 db	Tube	Indoor	15.70
B-24c	Home VHF/FM booster for up to 4 sets.	9 db	Tube	Indoor	24.95
IT-3	Home VHF/FM booster for up to 4 sets.	12 db	Transistor	Indoor	33.00
AB-4	Home VHF/FM booster, battery powered. For up to 4 sets.	12 db	Transistor	Indoor or Mast Mounted	29.95
AB-2	Home VHF mast mounted booster. Remote power supply.	10 db	Tube	Mast Mounted	53.95
UB (70-83)	UHF booster (ch 70 thru 83).	15 db	2 Tubes	Mast Mounted	84.50
UB (72-76)	UHF booster (ch 72 thru 76).	21 db	2 Tubes	Mast Mounted	103.75

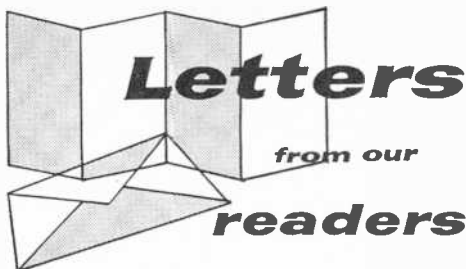
UHF CONVERTERS

MODEL	IMPEDANCE	INPUT CHANNELS	OUTPUT CHANNELS	GAIN	LIST PRICE
BTC-89R	300 Ohm	14 thru 83	5 or 6	—	23.95
BTU-2S	300 Ohm	14 thru 83	5 or 6	5 to 8 db	39.95
BT-70	300 Ohm	70 thru 83	5 or 6	5 to 8 db	41.50

engineered and manufactured by

BLONDER-TONGUE
9 Albany St., Newark, N. J.

Canadian Div.: Benco Television Assoc., (Tor., Ont.)
Export: Rocke Int'l. Corp., N. Y. 16, N. Y.
CABLES: ARLAB



CB-1 Squelch

■ I added the squelch circuit described in the November 1961 issue ("Add a Squelch to the CB-1") to my Heathkit CB-1. I was very pleased with the outcome, but carried out another modification which I think will interest other people who plan to use the circuit. Finding it very difficult to adjust the squelch potentiometer from the back, I installed it, in place of the mike connector, on the front panel. The connector, which rarely needs attention, was moved to the back. While making this change, incidentally, I substituted a shaft-controlled potentiometer for the original screwdriver-controlled unit.

DAVID HEDGECOTH
Crossville, Tenn.

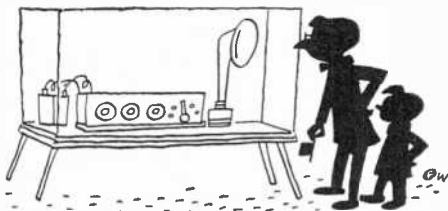
■ With reference to "Add a Squelch to the CB-1" in your November issue, I would like to suggest a small change. In the article, half of a 6AL5 dual diode is specified for the squelch circuit. If this 6-volt tube is used, one no longer has the option of operating the CB-1 with a 12-volt automobile battery. Half of a 12AT7 dual triode (with the grid and plate tied together) could be used instead. Since the latter tube has a 6- or 12-volt filament, you can ground one end of it, connect the other end to pin 4 of V₃, and tie the center-tap to pin 3 of V₃. Then the CB-1's filament circuit can be powered, as intended by the manufacturer, from a 12-volt as well as a 6-volt source.

EDWARD BRODERICK
Hall, N.Y.

Thank you both for your useful comments on the Heathkit modification. We're sure they will interest readers who are planning to install the squelch in their own CB-1's.

Another Radio Pioneer

■ Regarding Mr. Thomas New's 1919 radio broadcast (November "Letters" column), I know of at



least one station which was operating considerably earlier. San Francisco's KCBS celebrated its Golden Anniversary in 1959, having been founded (in

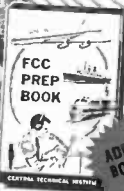
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Superintendent of Communications for the K. C. Southern Railway Company is Central graduate Lawrence D. Fry, with 15 years of railroad communications experience. "Central is a fine school," says Mr. Fry. "I've always recommended it, and have sent several students to Central."

Field Service Representatives for the Bendix Computer Division, L. A., California, are Central graduates E. John Kempf, left, and Robert Young. Mr. Kempf was employed as a maintenance man before he became interested in radio and TV. His first project was building test equipment at home. After enrolling with Central, he began to make extra money repairing radios, auto radios, etc. "The field of Computers is expanding, and there's a real need for trained technicians," he says. "I have found the work to be both profitable and interesting!"

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Letters

(Continued from page 8)

San Jose, Calif.) in 1909. It would be interesting to know if anyone can beat this.

CHARLES J. GRAHAM, K6KDZ
Del Paso Heights, Calif.

Any challengers?

Voltage Quiz

■ May I call your attention to two errors in the "Voltage Quiz Answers" in your December 1961 issue. In the answer to problem 6, point "A" should be + volts positive, not 2 volts positive, with respect to ground. In the answer to problem 7, point "A" should be 2.4 volts negative, not 2.4 volts positive, with respect to ground.

NORMAN A. STRADER, W9HUY
Physics and Mathematics Instructor
Charleston High School
Charleston, Ill.

You're correct on both points, reader Strader—and thanks for telling us about them.

Compactron V.H.F. Receiver

■ I've just completed the "Compactron V.H.F. Receiver" featured in the September 1961 issue. The power and selectivity of this one-tube circuit are amazing; they demonstrate the efficiency of the

G.E. Compactron and the excellence of Mr. Ralph Dorris's design and layout. Though I had difficulty



obtaining some of the components, the effort was more than justified by the final results.

ARTHUR L. WHALEN, WPE1AND
Fall River, Mass.

Bi-Slave for AG-1's

■ I think there are some errors in the article "Bi-Slave for AG-1's" (November, 1961). The polarity of solar cells PC1 and PC2 should be reversed since a negative—not a positive—pulse is required for transistor Q1 to conduct. Also, capacitor C2, rather than C1, is charged by battery B1.

ALAN G. HILL
Watkinsville, Ga.

You're quite right, reader Hill. The polarity of cells PC1 and PC2—as well as the polarity of capacitor C1—should be reversed, and in the third line from the bottom of the first column on page

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Letters

(Continued from page 10)

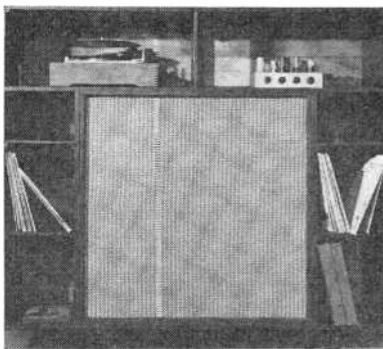
68, the word "positive" should read "negative." Also, in the fourth and eighth lines from the top of the second column on page 68, the capacitor referred to should have been C2 rather than C1. Thanks for calling these points to our attention.

De Luxe Sweet Sixteen

■ In your "Letters" column recently you asked for reports from builders of the "Sweet Sixteen" (January 1961 issue) with a tweeter ("Sweeter with a Tweeter," April, 1961). Here's a photo of the one we recently completed at our house.

All I can say is that we were amazed at what 16 little speakers and a tweeter horn could do. We had our doubts before hearing it, but the unit is everything you said it would be. It sounds better than a couple of commercial speakers we have in our living room, and we're proud of its looks, too.

The speaker enclosure is constructed of $\frac{3}{8}$ " plywood throughout and follows the dimensions specified in the two articles. The cabinet which sur-



rounds it, though, was my own idea. We call it the "Monster." Measuring 60" x 16" x 50", it accommodates a record changer, an amplifier—and the record collection which (with two teen-age daughters in the house) doesn't get much rest.

R. C. SCHOLL
Chicago, Ill.

Your deluxe Sweet Sixteen looks great, reader Scholl. Needless to say we're happy you're so pleased with it.

Satisfied CB'er

■ Thanks for your fine article entitled "Getting Peak CB Performance" (May 1961 issue). Following your instructions, I was able to achieve a perfect antenna match by inserting a miniature variable capacitor in series with the radiating element; the instrument I used to make the adjustments was a Johnson SWR bridge. I also confirmed your statement that large objects near the antenna change its matching characteristics.

FRANK RICHARDS, 18B2164
Blue Island, Ill.

We're glad to have been of service, reader Richards, and hope you enjoy your newly peaked-up rig.

—50—

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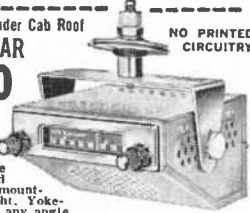
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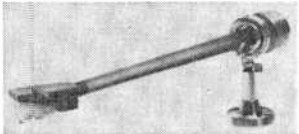


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Audio Dynamics ADC-85

tone arm, the system features extremely low inertia and tracks even warped records perfectly. Another feature of the combo is a side-thrust compensator which permits the stylus to maintain even pressure on both groove walls. Price of the complete ADC-85 arm-and-cartridge system, \$85.00; the ADC-40 arm alone, \$39.50.

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(Continued on page 20)

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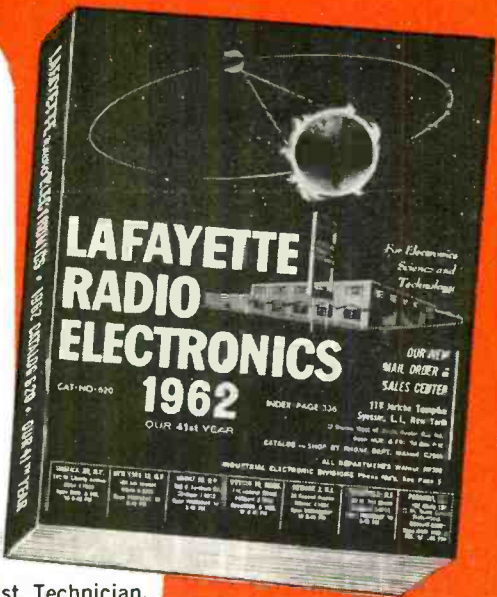
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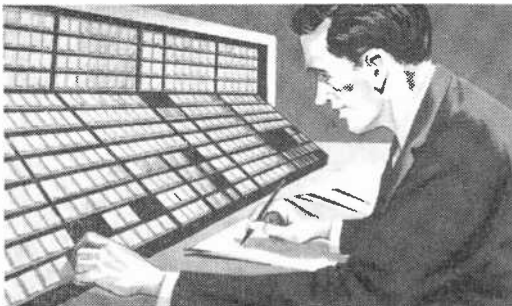
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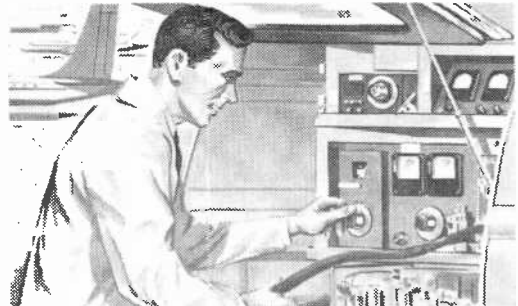
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3 NEW LOCATIONS

In addition to RCA Institutes Inc. courses, Radio Corporation of America offers a limited selection of basic Resident School Courses in Electronics at three new locations ... Chicago, Philadelphia, and Cherry Hill, N. J., (near Camden). For complete information, write the city of your preference next to your name on the attached postcard.

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The Most Trusted Name in Electronics

Showcase

(Continued from page 14)

unit, and two woofers, the "Symphony No. 1" system reputedly achieves even distribution of highs throughout the room in the horizontal plane. The "Symphony No. 1" measures 44" x 27 $\frac{3}{4}$ " x 16" and is available in certified walnut, mahogany, ebony, or fruitwood finishes. Crossovers are at 200 and 1500 cycles; impedance is 8 ohms.

A new multiplex adapter, **De Wald's P-400** can be

used with almost any tuner equipped with a multiplex jack. The adapter has a blend control for adjusting stereo separation to taste and em-

ployes a circuit built around two dual-purpose tubes. Price, \$57.95. . . . **EICO's** MX-99 multiplex adapter will work with all of the company's FM equipment (HFT-90, HFT-92, ST-96) as well as with other quality, wide-band FM tuners provided with a



De Wald P-400 adapter

multiplex output. The MX-99 is self-powered and includes low-impedance cathode-follower outputs; an indicator lamp comes on when the station selected is broadcasting multiplex stereo. Prices: \$39.95 in kit form; \$64.95 factory-wired. . . . Everyone knows that dust is no friend of records, and **Electro-Sonic's** changer "Dust Bug" sweeps record grooves scrupulously clean just before the stylus reaches them. Developed especially for record changers, the new "Dust Bug" is similar to the standard model. Both utilize a brush of pointed soft nylon fibers in conjunction with a cylindrical plush pad, and both are dampened with a special anti-static fluid which collects groove dust and neutralizes electrostatic charges on the record. Price? Just \$4.75. . . . From Germany comes a new two-track monophonic tape recorder, complete with case, microphone, power cable, and empty reel. The **Korting MT 136** operates from any 117-volt a.c. line, has two speeds (7 $\frac{1}{2}$ and 3 $\frac{3}{4}$ ips), and weighs only 29 pounds. Features include a tape-position indicator for both forward and rewind, a recording-level indicator, switchable input for microphone and radio, and separate bass and treble controls. The MT 136 recorder carries a list price of \$219.50.

A self-contained stereo system released

THE TURNER 254C

NEW BASE STATION MICROPHONE TO IMPROVE CB PERFORMANCE

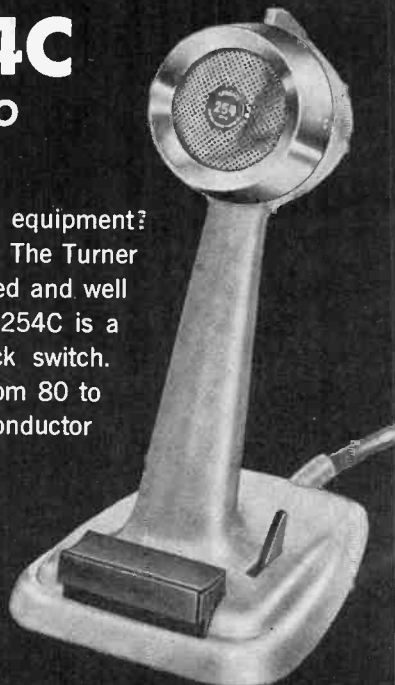
Not getting the performance you'd like from your CB equipment? The trouble could be in your present base station mike. The Turner Model 254C is the ideal replacement—attractive, rugged and well below the price you might expect to pay. The Model 254C is a ceramic microphone with on-off push-to-talk and lock switch. Durable gray hammertone finish. Smooth response from 80 to 7,000 cps. Level: -54 db. Cable is 7 feet long, single conductor shielded. Economy-priced at only \$14.10 net.

FOR MORE INFORMATION WRITE:

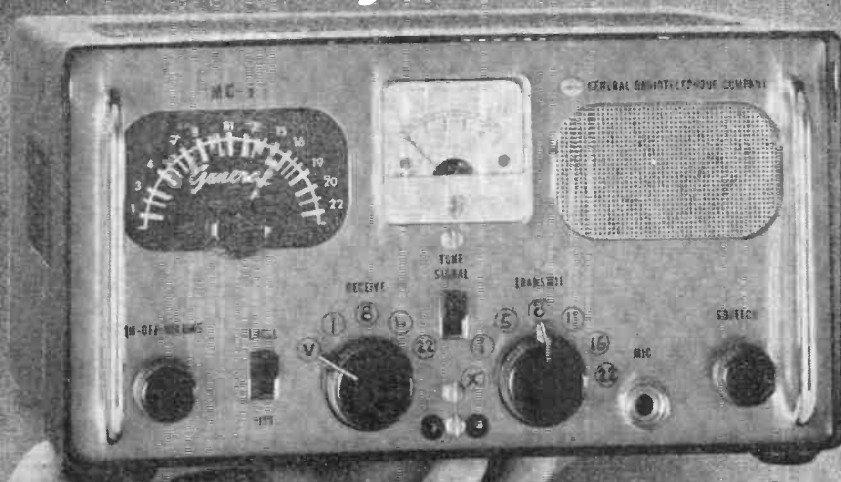


THE TURNER MICROPHONE COMPANY

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11 meter two-way radio...



General is in command with the new MC 5

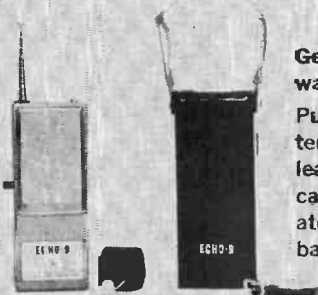
3.25-watts minimum output. • New phase-reversal modulation transformer for unparalleled talk power. • New Zener Diode shunt noise-clamp and series gated limiter circuit for highest noise limiting ever achieved. • New ultra-low drift oscillators for unsurpassed stability. • New Hi-level Tone-Signal. • 15 watt construction.

Net Price including microphone and crystal . . . \$199.95.

90 day warranty. F. O. B. Burbank, California

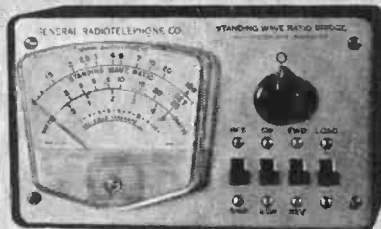
FREE—Write for schematic and complete technical manual

Under present rules part 19.32 the FCC does not provide for more than five (5) watt input in the Citizens Radio Service (26.965-27.225 MC Band).



General's new all transistor two-way pocket radio-telephone.

Push to talk communication system, 9 transistors, complete with leather case, earphone in leather case, batteries, "Ready to operate." \$59.95 each, F. O. B. Burbank, California.



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The only single precision instrument that measures True Power, Standing Wave Ratio, Relative Field Strength. Net price \$39.95.

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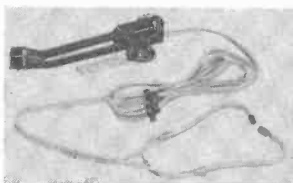
General Radiotelephone Company. DEPT. P2

3501 Burbank Boulevard, Burbank, California

Showcase

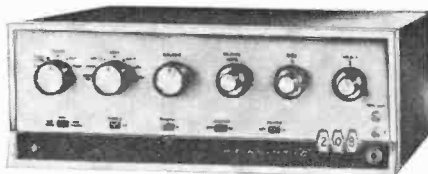
(Continued from page 20)

by *Lafayette* is actually a throwback to the old days of acoustic phonographs. A simple air-pressure device activated by the minute movements of the tone-arm stylus is the only moving part, and a balanced stereophonic sound issues from the earphones without use of amplifiers, speakers, or wires. A specially designed "controller" contains a volume control for each channel as well as an overall "balance" control; the earphone "tubes" are connected directly to the stereo tone arm. Ideal for schools, labs, or just plain "private listening sessions," the SH-100 can easily serve two, three, or even four persons with the addition of supplementary tubes and adapters. Price, \$29.50.



Lafayette SH-100 system

trols including a 5-position input selector switch; a 7-position function switch; ganged volume controls; concentric balance and



Radio Shack TA-208 stereo amplifier

blend controls; and switches for rumble, loudness, scratch, and power on/off. Frequency response is ± 1 db from 20 to 20,000 cycles; tape-recorder input and earphone jacks are located on the front panel. Prices: \$139.95 in kit form; \$189.95 factory-wired.

- Audio Dynamics Corp., 1677 Cody Ave., Ridgewood 27, N. Y.*
- Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.*
- Benjamin Electronic Sound Corp., 97-03 43rd Ave., Corona 68, N. Y.*
- De Wald Radio Div., United Scientific Laboratories, Inc., 35-15 37th Ave., Long Island City 1, N. Y.*
- EICO (Electronic Instrument Co., Inc.), 33-00 Northern Blvd., Long Island City 1, N. Y.*
- Kimberley International, Ltd. (Korting), 346 W. 44th St., New York 36, N. Y.*
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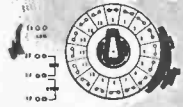
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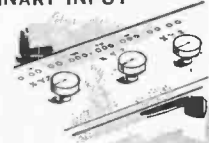
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DECIMAL INPUT-OUTPUT



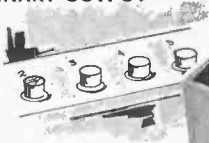
Motor-driven, sixteen position, non-shorting sequences.

BINARY INPUT



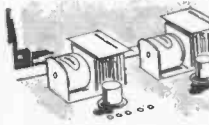
Transmits information for processing, six primary, double-pole, double-throw switches.

BINARY OUTPUT



Communicates to the operator results of the programming.

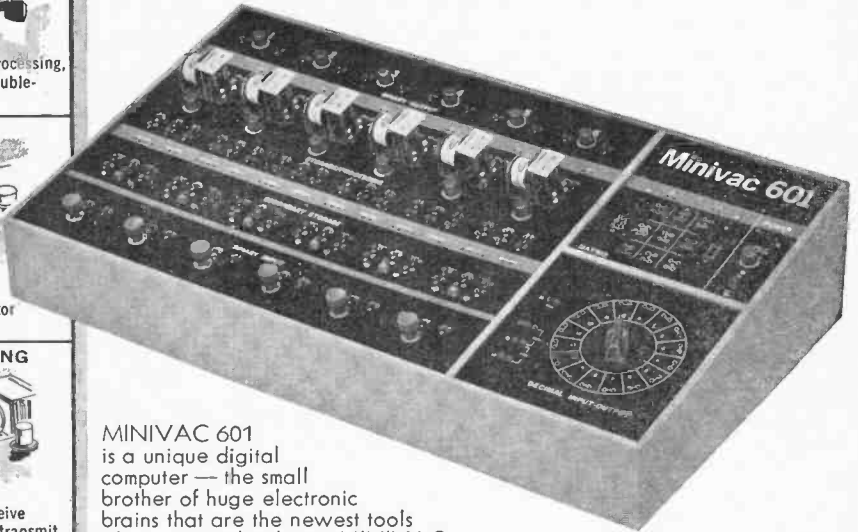
STORAGE PROCESSING



Six double-throw relays receive information... process it... transmit it to other components.

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MINIVAC 601 is a unique digital computer — the small brother of huge electronic brains that are the newest tools of science and industry. MINIVAC has memory — it thinks... it can even play games. It prepares teenagers and adults for the world of tomorrow.

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**Tips
and
Techniques**

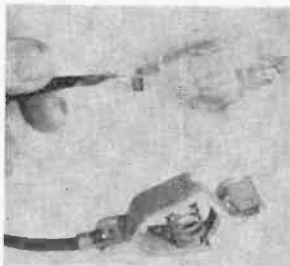


REMOVER FOR TUNER SPRINGS

An ordinary screwdriver with a "V"-shaped notch in the blade makes an ideal tool for pushing out the shaft-retaining screw from a drum-type TV tuner. Servicemen who must often disassemble such tuners for cleaning and repair will find that the modified screwdriver is a great time-saver—preventing the spring from accidentally flying into mid-air.
—George Lublien

QUICK INSULATION FOR CLIPS

Need some insulating covers for test clips in a hurry? Just wrap each clip with some material cut from an old clear-plastic bag. Secure the wrapping at the back of the clip with tape or a rubber band, then cut a small opening near the clip's mouth. If you don't have a supply of plastic bags at your house, you can use sections of the plastic wrappings in which the cleaner returns your suits.
—John Comstock



REMOVER FOR MINIATURE TUBES

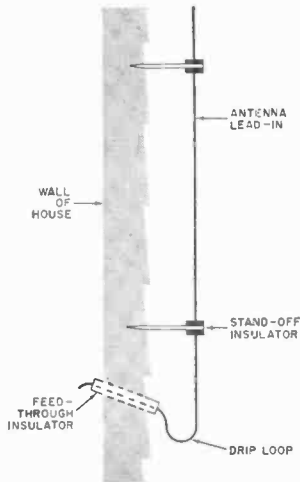
If you're working in close quarters, a toy plastic baby bottle with the top removed makes a good holder for removing or replacing miniature radio or TV tubes. Squeeze the sides of the bottle slightly to expel some air and slip the mouth over the top of the tube. When pressure is released, the resulting suction will firmly attach the tube to the bottle and you can quickly remove or insert it.
—Wayne Floyd



Always say you saw it in—POPULAR ELECTRONICS

LEAKLESS TV LEAD-IN

If you're putting up a TV antenna, you can prevent water from running into your house along the lead-in wire by taking two simple precautions. When installing the lead-in, form a "drip-loop" in the line as illustrated. And, if you put in a feed-through insulator, the mounting hole



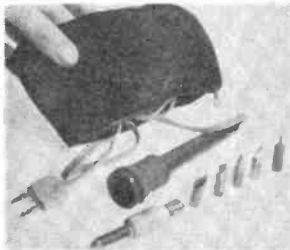
should be drilled at an angle, tilting slightly downward towards the outside of the house.

—Art Trauffer

POUCH STORES SOLDERING PENCIL

Having trouble digging your soldering pencil and its extra tips out of the tool box?

Make a quick trip to your neighborhood cigar store and pick up an inexpensive plastic tobacco pouch. Store your soldering apparatus in the pouch and you won't have to untangle the



pencil's line cord from a pile of miscellaneous tools or search around for an elusive tip.

—Charles Lang

STENCIL LABELS PANELS

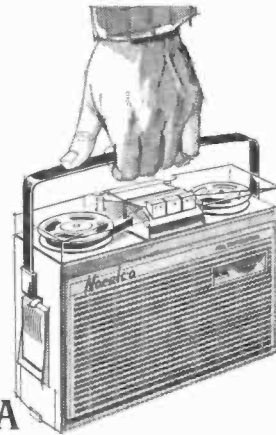
Ordinary typewriter stencils can be used to label equipment panels. Simply cut the stencil in the normal way and hold it in place against the panel. Then apply a small amount of paint to the end of your finger and draw it across the stencil. For best results, the paint should be about the consistency of Vaseline.

—C. Harvey Haas

CABLE STRAIN RELIEF

A quick way to provide a strain relief for a cable passing through a chassis opening is shown on page 26. Slit about four inches

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A PORTABLE TAPE RECORDER

that works on ordinary
FLASHLIGHT BATTERIES
so you can now record
anything, anytime, any-
where!

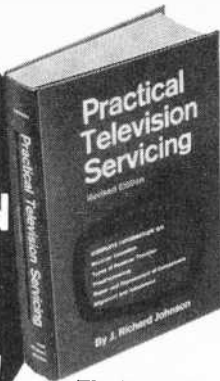
Only 7 lbs.—is worn over your shoulder like your camera. 100% transistorized. Records and plays back up to 2 hours on a 4" reel. Has constant speed motor and capstan drive. Combined indicator for modulation level and battery life. Input for mike/phone. Output for external amplifier. Response: 100 to 6000 cps. Signal-to-noise ratio: better than -40db. Completely self-contained with dynamic cardioid microphone, 4" speaker, patchcord assembly for recording and playback thru radio, TV or record player. Ruggedly built, handsomely styled, suprisingly low-priced. It's the new Continental '100'.

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- **FIRST** you learn all about receiver construction sections, functions and other basic data so essential to modern servicing.
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- **CRITICAL ALIGNMENT PROCEDURES** including the connecting and adjusting of test instruments are fully described.
- **COMMON FAULTS** in TV circuits are explained section by section.

448 pages and over 325 illustrations bring you full, easily understood details on servicing tuners; video IF and detector sections; video amplifiers; synchronizing and sweep circuits; picture tubes; sound; power supplies; antennas (including helpful installation tips); quick troubleshooting techniques; wiring; component replacements . . . and all the rest. In addition a chapter on Color TV principles brings you up-to-date in this important field.

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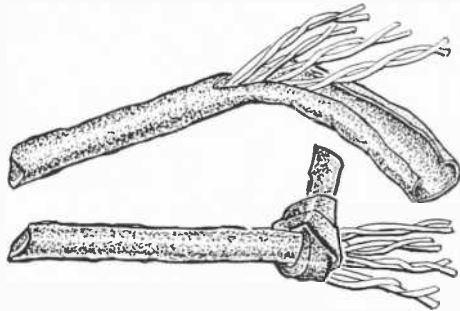
Send new, revised PRACTICAL TV SERVICING manual for 10-day FREE EXAMINATION. If I decide to keep book, I will then send you \$7.95 plus postage in full payment. If not, I'll return book and owe nothing. (#705657) (SAVE! Send \$7.95 with order and we pay postage. Same 10-day return privilege with money refunded.)

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Tips

(Continued from page 25)

of the cable's outer insulation as shown, pull the insulation away from the conductors, and tie a knot in it. This method makes it

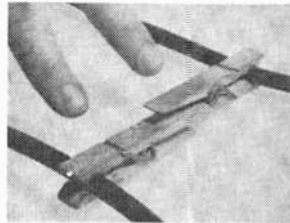


unnecessary to knot the whole cable, and is especially useful in cases where the conductors are delicate. —Dennis Gunst

CLOTHESPINS PREVENT HUM

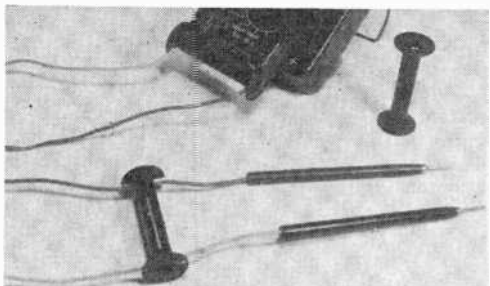
Hum is often picked up in hi-fi systems because audio cables (even shielded ones) and power cables are too close together. Keeping these cables apart isn't always easy, but you can solve the problem with a couple of spring clothespins. Just cement them together back-to-back and clamp a cable in each jaw.

—Joseph Carroll



FILM SPOOLS "SPACE" TEST LEADS

When taking measurements in sensitive circuits, it's sometimes necessary to keep the test leads some distance away from each other. Plastic film spools make ideal



spacers for this purpose. It's only necessary to saw a slot in each flange large enough to accommodate the wire. —Charles Lang

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

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

ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

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THE "EDU-KIT" IS COMPLETE

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

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

PRINTED CIRCUITRY

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

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

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

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- PLIERS-CUTTERS
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- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

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

FROM OUR MAIL BAG

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

Ben Valerio, P. O. Box 21, Magna, Utah, writes: "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, and 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., writes: "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."

UNCONDITIONAL MONEY-BACK GUARANTEE

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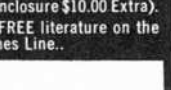
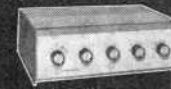
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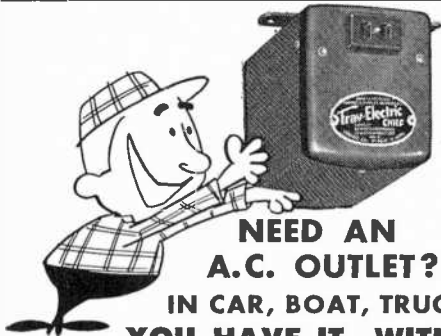
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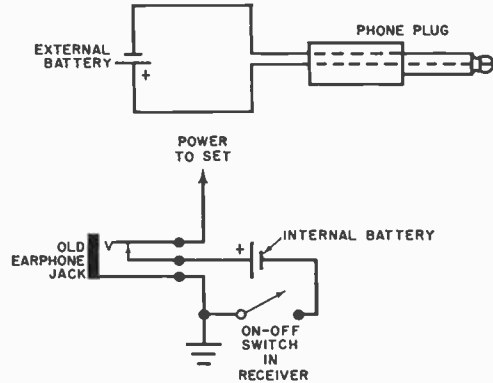
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External Power Supply for Transistor Radio

IF you don't use the earphone attachment on your transistor radio, its jack can serve as a handy connector for an external battery power supply. Use of an external supply, made up of standard flashlight cells, will save the set's small internal batteries for occasions when true portability is needed.

The earphone jack is usually of the closed-circuit type, wired to cut off the speaker when the earphone is plugged in. The leads connected to the two ungrounded jack contacts should be removed, then spliced together to provide an unbroken circuit to the speaker. When this is done, disconnect the wire running to the ungrounded terminal of the bat-



tery plug and connect it to the phone-tip contact of the jack. The shorting contact of the jack is connected to the battery-plug terminal previously disconnected.

Wire up enough penlight or standard flashlight cells in series to match the voltage of the internal battery (usually 9 volts). The leads from this external battery should be connected to a phone plug (possibly the old earphone plug). Be sure to wire up the plug so that the polarity of the external battery matches that of the internal one.

Your external power supply is now ready to use. Just plug it in and the internal battery will be automatically disconnected. —Ronald Cerrato

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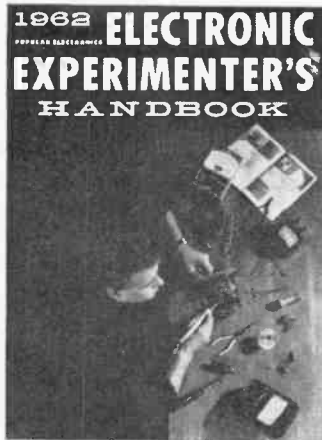
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by Marvin Tepper

"Basic Radio" draws on the author's experience in electronics publishing, education, and repair to clearly and accurately teach the fundamentals of radio communications. Principles are discussed at the technical institute level, and carefully presented so that they can be grasped with ease. The six volumes in the set are titled, respectively, "DC Electricity," "AC Electricity," "Electron Tube Circuits," "AM and FM Receivers," "Transistors," and "AM and FM Transmitters."

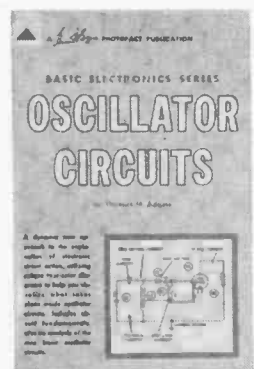


Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York, N.Y. Total number of pages, 776. Soft cover, \$13.85. Hard cover, \$14.85. Volumes may be purchased individually at prices ranging from \$1.90 to \$2.70.

OSCILLATOR CIRCUITS

by Thomas M. Adams,
Captain, United States Navy

The first of several volumes in a new Basic Electronics Series by Captain Adams, this book utilizes four-color diagrams to help the reader visualize the operation of nine basic oscillator circuits. An introductory chapter covers the fundamentals of electronic circuit operation, and nine additional chapters are devoted to specific oscillator types. Suitable for home as well as classroom study, "Oscillator Circuits" deals with crystal oscillators; Hartley; Colpitts; tuned-plate; tuned-grid; electron-cou-



pled; phase-shift; and blocking oscillators; multivibrators; and thyatron sawtooth generators.

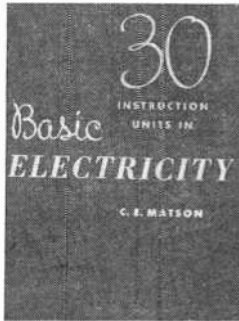
Published by Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind. 128 pages. Soft cover. \$2.95.



30 INSTRUCTION UNITS IN BASIC ELECTRICITY

by C. E. Matson

Designed for classroom use, this complete course in basic electricity may be employed on a junior high, senior high, or adult education level. The material is presented in simple, vivid form, and each instructional unit contains directions for practical work to illustrate the theory. The appendices offer the teacher an outline of the course, charts to record



the progress of each student, lists of necessary equipment and supplies, a suggested shop layout, and a bibliography.

Published by McKnight & McKnight Publishing Co., Bloomington, Ill. 127 pages. Soft cover. \$1.70.



DIAGNOSES OF TV & RADIO FAULTS (Teach-R-Matic Study Course No. TV-1)

by H. G. Cisin

An automated course in diagnosing TV and radio troubles, this book contains 50 cards on which multiple-choice questions are printed. These cards are used in conjunction with the "Teach-R-Matic," a rotary indicator which immediately tells the student whether his answer is right or wrong. The course may be used alone or with standard texts.

Published by Harry G. Cisin, Publisher, Amagansett, N.Y. 16 pages. Soft cover. \$4.90 (including the Teach-R-Matic).

New Literature

Norelco has released a new high-fidelity equipment and components catalog. The 8-page booklet contains photographs and spec-



PERSONAL Messenger

- No license required—may be used at once!
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This is the new "Personal Messenger"—a superbly engineered 2-way crystal-controlled transceiver so compact it fits in your hand—so flexible it can be used in thousands of applications! 11 transistors and 4 diodes—superheterodyne receiver with exclusive tuned R.F. amplifier gives you twice the sensitivity and more than 40% more range than units with conventional circuitry! Powerful two-stage transmitter delivers more power output than similar units with the same rated input! Unmatched audio intelligibility and razor-sharp voice reproduction—automatic noise limiter—automatic volume control—positive squelch control—elastic hand strap—operates on penlight or rechargeable nickel-cadmium batteries. **\$109.50**

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- GENERATOR NOISE SUPPRESSOR Model GNS Reg. \$3.98 tuneable for CB band (3 or more- \$1.49 ea.) \$1.99
- 11-PC. CB SILENCER KIT Model NN-1 Reg. \$8.95 spark plug & distributor suppressors + gen. cond. and GNS \$3.49
- RG8u COAXIAL CABLE... 100 feet for \$7.99
- RG58u COAXIAL CABLE... 100 feet for \$2.99

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Bookshelf

(Continued from page 31)

ifications of the four "Continental" tape recorders, and describes the full line of Norelco T-7 high-fidelity loudspeakers. Copies are available from North American Philips Co., Inc., High Fidelity Products Div., 230 Duffy Ave., Hicksville, L.I., N.Y.

A 4-page circular released by Supreme Publications describes their newly published "1962 Television Servicing Manual" and other available books. Write Supreme Publications, Highland Park, Ill., for a copy.

Now available from Allied Radio is a 144-page "Discount Stereo Record and Tape Catalog." Organized into three sections, it details more than 1600 of the latest stereo record releases, 300 monophonic recordings, and about 800 4-track stereo tapes. Included are monophonic "talking-book" children's records and foreign-language listings. Contact Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill., and request Catalog #211.

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Improves signal/noise up to 20 DB by eliminating precipitation static

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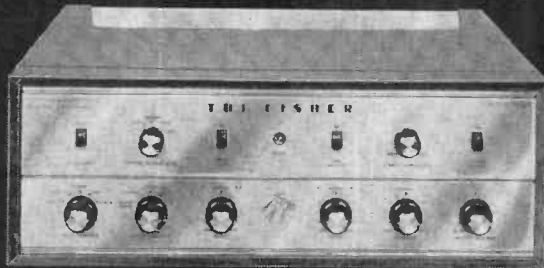
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The StrataKit method of kit construction permits assembly by easy, error-proof stages (strata), each stage corresponding to a *particular page* in the Instruction Manual and to a separate transparent packet of parts, separately identified. Major components come already mounted on the rugged chassis, and wires are *pre-cut* for every stage—which means every page!

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proceeding to the next stage. There are no surprises with a Fisher StrataKit, only the pleasure of accomplishment and of effortless learning.

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80 watts IHFM music power—the maximum available today with any control-amplifier kit. Harmonic distortion 0.4%. Hum and noise 93 db below full output.

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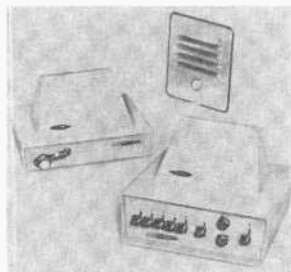


measures resistance as well as d.c. and a.c. voltages entirely electronically. Voltages to 1500 volts a.c. or d.c. are handled in five ranges; resistances from 0.2 ohms to 1000 megohms are covered in another five ranges. Input impedance is 11 megohms on d.c., 1

megohm on a.c. The unit is supplied with EICO's "Uni-Probe," which can be switched from a.c. volts to d.c. volts simply by turning the tip. The Model 222 sells for \$27.95 in kit form, \$42.95 factory-wired.

INTERCOM KIT

You can have both indoor and outdoor communications with the new Heathkit intercom system. There are separate "talk" and "listen" level controls on the transistorized master unit, and provision is made for up to five remote stations. The indoor and outdoor remote stations are each supplied



with 50 feet of wire, and the indoor remotes can be switched by the master to be heard at any other remote in the house. The master station itself can call any individual remote or all remotes at once. Indoor remotes (GD-131) sell for \$8.95; outdoor remotes (GD-141) for \$5.95; and the master unit (GD-121) for \$29.95. (*Heath Company*, Benton Harbor, Mich.)

SCREW-HOLDING SCREWDRIVERS

A complete line of screwdrivers for holding and starting extremely small screws (sizes
(Continued on page 38)

Always say you saw it in—POPULAR ELECTRONICS

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you can afford!

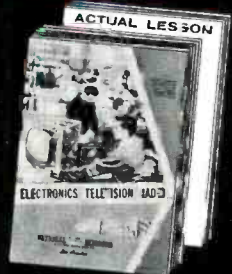
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When I enrolled with N.T.S. last November, I was trained as a Seismograph

Observer. I was promoted to that job on May 1st of this year. With your school and my practical work in the field, my superiors recognized that I was capable of handling the job of Seismograph Recording. My superiors highly praise your school. The day I enrolled started me off to success.

Edgar Wesatzke

As field director of Berean Mission Inc., I have complete charge of our radio work.

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

Rev. Enoch P. Sanford



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

Air Force but I have paid for all my equipment with money earned servicing TV sets. Yes, N.T.S. gave me my start in television.

Louis A. Tabat

I have a TV-Radio shop in Yorkville, Illinois, about 4 miles from my home, and it

has been going real good. I started part-time but I got so much work that I am doing it full-time. Thanks to National Technical Schools.



Alvin Spera

ALL 8 PHASES IN ONE MASTER COURSE

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

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

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

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

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

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

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

**PHASE 8
BROADCASTING &
COMMUNICATIONS**
In the entertainment industry, or in commerce, communications and broadcasting have great importance. Installation and maintenance of equipment requires trained technician know how.

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INTERNATIONAL'S **Executive** **MODEL 100**



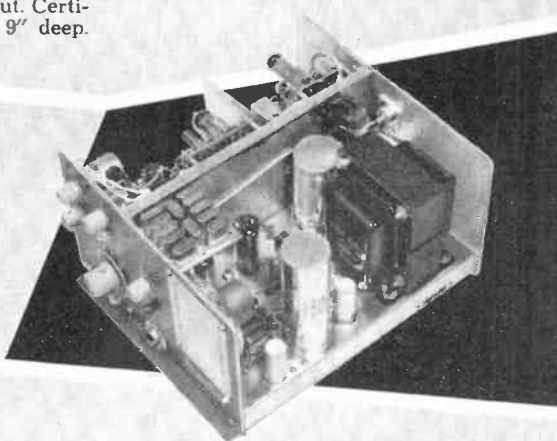
**citizens
band
transceiver**

A precision engineered transceiver for Citizens Band licensees seeking outstanding design and performance. Tunable dual conversion superheterodyne receiver covering all 23 channels. Two crystal control receive positions. Push-to-talk operation. Three way power supply for 6/12 vdc and 115 vac. Five watts plate input. Certified tolerance $\pm .005\%$. Size 5½" x 8½" x 9" deep.

Complete with 1 transmit crystal, 1 receive crystal, new style ceramic microphone and coil cord..... \$199.50

Advanced engineering featured in the Executive Model 100

- NEW crystal filter minimizes adjacent channel interference.
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- NEW International NR squelch.
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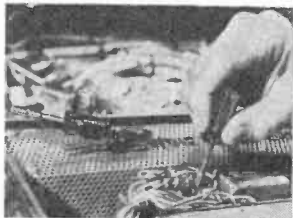
City _____ Zone _____ State _____

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products

(Continued from page 34)

from #00 to #2) has been added to the Hunter "Magic Tip" line. Supplied in three different lengths (2½", 4", and 7"), they sell for under \$3.00 each. In every case, the holding mechanism is internal and fully automatic. To lock the



screw on the tip of the driver, the user merely presses forward on the handle; this rotates a small spring-steel wire which runs down the blade, wedging it into the head of the screw. (R. N. Hunter Sales Co., 9851 Albertus Ave., Santa Fe Springs, Calif.)

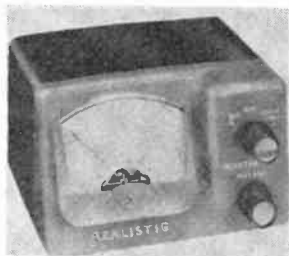
CB MICROPHONE

A desk-type ceramic microphone, specifically intended for Citizens Band base-station use, is being marketed by Turner. The Model 254C, which uses the same ceramic cartridge as the Turner Model 350C, has been

designed for clear, distinct, voice transmission. It has a frequency response of 80-7000 cycles and an output of -54 db. Provision is made for the actuation of a transmit/receive relay, and two "on/off" switches are included. One of these is a "touch bar" type; the other is a lever which can be locked in the "on" position. The handsomely-styled unit should please the eye of almost any CB'er. Price: \$14.10. (Turner Microphone Company, 901 17th Street, N.E., Cedar Rapids, Iowa.)

ELECTRONIC THERMOMETER KIT

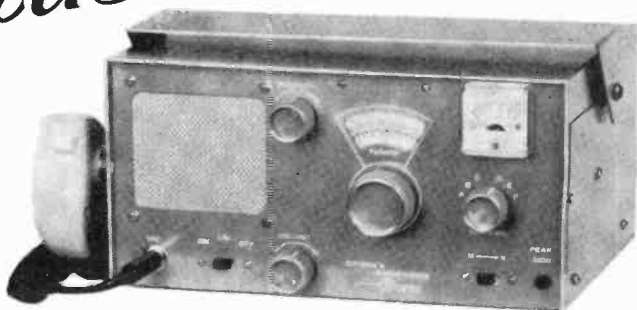
Radio Shack recently introduced the "Novatherm," an electronic thermometer that measures a temperature range from -20°F to 120°F. This device, which utilizes semiconductors, has an accuracy of ±½°F and can provide readings of two different temperatures at two different locations. It registers lightning-fast reac-



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MOBILE

- 17 Tube Performance
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- Transistorized Power Supply
- 6 or 12 Volt D.C. Input

MODEL
TR-70 \$210



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PRESENTING — The TR-70 CITIZEN'S BAND MOBILE RADIOPHONE. At last — a mobile that will really get out. Copy your stations from locations you never thought possible. Extended range and fewer "dead spots" are now yours with the hottest mobile on the market.

With 100% modulation you will be transmitting with the crispest signal ever. Be free from adjacent channel interference and have four watts of undistorted audio at your fingertips as well as 3.5 watts MINIMUM output. This mobile combines TRAM base station performance with mobile compactness. It is designed to operate on either 6 or 12 volts DC.

The companion TR-27 Base Station as advertised
in January issue of Popular Electronics — \$239

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AND SPECIFICATIONS, WRITE TO



TRAM ELECTRONICS

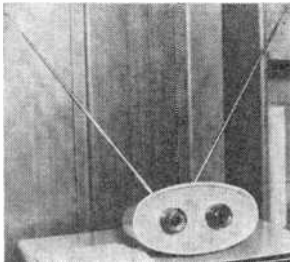
P. O. BOX 187, WINNISQUAM, N. H.

tions to temperature change and will take readings up to 1000 feet from the sensing unit without recalibration. The Novatherm kit sells for \$19.95; the unit can be purchased fully wired for \$29.95. An accessory kit, extending the range of the Novatherm, is available for \$3.95. (*Radio Shack Corp.*, 730 Commonwealth Ave., Boston 17, Mass.)

RABBIT-EARS FOR SWL'S

Short-wave listeners who, for one reason or another, are not able to erect an outdoor antenna will be interested in the Hy-Gain Model SWI indoor antenna system which consists of a

set of telescoping "rabbit ears" mounted on an antenna tuner. It covers the frequencies from 5 to 30 mc. and may be matched to the input of any short-wave receiver; separate "match" and "tune" controls are provided. In addition to its normal use, the unit can easily be adapted to act as a tuner for an outside antenna. Price, \$14.75. (*Hy-Gain Antenna Products*, 1135 N. 22nd St., Lincoln, Nebr.)



WALKIE-TALKIE KIT

A low-cost, do-it-yourself version of the "Spacephone," a transistorized walkie-talkie produced by Electrosolids, is now available. The assembled radiomeasures 2½ x 5", weighs only 8 ounces with battery, and has a range of ½ mile (up to 2 miles under favorable conditions). A printed-circuit board simplifies the construction, and a screwdriver and soldering iron are the only tools required for assembly. The "Spacephone" kits are being offered at two for \$29.95, about half the price of the factory-wired version. (*Electrosolids Corp.*, 12740 San Fernando Rd. N., Sylmar, Calif.)

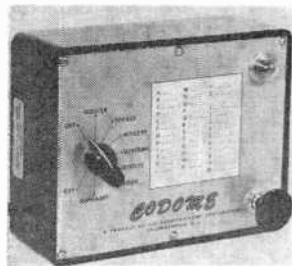


CODE PRACTICE DEVICE

The "Codome," a Morse-code self-teaching device marketed by the *Accentrome Corp.*,

117 Crestmont Terrace, Collingswood, N. J., automatically transmits code characters in random order.

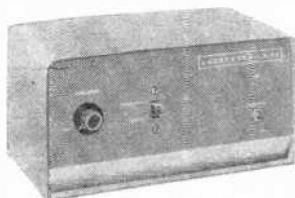
The alphabet and numbers are divided into 6 groups of 6 characters each; any group—or the complete alphabet—can be selected for random transmission. Transmission speed is about 6 words per minute, and both audible (buzzer) and visual (flashing light) signals are produced. An external code oscillator may be connected, if desired, to replace the buzzer, and a built-in manual key allows you to practice sending. Price, \$17.95.



WIRELESS BROADCASTER/AMPLIFIER

A wireless broadcaster available in kit form from *Lafayette Radio Electronics Corp.*, 111

Jericho Turnpike, Syosset, L. I., N. Y., can also be used as an audio amplifier. Designed for either crystal or magnetic mi-



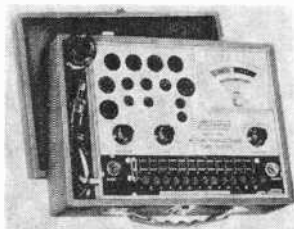
crophones or cartridges, the device will broadcast through AM radios or through a 4 - 8 ohm PM speaker. The KT-195 sells for \$11.95. A factory-wired version (Model LA-23) costs \$14.95, and a crystal microphone for either unit (Model PA-73) is \$2.95.

COMPACT TUBE TESTER

The Model 1000 mutual conductance tube tester produced by *Mercury Electronics Corp.*, 111

Roosevelt Ave., Mineola, N. Y., accommodates all the new tubes—including Nuvistors, Compactrons, Novars, and 10-pin types.

Tests can be made for dynamic mutual conductance, interelement shorts and leakage, grid emission, and gas. Additional features of the Model 1000 include automatic line voltage regulation and built-in pin straighteners. Said to be the most compact of its type, the tester sells for \$79.95.



BEST BUYS IN STEREO AND MONO HI-FI

New Transistorized Stereo/Mono 4-Track Tape Deck RP100 Semikit (electronics in kit form) \$299.95 Wired \$399.95



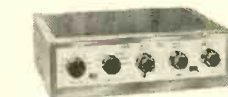
New FM-AM Stereo Tuner ST96 Kit \$89.95 Wired \$129.95 Incl. FET

New 70-Watt Integrated Stereo Amplifier ST70 Kit \$94.95 Wired \$149.95



New 40-Watt Integrated Stereo Amplifier ST40 Kit \$79.95 Wired \$129.95

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AM Tuner HFT94 Incl. FET Kit \$39.95 Wired \$65.95



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70W HF87: Kit \$74.95 Wired \$114.95
28W HF86: Kit \$43.95 Wired \$74.95

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Bookshelf Speaker System HFS1 Kit \$39.95 Wired \$47.95

BEST BUYS IN CITIZENS TRANSCEIVERS, HAM GEAR, RADIOS

Citizens Band Transceivers from Kit \$59.95 Wired \$89.95



New 60W CW Transmitter #723 Kit \$49.95 Wired \$79.95



NEW Walkie-Talkie Citizens Band Transceiver #740 Kit \$54.95 Wired \$79.95. Complete with rechargeable battery & charger.



BEST BUYS IN TEST EQUIPMENT

New Metered Variable Auto-Transformer AC Bench Supplies Model 1073 (3 amps) Kit \$35.95 Wired \$47.95 Model 1078 (7½ amps) Kit \$42.95 Wired \$54.95



Peak-To-Peak VTVM #232 & Uni-Probe® Pat. #2,790,051 Kit \$29.95 Wired \$49.95



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NEW AC Volt-Watt Meter #260 Kit \$49.95 Wired \$79.95



Multi-Signal Tracer #145A Kit \$19.95 Wired \$28.95



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Electronics is the nation's fastest-growing industry, and the demand for the formally trained electronics technician will exceed the supply for years to come. If your future lies in electronics, then an electronics training school can open the door to success.

ELECTRONICS SCHOOLS

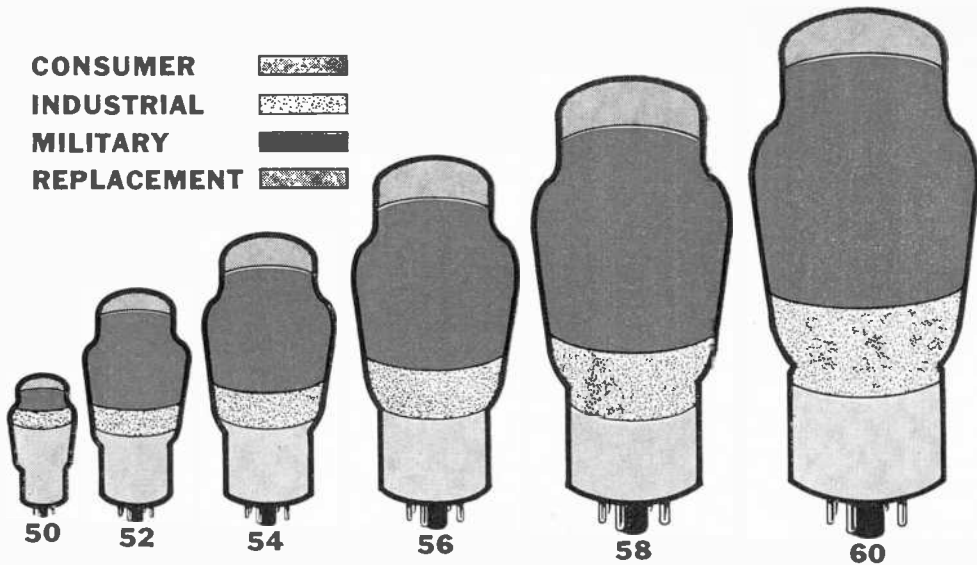
the key to your future

Part 1 of 3 Parts

By JOHN D. & IRENE LENK

“THE Electronics Age . . . Outer Space . . . FCC License . . . Color TV . . . Earn While You Learn . . . Radio Astronomy . . . B.S.E.E. Degree . . . Technical Writing . . . Big Pay . . . Computer Specialist . . .” Any of these sound familiar? If so, it's likely that you've been reading some of the advertisements for electronics training schools. If you've paid any attention to these ads, you know that they point to an almost unlimited future in the field of electronics. They indicate that there are thousands of job openings today, with many thousands more to come in the years ahead.

But what are the facts? Is the picture really this bright? Can *you* step into a rewarding career by spending the next year or so at intensive study? The answer is unquestionably, “Yes.” Why? To find out all about electronics schools and the status of the professional electronics



Electronics is the fastest-growing industry in the United States

technician today, we've poured through reams of government and independent manpower surveys. We've questioned dozens of schools, and we've interviewed leaders of the electronics industry. Despite a certain confusion in terminology (there are at least four different descriptions of an "electronics technician"), certain facts are quite clear.

The electronics field is expanding at a fantastic rate, and the advertisements tell only part of the story. If all of the schools operated all of their training facilities at full blast, they would still have difficulty in filling present job openings. And they wouldn't even make a fair-sized dent in the potential jobs due to open up within the next few years.

You will need training and more training to qualify for the newer developments in electronics. There has never been any room for the "screwdriver-and-pliers mechanic" in the electronics field. The half-trained or "self-taught" man is equally lost. There is only one way to enter or to advance yourself in the electronics industry. You must study a planned program under the direction of qualified instructors. And that's where electronics schools come in.

There is an electronics school to fit every specific need and every pocket-book. Our survey shows that there are

at least 240 schools in the United States offering some form of electronics training. Over 50 of these provide home-study courses. Another 150 schools have evening classes. This means that there is really no excuse for someone who wants to enter the electronics field, but feels that he has no chance because he lacks training.

So where does this leave you? Let's say that you're wise enough to realize the value of electronics training. But which school and which course will be best for you? Your first step is to decide which particular branch of electronics you want to enter. Then find out the qualifications (and rewards) for this specialization. Next, determine what training the various schools have to offer, and how they operate. This will tell you which school will "phase in" with your particular needs.

For purposes of the survey, we defined an electronics technician as "anyone whose job duties demand a basic knowledge of electronics, as well as specific knowledge of a particular electronics field, but who is not a graduate engineer." With this in mind, we arbitrarily divided the entire electronics field into five sections. Actually, some sections overlap others. But each has certain characteristics that make it stand out.



UPI

SERVICING

ALTHOUGH not the largest and not necessarily the most rewarding, radio and television repair is still the best known phase of electronics. Today, there are nearly 50 million TV sets in the United States, not to mention the millions of radios, hi-fi systems, phonographs, and tape recorders. All of these devices, needless to say, will require touch-up and repair at some time in their lives. This means 100,000 jobs in home electronics servicing at present, with an estimated increase of 15% per year over the next seven years.

Even in large metropolitan areas where the TV repair business is most competitive, a trained repairman can earn from \$6000 to \$10,000 per year. However, to make the top end of this pay scale, a repairman must be thoroughly trained in more than one specialty—color TV, for example, is a subject that is almost impossible to master without professional training. And while the radio/TV repair field offers the greatest opportunity for self-employment, complete training in all phases of home electronics is of utmost importance to the man who is seriously planning to enter this end of the business.



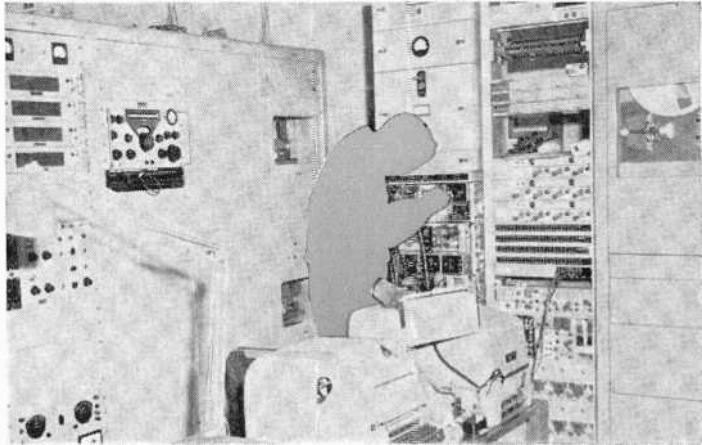
BROADCASTING

TO SOME, radio and television broadcasting is the most glamorous phase of electronics. With just a little imagination, you can visualize yourself as technical director on some network variety show, taking your coffee break with Dinah Shore. In reality, however, most cameramen, technical directors, sound men, and so on are not in the business for its glamour. Our survey shows that starting salaries in this field are in the \$6000-per-year bracket, with top technical personnel receiving \$14,000—and these figures are for a 40-hour, “full-coffee-break” week!

To some degree, this relatively high pay scale is the result of the rapid expansion in the field. Take TV as an example. In 1952, there were about 100 TV stations. Today, there are roughly 500 such stations, and the supply of trained personnel has never quite matched the demand.

The most important consideration for training in this field is the fact that you must hold a first-class radiotelephone license for just about any position. For this reason, most electronics schools now include license preparation as part of their courses.

COMMUNICATIONS



UPI

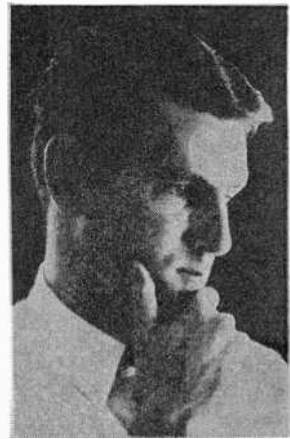
MOBILE and communications radio is another branch of electronics that has expanded into a big business overnight. Ten years ago, there were about 100,000 licensed communications stations in use. These included stations for police and fire departments, airlines, the merchant marine, pipelines, telephone companies, taxicabs, railroads, trucking firms, delivery services, and so on. Today, there are over a million such stations on the air, and the number is growing constantly.

About 60% of the technicians working in this field are employed by service companies who install and maintain equipment on a contract basis. Another 10% are employed by state and municipal governments as civil service employees. The remaining 30% is divided between employees of the merchant marine, airlines, telephone companies, and individual technicians who operate their own service companies.

Although actual earnings will depend upon the individual, the average is quite high. For example, a typical mobile radio service maintenance contract pays about \$100 per month. It's quite possible for a trained technician to maintain eight to ten such mobile stations single-handed, while some individuals are now covering 15 stations by themselves.

Besides a first-class radiotelephone li-

cence, the person interested in communications must have *practical experience* with communications equipment. And this is the snag. Since you are not permitted by law to use or operate such equipment without a license, or without being under the direct supervision of a



licensed operator, your chances of bypassing formal electronics training and breaking directly into the communications field are just about non-existent. Fortunately, most electronics training schools already include mobile radio courses (sometimes called communications courses) as part of their programs.

THE TERM "industrial electronics" is just about as broad as the term "electronics technician." For that reason, it has been next to impossible to pin down exact figures as to the number of people employed in this field. It is even more difficult to predict the future needs of this vast and rapidly growing branch of electronics.

For example, there are about 3300 computers and electronic processing machines now in use (excluding those operated by the military). The estimated non-military potential is for 50,000 to 60,000 such machines and this figure assumes no increase in our population! While a widespread use of this equipment may wipe out armies of semi-skilled clerical help, it will create even greater needs for trained electronics technicians.

Using the present figure of 8 to 10 technicians for each computer operating on a 24-hour basis, we will need over one-half million technicians to maintain

our future electronic processing systems alone. And this is only part of the picture. Our term "industrial electronics" includes automation, all non-military research and development, medical electronics, closed-circuit TV, railroad control, materials control, and several other minor fields or specializations.

To qualify as an industrial electronics technician, you must have intensive training in both the basics of electronics, and in one or more specialized fields. Assume that you now have a good working knowledge of basic electronics. Further assume that you want to enter the field of automation—say at the Ford Motor Company, which has an automated factory producing motor blocks.

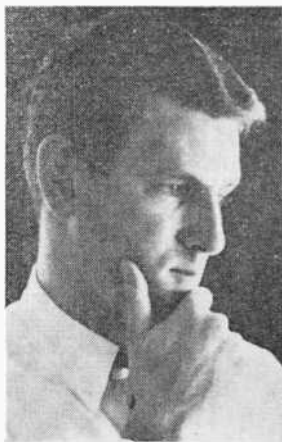
To qualify as an operator or maintenance technician for the electronics nerve center which controls this factory, you must be trained in all aspects of electronics automation. Because these automation techniques are so advanced and so far removed from the every-day branches of electronics, a specialized course at an electronics school is almost the only way to acquire the necessary skills.

The rewards in industrial electronics are understandably high. Our survey shows that starting salaries for graduates of electronics schools are in the area of \$6500 a year. And we have recorded many examples of industrial electronics personnel earning in the very pleasant neighborhood of \$20,000. Despite what you may think, these men are not graduate engineers. But they are graduates of advanced level trade schools or, in most cases, of technical institutes.

INDUSTRIAL



*This is the first part of
POPULAR ELECTRONICS'
special three-part report
on electronics schools.
The second installment
in this important series
will appear next month
and deal extensively with
correspondence schools.
The series will conclude
with a final installment
on residence schools.*



U. S. Air Force photo

MILITARY

ALTHOUGH there are no precise figures available, it has been reliably estimated that about half the electronics technicians working in the U.S. are connected directly or indirectly with the military. And while we will not deal extensively with military personnel in this series, it can be said that a graduate of an electronics training school who enters one of the armed services will have a 300% better chance of promotion than the untrained recruit.

For every military technician, there are five or six civilian technicians to back up the man behind the gun. Several thousand of these technicians work directly for the services, or as liaison men between the services and the equipment manufacturers. Generally known as field engineers, they maintain and repair radar, sonar, and guided-missile equipment, solve technical problems, or instruct service personnel. Such men enjoy officer status, receive generous travel and "per diem" allowances, and draw salaries in the range of \$7000 to \$11,000 a year.

At one time, the field specialist came largely from the ranks of graduate electrical and electronics engineers. But

this has been changed by the rapid post-World War II expansion. Today, less than 20% of the field engineers are college graduates. The remaining 80% are recruited directly from the electronics schools of the advanced trade or technical institute level.

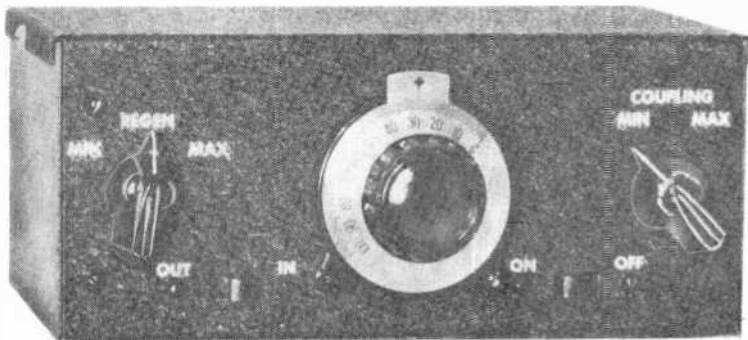
The great bulk of military electronics technicians are employed by firms which manufacture electronic equipment. These people work as engineering aides, research and development laboratory technicians, quality-control specialists, production-line trouble-shooters, and technical writers, to name a few classifications. Significantly, there are over 1000 such electronics manufacturing firms in the United States.

To solve the shortage of electronics personnel, some companies will even hire you, then send you to a training school at their expense! Most firms are not in a position to do this, however, so they must rely on new graduates to fill their needs. It goes without saying that if you are already trained, the electronics manufacturing firms will welcome you with open arms.

-50-

NEXT MONTH: Correspondence Schools

POPULAR ELECTRONICS



THE S-9'er

By JAMES G. LEE, W6VAT

This unusual preselector will pep up sensitivity, decrease images, in receivers without r.f. stages

“WOW! What black magic did you use to get those rare QSL's?” one SWL asked his buddy in amazement. “I've never really been sure I've heard those guys through all the QRM.”

“No black magic,” replied the second, “just that little black box sitting on top of my receiver.”

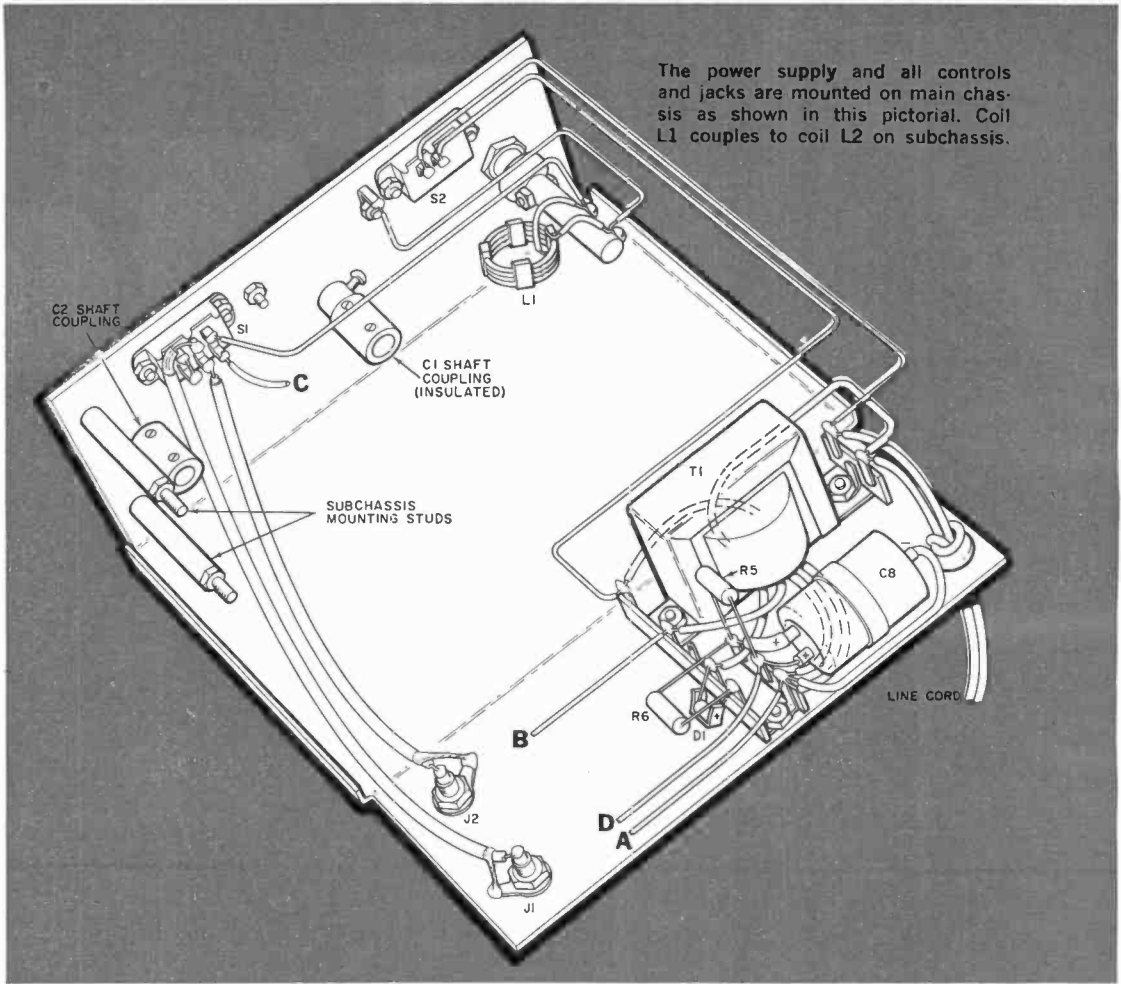
The “black box” referred to by the second SWL was the *S-9'er*, an unusual type of preselector. If your receiver has no r.f. stage, this unit can increase its sensitivity and image rejection to the point where you, too, will have a better chance of hearing and receiving QSL's from those rare DX stations. Covering 5 to 20 megacycles, the *S-9'er* is also useful to hams who do much of their operating in the 40- or 20-meter bands.

About the Circuit. The *S-9'er* is designed to be inserted in series with the line between the antenna and the receiver. With *S1 Out* (see schematic on p. 51), the preselector is bypassed and the antenna connected directly to the receiver.

When *S1* is in the *In* position, however, the antenna is switched to the preselector's input and the output of the preselector is connected to the receiver's antenna terminal.

In the latter case, the r.f. signals entering input jack *J1* from the antenna pass through coil *L1*, which is a movable link coupled to coil *L2*; this adjustable coupling allows the use of a variety of antennas. Coil *L2* is tuned by a dual variable capacitor (*C1*) in such a way that, for any setting of *C1*, the L/C combination resonates at two frequencies at once. In this way, the ranges of 5-12 and 11-20 megacycles are tuned simultaneously—eliminating the need for a bandswitch or for separate plug-in coils.

From the tuned circuit, the selected signals pass to the grid of triode *V1a*, which is connected as a neutralized r.f. amplifier. Capacitors *C2* and *C3* adjust the degree of neutralization; when the neutralization is reduced below a certain



The power supply and all controls and jacks are mounted on main chassis as shown in this pictorial. Coil L1 couples to coil L2 on subchassis.

point, *V1a oscillates* (regenerates) due to increased interelectrode coupling. The regeneration, carefully controlled, is used to increase the sensitivity and gain of the amplification stage, and the selectivity of the tuned circuit.

The amplified signal passes, through triode *V1b*, to output jack *J2* and is fed to the receiver. Triode *V1b* is connected as a cathode follower and contributes no further amplification. It serves, rather, to isolate the load of the receiver and connecting cable.

Power for the preselector comes from a built-in supply utilizing a silicon diode in a half-wave circuit.

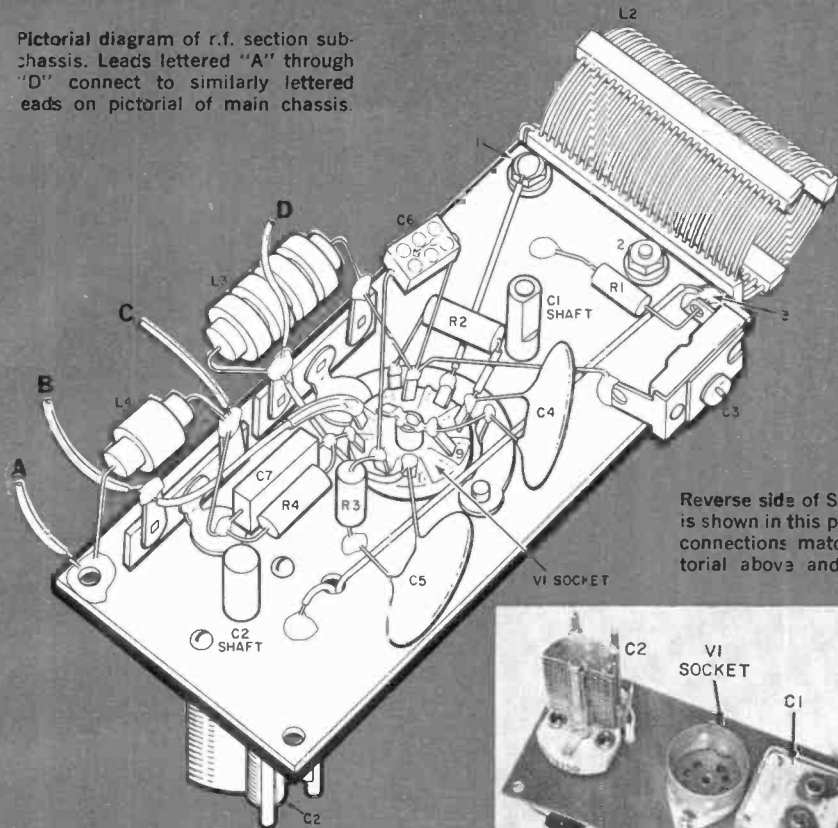
Construction. A 7" x 5" x 3" chassis box houses the preselector. The controls,

power supply, and input and output jacks are mounted on the chassis itself, while the r.f. section is built on a separate subchassis. Construction details are shown in the photographs and pictorial diagrams and should be followed fairly closely.

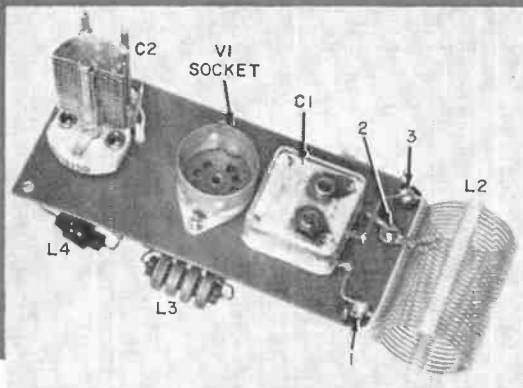
Begin by mounting the main tuning dial at the center of the front panel, then install slide switches *S1* and *S2*. When the above front-panel components are in place, the power transformer, filter capacitor, tie points, line-cord grommet, and input and output jacks are mounted on the rear wall.

At this point, the line cord should be installed and the power-supply circuit wired. When the wiring is complete, temporarily install a 10,000-ohm, 1-watt

Pictorial diagram of r.f. section sub-chassis. Leads lettered "A" through "D" connect to similarly lettered leads on pictorial of main chassis.



Reverse side of S-9'er subchassis is shown in this photo. Numbered connections match those on pictorial above and on schematic.



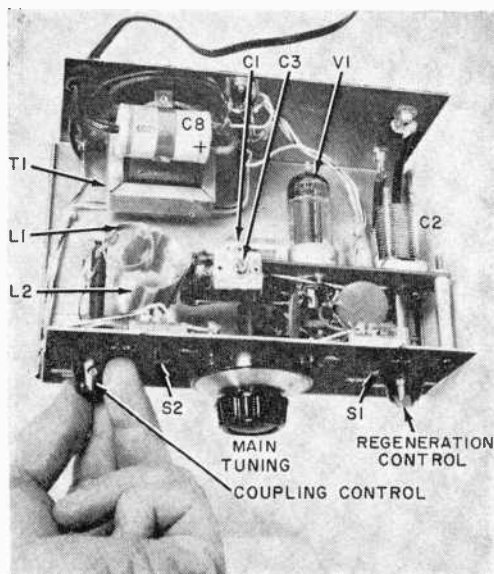
load resistor from the junction of *C8a* and *R5* to ground. Plug in the line cord, switch on *S2*, and measure the voltage across the load resistor. It should be at least 100 volts.

When the power supply has been checked out, wire the input and output jacks to switch *S1* using RG-58/U coaxial cable. The main chassis is now set aside for the time being and construction begun on the r.f. section.

The r.f. section is built on a 2" x 4½" Bakelite board which is copper-clad on one side. This type of board is intended for printed-circuit work, and is used here merely to simplify construction. The material is easy to drill and grounds can be soldered directly to the copper—allowing the use of short leads.

All three major components, capacitors *C1* and *C2* and the socket for *V1*, mount along the center line of the board. The tube socket is mounted in the exact center of the board; capacitor *C1* is mounted 1½" in from one end and positioned so that its lugs point away from the tube socket; capacitor *C2* is placed 5/8" in from the other end of the board. The shafts of the capacitors and the bottom of the tube socket should pass through to the copper-clad side of the board. Capacitor *C1*'s shaft must be isolated from ground, so be sure to make the hole through which it will pass large enough to avoid shorts to the copper.

The connections (labeled 1, 2, and 3 on the schematic) to coil *L2* are made via three terminals (labeled with cor-



The relationship between the main chassis and sub-chassis can be seen in this photo of the completely assembled S-9'er. Main tuning and regeneration controls are coupled to shafts of C1 and C2 respectively.

PARTS LIST

- C1—195- μ f. and 87- μ f., two-gang midjet variable capacitor (Lafayette MS-270 or equivalent)
 C2—140- μ f. miniature variable capacitor (Hammarlund APC-140 or equivalent)
 C3—30- μ f. trimmer capacitor
 C4, C5—0.02- μ f., 600-volt ceramic disc capacitor
 C6—270- μ f. silvered-mica capacitor
 C7—0.001- μ f. silvered-mica capacitor
 C8—20/20- μ f., 150-volt electrolytic capacitor
 D1—Silicon diode, at least 25 ma., 350 P.I.V. r.m.s. (Lafayette SP-196 or equivalent)
 J1, J2—Phono jack, RCA-type
 L1—4 turns of B&W 3011 Miniductor coil stock, or equivalent ($\frac{3}{4}$ " diameter, 16 turns per inch)
 L2—28 turns of B&W 3015 Miniductor coil stock, or equivalent (1" diameter, 16 turns per inch) tapped at 10 turns from "cold" end
 L3, L4—1-mh. r.f. choke
 R1, R3—100,000-ohm, $\frac{1}{2}$ -watt resistor
 R2, R4—68-ohm, $\frac{1}{2}$ -watt resistor
 R5—1000-ohm, 2-watt resistor
 R6—39-ohm, 1-watt resistor
 S1—D.p.d.t. slide switch
 S2—S.p.s.t. slide switch
 T1—Power transformer; primary, 117 volts; secondaries, 125 volts @ 15 ma., 6.3 volts @ 0.6 amp. (Stancor PS-8415 or equivalent)
 V1—6CG7 tube
 1—7" x 5" x 3" chassis box (LMB 145 or equivalent)
 1—2" x 4 $\frac{1}{2}$ " Bakelite board, copper-clad on one side (Lafayette MS-513 or equivalent)
 1—2"-diameter vernier dial (Lafayette F-347 or equivalent)
 Misc.—Knobs, shaft bushing, shaft couplings, tube socket, wire, hardware, line cord and plug, tie points, RG-58/U coax, etc.

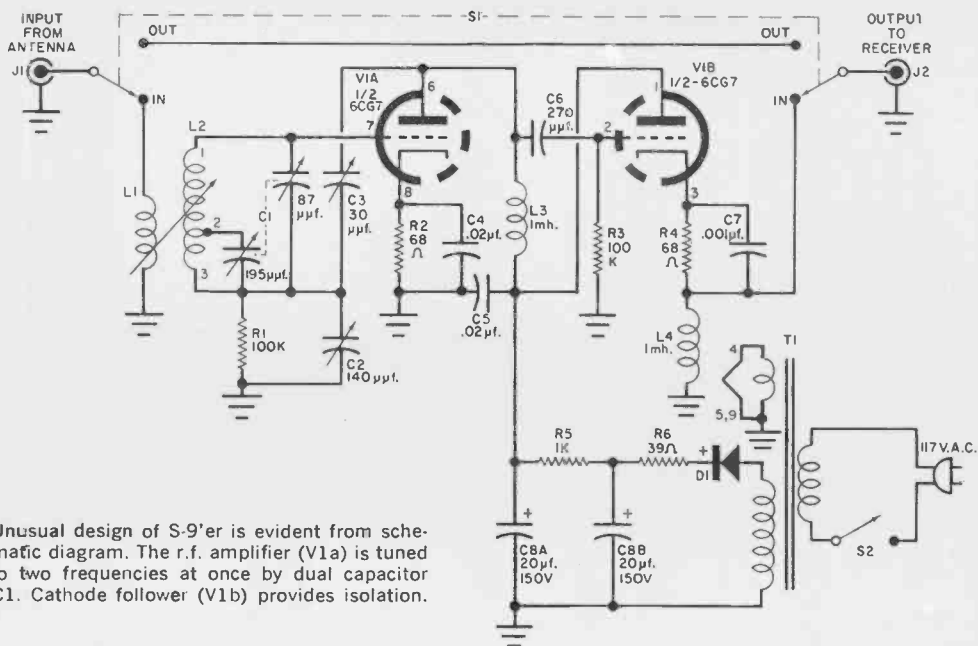
responding numbers on the pictorial diagram and photo of the r.f. section) mounted on the end of the board nearest C1. Each terminal consists of a 4-40 x $\frac{1}{4}$ " screw and nut insulated from ground by means of shoulder washers. The screw heads should be located on the unclad side of the board. Install terminals 1 and 3 at the corners of the board as shown in the pictorial. Terminal 2 is mounted about $\frac{3}{4}$ " from terminal 3; place two solder lugs under its screw and do not tighten it.

Now cut coil L2 from the B&W Miniductor stock, leaving the leads extra long. The coil is then placed against the end of the board on which the terminals are mounted; one lead is soldered into the screw-slot of terminal 1, the other into that of terminal 3. Use the excess lead lengths to make connections to capacitor C1. One of the lugs on terminal 2 is soldered to L2 at a point 10 turns up from the terminal 3 end of the coil, the other is soldered to the appropriate lug on C2. Terminal 2 may now be tightened and, to insure good electrical continuity, the two lugs should be soldered to the screw.

The two tie points are mounted on the copper-clad side of the board as shown on the pictorial diagram. Fasten the tie point nearest V1 under one of the tube-socket mounting screws. The other tie point may be soldered directly to the copper. This all but completes the mechanical work on the r.f. section, but before beginning the wiring you should drill a small hole in the chassis, near the terminals of C2, to accommodate the leads to that component.

All wiring is point-to-point, and the grounds can be soldered directly to the copper. To make some of the ground connections, the author used a semi-circular ground-lug strip which was supplied with the tube socket; it's not necessary to employ such a strip, however. All further connections to L2 and C1, incidentally, are made via leads soldered directly to the nuts of terminals 1 and 3. Leads A, B, C, and D are connected to the main chassis as shown in the two pictorials. Make leads A, B, and D 8" long; lead C should be about 3" long.

The r.f. section is mounted on the front panel of the main chassis by means of two studs spaced 1 $\frac{1}{2}$ " from the panel;



Unusual design of S-9'er is evident from schematic diagram. The r.f. amplifier (V1a) is tuned to two frequencies at once by dual capacitor C1. Cathode follower (V1b) provides isolation.

additional support is given by the insulated coupling between the shaft of *C1* and the tuning dial. After the r.f. section is mounted, connect the free ends of leads *A, B, C*, and *D*. Then drill a hole in the front panel to line up with *C2*'s shaft (use a piece of paper to catch any metal shavings which might fall onto the sub-chassis). Attach an extension to the shaft to bring it out through the front panel, and install a pointer knob.

The last item to be put together is the variable antenna coupling. Drill a $\frac{3}{8}$ " hole, positioned symmetrically with respect to the hole for *C2*'s shaft, on the other side of the tuning dial. Install a $\frac{1}{4}$ " shaft bushing in the hole, then cut a $2\frac{1}{2}$ " length of $\frac{1}{4}$ " Bakelite rod. Three holes for #4 screws should be drilled in the rod—the first is located $\frac{1}{8}$ " from an end; the second, $\frac{1}{2}$ " further in; and the third, 1" in from the other end. Cut coil *L1* from B&W Miniductor stock, making the leads about $1\frac{3}{8}$ " long, and slide a $\frac{3}{4}$ " length of spaghetti over each lead. The lead ends are secured under #4 sheet-metal screws installed in the first two holes; about $\frac{3}{8}$ " of each lead is left protruding for use in making connections to the coil.

Run a 4-40 nut up to the head of a 4-40 x $\frac{1}{2}$ " screw and insert the screw through the remaining hole. This screw is secured in place with another 4-40 nut, and a $\frac{3}{8}$ " grommet is slipped over the undrilled end of the shaft. Slide the same shaft-end through the bushing in the panel; push it in so that the grommet is slightly compressed between the screw and the bushing, and install a pointer knob on the shaft.

The leads of coil *L1* are bent so that the coil penetrates a turn or two into *L2* at the maximum coupling position; the plastic structural bars of both *L1* and *L2* may have to be filed down a bit in order to make this possible. Be sure that the coils do not short together at any point in the adjustment range. Solder leads to each of the coil wires, running one to *S1* and the other to a ground lug secured under one of the tuning dial nuts. Make a final check of all the connections, and you're ready to try out the S-9'er.

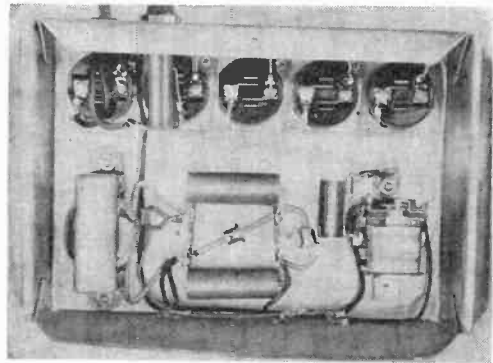
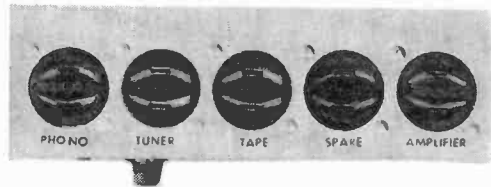
Adjustment and Operation. Attach your antenna, receiver antenna terminal, and ground to the input and output jacks of the S-9'er (see schematic); be sure to
(Continued on page 100)

Introducing **AUNT MINNIE &**



*... an electronic genie
devised by an audiophile
to simplify switching in
a component hi-fi system*

By **BASIL BARBEE**, W5FPJ



Switchless control unit contains minimum of parts.

EVERYONE who assembles a "music wall" runs into the problem of too many switches—often, as many as three power switches must be turned on to place the system in operation. And the more switches, the more confusion there is for other members of the household, sometimes even for the owner himself.

Besides being a nuisance, this multiple switching chore has a couple of other drawbacks. Suppose your Aunt Minnie (or whoever) comes along and wants to play the "radio." Being accustomed to a table-model set with two knobs, she turns on the tuner and waits; turns the volume or loudness control wide open; discovers the amplifier's power switch; if the pre-amp has a separate switch, she presently locates that and turns it on; fiddles with the function switch, and eventually finds the right position. But (you guessed it!) before she can "rediscover" the volume control, a speaker or two and some glassware have been damaged!

Another serious drawback of most stereo/hi-fi setups is the necessity of remembering to turn off the amplifier after the automatic record changer has shut off. The wiring can be arranged so that the changer automatically turns the amplifier on and off, of course. But this makes an "override" switch necessary in

order to use the amplifier with the tape deck or tuners, so the situation is hardly any better than before.

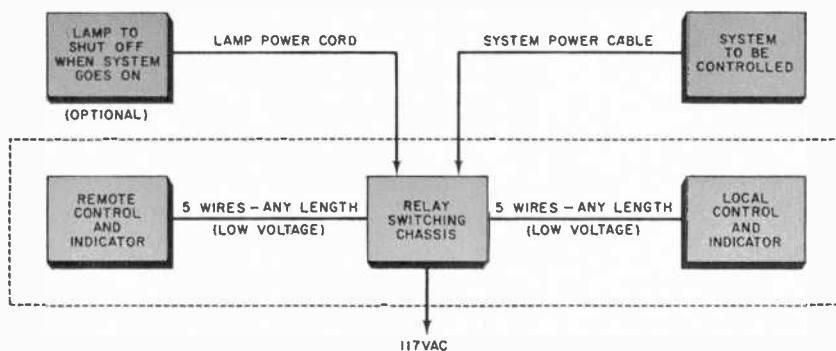
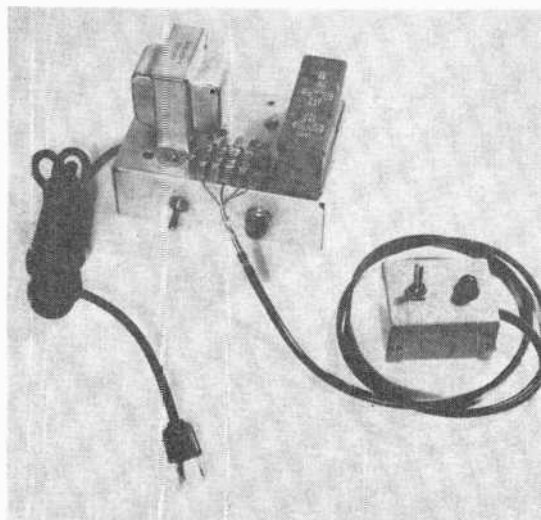
Switchless Control. The "Aunt Minnie" switchless control unit pictured here overcomes all these difficulties in a unique, simple, and inexpensive fashion. As you can see from the photos, the device looks like little more than a series of receptacles mounted on a chassis, which, in a sense, is what it is.

Here's how it works. As shown in the schematic diagram, we have a saturable
(Continued on page 54)

UNCLE TIM

... a remote control device that enables you to turn your hi-fi/stereo system on and off almost anywhere

By ALEXANDER ROSNER



Block diagram of typical installation employing the "Uncle Tim" remote control device.

IN A GOOD MANY home hi-fi installations, it's often desirable to be able to turn the system on and off from several remote locations. For example, if extension speakers already exist in the bedroom, you may want to control the system from there. Again, if your hi-fi system is located in a basement rec room, a control switch in the living room might come in handy.

With this type of arrangement, means could be provided to turn the system on downstairs, turn it off on the main floor, turn it back on upstairs, and so forth. As you might suspect, this setup isn't limited to controlling a hi-fi or stereo system, since it can be used to switch any system or appliance on and off. In addition, a suitable pilot light can be installed at any or all control locations

to indicate when the system is on.

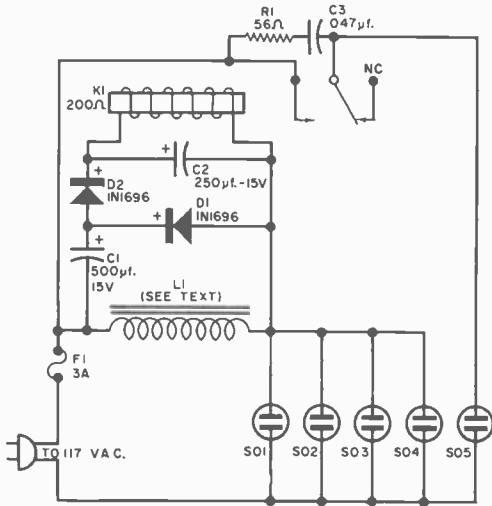
Because 117-volt line cords strung all over the house are dangerous, a two-station setup using low-voltage wiring and costing under \$20.00 was devised—see photo above. The "active" components are a latching relay which does the switching, a step-down transformer which supplies the necessary voltage, two toggle switches to facilitate control, and two pilot light indicators.

Almost any latching relay will be suitable, and the necessary control voltage can be obtained from a 6.3- or 25.2-volt filament transformer, depending on whether a 6- or 24-volt relay is used. Since the contact rating of the relay limits the current that can be switched, spare poles and associated contacts

(Continued on page 55)

AUNT MINNIE

CONTINUED



PARTS LIST

- C1—500- μ f., 15-volt electrolytic capacitor
 C2—250- μ f., 15-volt electrolytic capacitor
 D1, D2—1N1696 silicon rectifier
 F1—3-amp., "Slo-Blo" fuse (Littlefuse 313000, 3AG series or equivalent)
 K1—200-ohm, 10-ma., s.p.d.t., d.c. relay (Sigma 4F-200-S/SIL or equivalent)
 L1—90 turns of No. 20 enameled wire, close-wound on old 4-watt output transformer core, gap removed
 SO1, SO2, SO3, SO4, SO5—2-pole female a.c. socket (Amphenol 61F or equivalent)
 1—2" x 9" x 7" aluminum chassis (Bud AC-406 or equivalent)

Additional Parts for "Heavy-Drain" Version

- F1—5-amp. "Slo-Blo" fuse (Littlefuse 313000, 3AG series or equivalent)
 L1—22 turns of No. 18 enameled wire (terminals 1 and 2); 53 turns of No. 22 enameled wire (terminals 2 and 3); 82 turns of No. 24 enameled wire (terminals 3 and 4); same core as for standard version

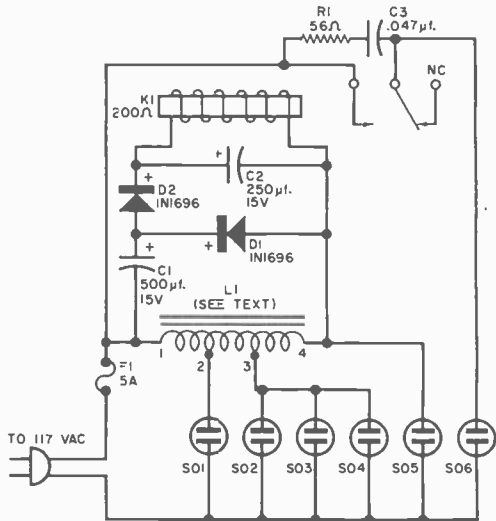
reactor, *L1*, which is connected in series with the power line to a group of receptacles, *SO1* through *SO4*. All "components"—record players, tape decks, tuners, and so on—are plugged into these receptacles. If required, additional receptacles can be connected in parallel without limit, since only one unit will normally be turned on at a time.

When any player or tuner is turned on with its own switch, the current it draws

will produce a slight a.c. voltage drop across *L1*. This voltage is rectified and doubled by the half-wave voltage-doubler/rectifier *C1/D1* and *C2/D2* to actuate d.c. relay *K1*. The relay, in turn, applies power from the line to receptacle *SO5*, into which the power amplifier and preamplifier (if any) are plugged. An arc suppressor, consisting of *R1* and *C3*, prevents a loud "pop" from occurring when the system is turned off.

Motors to Tuners. The smallest load required to actuate the relay is likely to be a 15-watt phono motor; the largest that can be handled safely is usually an AM/FM tuner rated at about 75 watts power consumption. A 15-watt phono motor, due to its low power-factor, actually draws about 40 volt-amperes, so that at 120 volts its current drain is 0.3 ampere; this current through *L1* produces

Standard "Aunt Minnie" (left) is easiest to build. "Heavy-drain" version (below) uses tapped inductor, wound on same type of core as in standard version.



a d.c. voltage at the relay coil of 5.3 volts. Since the relay will pull in at 3.5 volts, there is an adequate margin of dependability.

A 75-watt tuner, on the other hand, has a power-factor near unity. This means that its current will be about 0.63 ampere, causing a voltage of 7.2 volts d.c. to appear across the relay coil.

Thus, it can be seen that the voltage
 (Continued on page 98)

UNCLE TIM

CONTINUED

should be ganged to provide a larger path. For instance, if contacts are rated at 3 amperes, then three ganged poles and contacts should permit 9-amp. switching. A fuse limits the current that can be drawn through the device and protects the relay contacts.

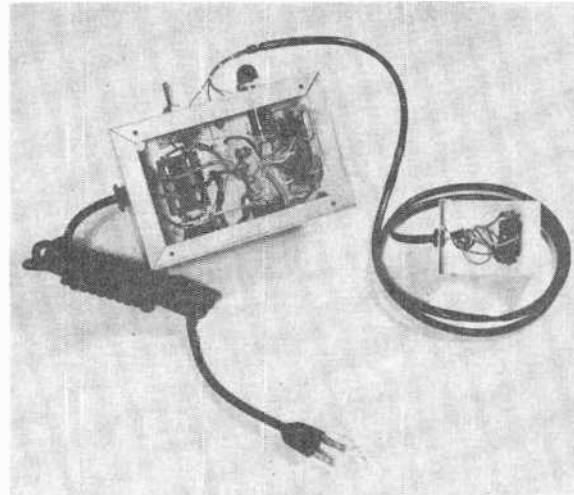
The unit is wired following the schematic and block diagrams. Placement of the components isn't critical, but a reasonable distance should be maintained between them for easy access during wiring. The remote control switch and indicator light can be mounted on any convenient panel or even in a wall. Similarly, the local control switch can be built right into the relay switching chassis or it can be mounted at any other convenient location—on the pre-amplifier, for instance.

The system to be switched is plugged into receptacle *SO1* which is connected to three of the *NO* (normally open) contacts of relay *K1* (poles 3, 4, and 5 are tied together to allow greater current flow). With the relay in the position shown, receptacle *SO1* remains de-activated. When the relay closes, current will flow from the source through fuse *F1* and relay poles

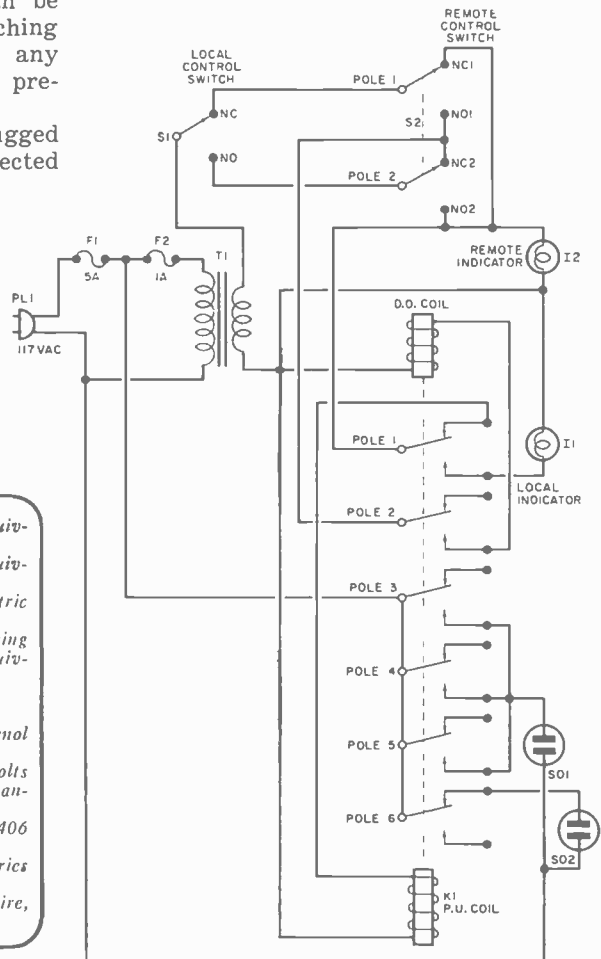
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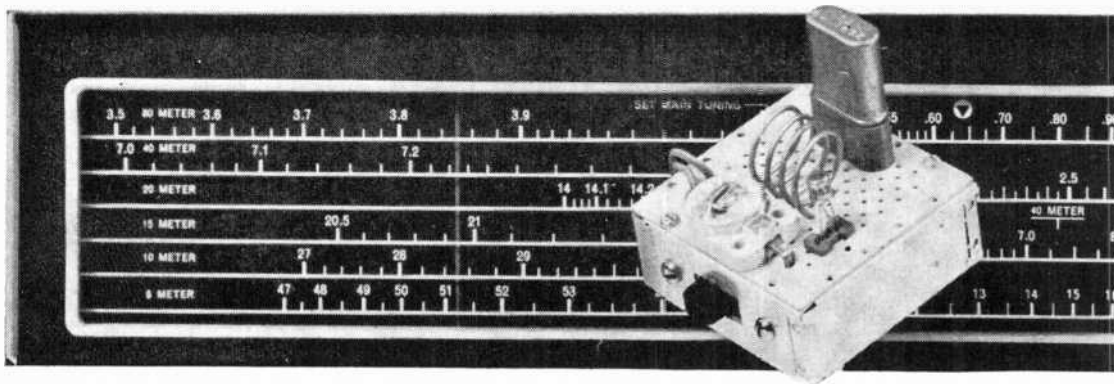
PARTS LIST

- F1*—5-amp. fuse (Littelfuse 3AG series or equivalent)
- F2*—1-amp. fuse (Littelfuse 3AG series or equivalent)
- I1, I2*—28-volt miniature lamp (General Electric 313, 1820, 1829, or equivalent)
- K1*—6-pole, double-throw, 24-volt a.c. latching relay (Potter & Brumfield KB23AY or equivalent)
- S1*—S.p.d.t. toggle switch
- S2*—D.p.d.t. toggle switch
- SO1, SO2*—2-pole female a.c. socket (Amphenol 61F or equivalent)
- T1*—Filament transformer: primary, 117 volts a.c.; secondary, 25.2 volts @ 1.0 amp. (Stancor P6469 or equivalent)
- 1—2" x 9" x 7" aluminum chassis (Bud AC-406 or equivalent)
- 2—Pilot-light assemblies (Dialco 81410X series or equivalent)
- Misc.—Terminal strips, tin cord and plug, wire, solder, etc.



Bottom view of "Uncle Tim" remote control unit (above) and schematic diagram (below).





Milliwatt on 6

Tunnel diode transmitter affords opportunity to study and experiment with new techniques

AS A CIRCUIT ELEMENT, the tunnel diode opens up an entirely new approach to the design of amplifiers, oscillators, and other devices. Tunnel-diode circuits are very simple, and the many novel applications for tunnel diodes should be enticement enough for most experimenters. One such application—which should have special appeal to the ham experimenter—is in a crystal-controlled, 6-meter transmitter, complete with modulator.

The unit presented here consists of a handful of parts, delivers approximately 1 milliwatt, and should take about an hour to build. The only equipment required to put the transmitter into operation is a VOM and a receiver capable of tuning six meters—items which almost any ham is certain to have around the shack. Naturally, since this is a transmitter (albeit a very low powered one), only a duly licensed radio amateur can legally put it on the air.

Understanding Tunnel Diodes. Before we begin construction, let's review what makes a tunnel diode "tick."* Figure 1 illustrates the behavior of current as a function of applied voltage through an ordinary resistor and through a tunnel

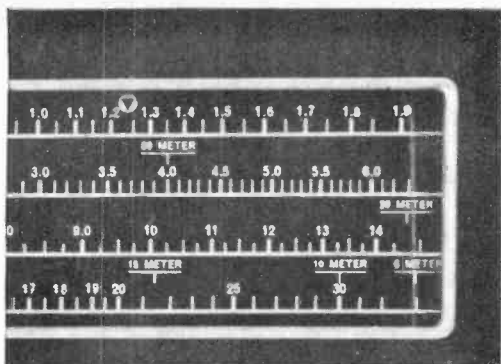
diode. As the applied voltage across the resistor is increased, the current through it increases proportionately. Since this voltage/current curve is a straight line, we say that it is a *linear* function.

The tunnel diode, however, behaves in a peculiar fashion. Current through the diode increases as the applied voltage is increased, but only to the point I_p (peak current) on the curve. As the applied voltage continues to increase beyond this point, the current decreases and continues to do so until point I_v (valley current) is reached. A further increase past the I_v point reverses the process, and the current once again increases in proportion to the applied voltage.

The region between the peak current and the valley current is known as the *negative-resistance* region, and it is this negative-resistance phenomenon which gives rise to the application of the tunnel diode as an active circuit element. By applying the proper amount of bias voltage to a tunnel diode, it can be operated in the negative-resistance region and thereby made to function either as an oscillator or an amplifier.

The Transmitter Circuit. The circuit diagram of the 6-meter transmitter is shown in Fig. 2. Power for the circuit is provided by a 1.35-volt mercury battery, $B1$, and resistors $R2$ and $R3$ form a sim-

*The tunnel diode was first introduced to readers of POPULAR ELECTRONICS in an article by Donald L. Stoner, W6TNS, in September, 1960 (p. 52).



By **CHARLES CARINGELLA**
W6NJV

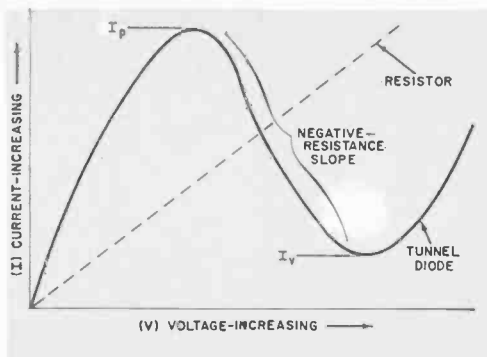
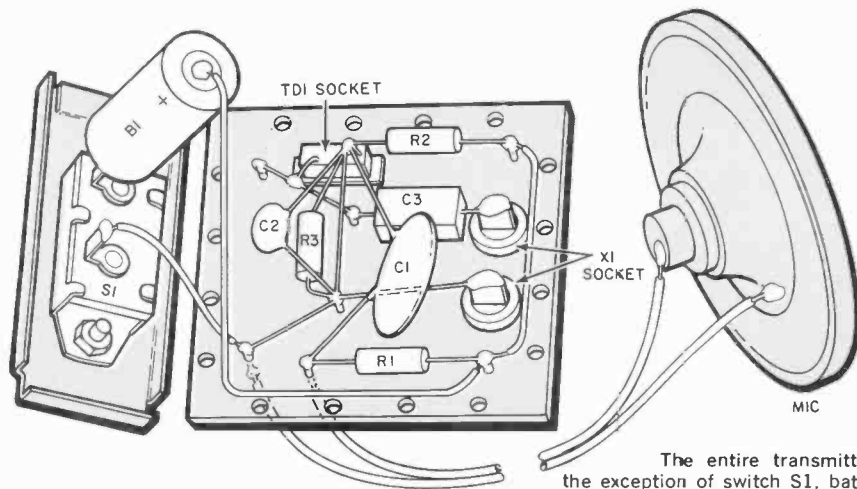


Fig. 1. Typical voltage-vs-current curves for a resistor and for a tunnel diode. Negative resistance slope of tunnel-diode curve falls between points I_p (peak current) and I_v (valley current).



The entire transmitter, with the exception of switch S1, battery B1, and the mike is mounted on a 2" x 2" Vectorboard. For simplicity, only one end of chassis is shown.

PARTS LIST

- B1—1.35-volt mercury battery (Mallory RM-401R or equivalent)
- C1—2.2- μ f., 3-volt miniature ceramic disc capacitor (Sprague HY-150 or equivalent)
- C2—0.001- μ f. ceramic disc capacitor
- C3—33- μ f. silver mica or ceramic disc capacitor
- C4—7-45 μ f. ceramic trimmer capacitor (Eric TS-E or equivalent)
- L1—4 turns of #16 copper wire, $\frac{5}{8}$ " in diameter, $\frac{5}{8}$ " long
- L2—1 or 2 turns of hookup wire, $\frac{5}{8}$ " in diameter
- MIC—Carbon microphone, or element from telephone handset (available from most electronic surplus stores)
- R1—100-ohm, $\frac{1}{2}$ -watt resistor
- R2— $\frac{1}{2}$ -watt resistor—see text
- R3—10-ohm, $\frac{1}{2}$ -watt resistor
- S1—S.p.s.t. slide switch
- TD1—1N653 or XA653 gallium arsenide tunnel diode (Texas Instruments or equivalent)
- X1—26-mc. or 52-mc. third-overtone crystal—see text
- Misc.—Crystal socket, transistor socket (for tunnel diode), small chassis and 2" x 2" section of perforated board (Vectorboard or equivalent), wire, solder, etc.

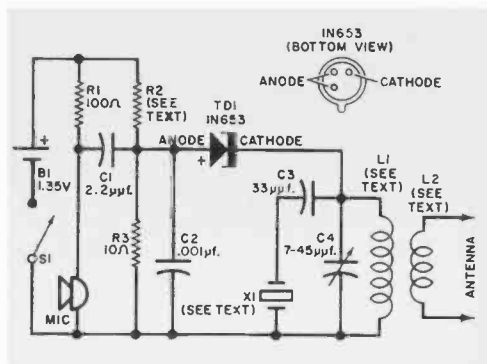
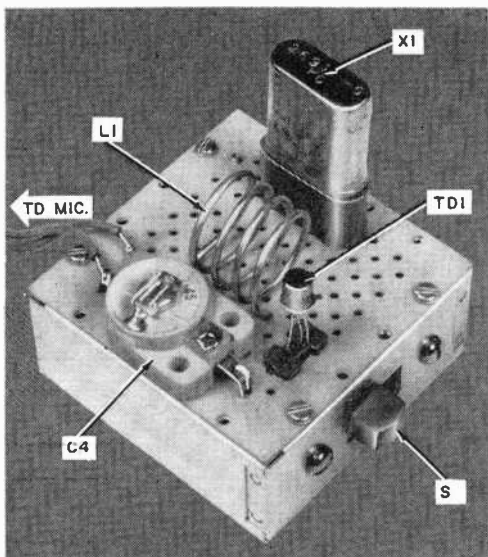


Fig. 2. Schematic diagram of tunnel-diode transmitter. Value of resistor R2 is critical and must be determined experimentally, as explained in text.



Top view of completed transmitter. Although not shown here, coil L2 consists of one or two turns of ordinary hookup wire and couples the output of the transmitter to a suitable antenna.

ple voltage divider which sets the operating point of the tunnel diode in the negative-resistance region. Coil *L1* and capacitor *C4* form the tank circuit and resonate at the operating frequency. These components, along with the tunnel diode (*TD1*), constitute the basic oscillator circuit.

The addition of the crystal to the tank circuit stabilizes it in frequency and keeps the frequency-modulation component to a minimum when the oscillator is modulated; capacitor *C3* couples the crystal to the tank circuit. The modulator consists of resistor *R1* and a carbon microphone. Again, this combination is a simple voltage divider, since the carbon microphone is effectively a variable resistor (its resistance varies in accordance with the speech input).

The modulation voltage is impressed upon the d.c. bias by means of capacitor *C1*. Since the varying modulation voltage shifts the operating point of the tunnel diode accordingly, the power output is varied. The transmitter, then, is effectively amplitude-modulated.

Building the Transmitter. As shown in the photos, the transmitter is constructed on a 2" x 2" Vectorboard chassis. The tunnel diode is a three-lead device and will fit a standard transistor socket. Layout of the components isn't critical, but all leads should be kept as

short as possible. Needless to say, care should be taken to avoid overheating any of the components when soldering.

A 1N653 gallium arsenide tunnel diode, manufactured by Texas Instruments, was employed by the author, mainly because of its low cost. It is interchangeable with the XA653, which is a later designation for the 1N653. (The "XA" prefix denotes that the unit is for experimental purposes only.)

The crystal used in the author's model was a 26-mc. third-overtone type. The transmitter locked in very nicely on its second harmonic, which lies in the 6-meter amateur band. A third-overtone 52-mc. crystal was also tried on its fundamental operating frequency with equal success.

Setting It Up. The value of resistor *R2*, which sets the operating point for the tunnel diode, can be readily determined with a little experimentation. First, substitute a 100-ohm potentiometer for the fixed resistor, *R2*. Connect a VOM across resistor *R3*, and tune your receiver to the operating frequency in the 6-meter band. Make sure that the potentiometer is set for maximum resistance before proceeding with the test.

Next, apply power to the oscillator, and slowly turn the potentiometer while observing the voltage across *R3*. The operating point will be at approximately 0.2 volt, although this value will vary from diode to diode.

At a bias voltage of about 0.17 volt, a slight upward "kick" in voltage will be noticed. This indicates that the tunnel diode has gone into oscillation, and the signal should be audible in the receiver. Incidentally, you'll find the receiver extremely helpful in determining the most stable operating point, since the transmitter will break in and out of

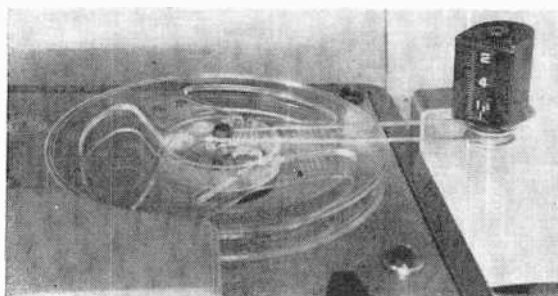
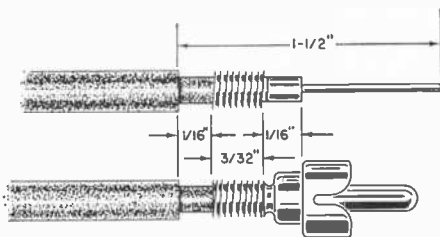
(Continued on page 106)

hi-fi HINTS

RELIABLE PHONO PLUGS

Coax antenna cable makes better phono cables than most of the flimsy stuff on the market. Try making your next set out of Amphenol Type RG-58A/U cable. First prepare the cable by stripping back the outer insulation $1\frac{1}{2}$ ". Clip off about $1\frac{1}{8}$ " of the braid and $1\frac{1}{16}$ " of the center insulation, and wrap five or six turns of #20 wire around the braid to prevent fraying. Then slip on the phono plug and solder the center conductor. Point the phono plug toward the floor and allow solder to flow around the wire wrapping so that it will be securely attached to the phono plug. Finally, cut off the excess solder from the center conductor and clean the soldered connections with solvent.

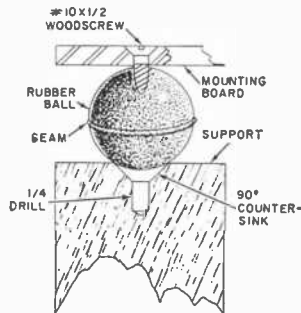
—Paul Galluzzi



TAPE COUNTER

If your tape recorder lacks a counter, you can easily attach one without tearing up the insides of the recorder. Check the Radio Shack catalog for three- or five-digit counters (a three-digit counter, #H97L839, was listed in their catalog for 69 cents). Fabricate a simple bracket to mount the counter to the side of the recorder near the takeup reel. Then attach the counter to the hub of the takeup reel with a rubber band, and away you go.

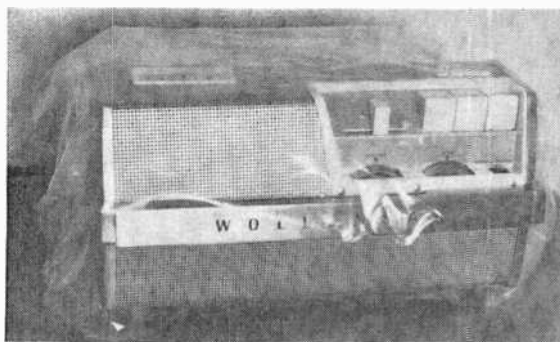
—Fred Blechman



TURNTABLE MOUNTING

You can make your own shockproof turntable mounting with four dime-store rubber balls—look for very soft rubber balls with a diameter of about $1\frac{1}{4}$ ". Pierce the top of each ball with a sharp instrument and hold the ball in place by filling the screw threads with glue. Countersink small recesses in the turntable support— $\frac{5}{8}$ " deep will do nicely—being sure that they line up with the balls attached to the turntable board. Let the four balls rest in the countersunk holes, and your turntable will be vibration-proof.

—Rudolf Bohm



PROTECTIVE COVERING

Your local hardware, building or lumber supply dealer can sell you Visqueen plastic film for protective storage of hi-fi, CB, or ham gear. This flexible plastic sheeting is only two or three cents per square foot and comes in various thicknesses (.004" being the most popular). It will also be useful as a transparent dust cover in many spots around the home.

—George Cunningham

JUNIOR'S PORTABLE

Sensitive BC set has transistorized regenerative circuit, can be carried around anywhere—your small fry will love it

By **MARTIN H. PATRICK**

A SURPRISINGLY good performer for its small size, this two-transistor regenerative broadcast receiver is completely portable. A single penlight cell supplies all the necessary power, the set has its own built-in loop antenna, and no ground is necessary. The author's model picked up local broadcasts with ease and, even during daylight hours, pulled in stations a couple of hundred miles away. It'll take you only a few hours to put one together for Junior to use on camping trips, to attach to his bicycle—or just carry around with him.

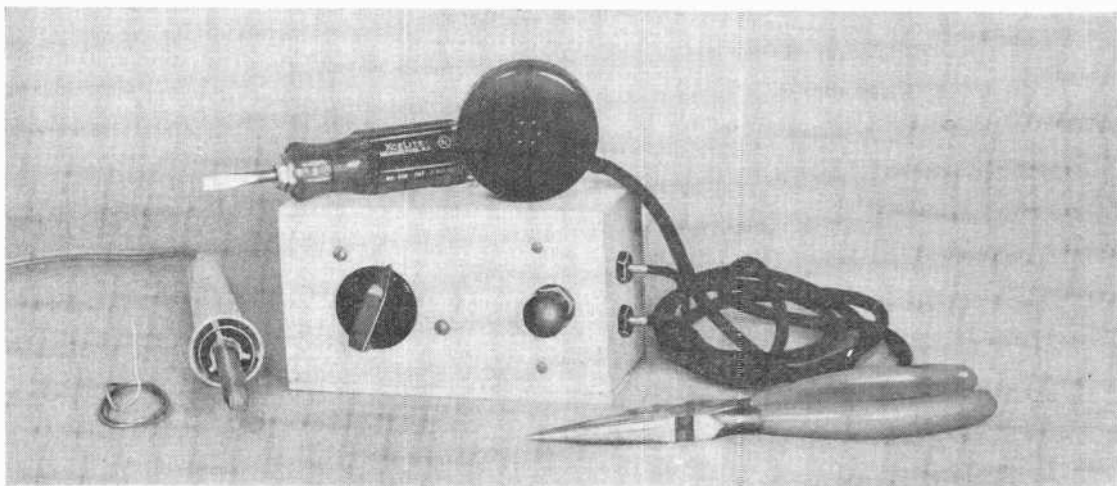
About the Circuit. Loop antenna *L1* is tuned by capacitor *C1* (see page 62), and the selected r.f. signal is coupled to the base of transistor *Q1* through capacitor *C2*. The signal is detected and amplified at *Q1*, then directly coupled to the base of transistor *Q2*. Further amplified by *Q2*, the signal passes through tickler coil *L2* and the headphones connected at jacks *J1* and *J2*. Base bias for *Q1* is supplied through potentiometer *R1*, and *Q2*'s base is biased through resistor *R2*.

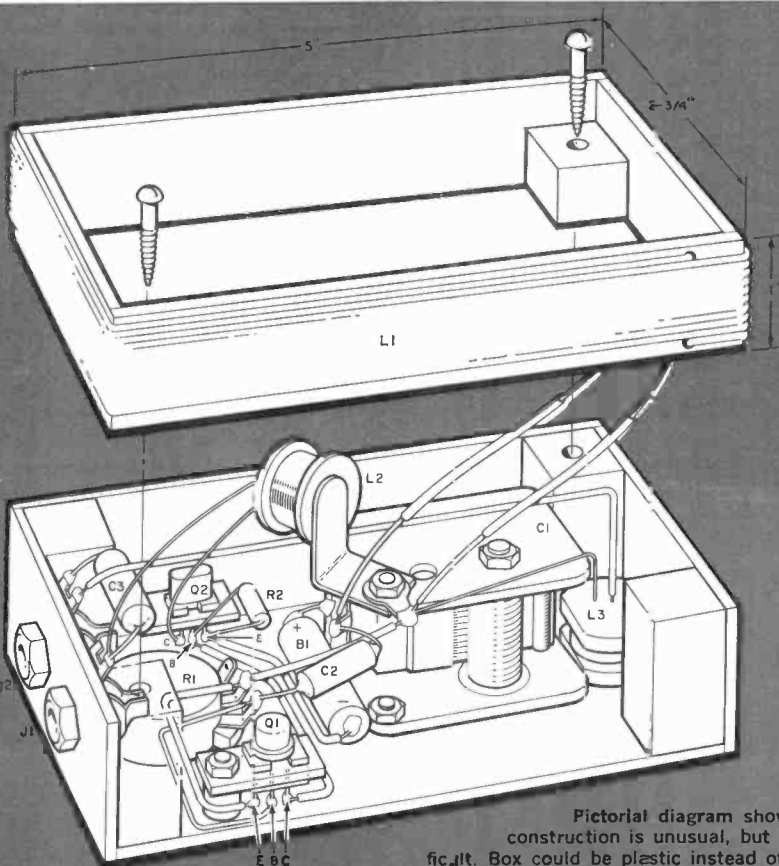
The feedback necessary for regeneration takes place through *L2*, which is loosely coupled to *L1*. Base bias potentiometer *R1* serves as the regeneration control. The r.f. of the regeneration circuit is bypassed around the phones by capacitor *C3* and suppressed by choke *L3*.

Power for the receiver is supplied by battery *B1*, and no on-off switch is used. When the phones are disconnected from *J1* and *J2*, transistor *Q2*'s power is cut off automatically; though *Q1* is never cut off, its current drain is negligible. A switch could be installed, if desired, in one of the leads from *B1*.

Construction. The first step is to put together loop antenna *L1* by winding 20 turns of No. 23 plastic-covered wire on a 5" x 2 $\frac{3}{4}$ " x 1" form. The leads at the beginning and end of the coil are brought through two small holes drilled in the form (see pictorial diagram for details). Elastic bands or household cement can be used to hold the windings in place.

The 5" x 2 $\frac{3}{4}$ " x 1 $\frac{1}{2}$ " box for the receiver proper can be constructed of either





Pictorial diagram shows that construction is unusual, but not difficult. Box could be plastic instead of wood.

PARTS LIST

B1—1.5-volt penlight coil (Burgess Type 7 or equivalent)
 C1—565- μ f. variable capacitor
 C2—0.001- μ f., 200-volt paper capacitor
 C3—0.01- μ f., 200-volt paper capacitor
 J1, J2—Tip jack
 L1—20 turns of #23 plastic-covered wire close-wound on 5" x 2 3/4" x 1" form—see text
 L2—350 turns of #27 enameled wire scramble-wound on wooden spool—see text

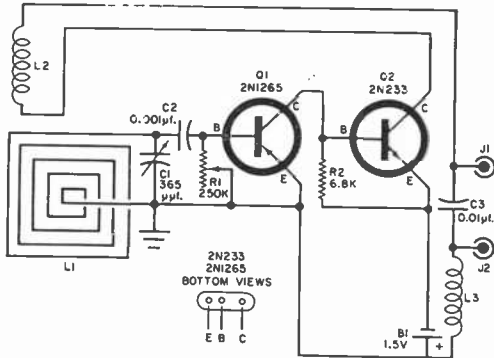
L3—200 turns of #27 enameled wire scramble-wound on wooden spool—see text
 Q1—2N1265 transistor
 Q2—2N233 transistor
 R1—250,000-ohm potentiometer
 R2—6800-ohm, 1/2-watt resistor
 1—5" x 2 3/4" x 1 1/2" wooden or plastic box
 Misc.—Material for coil spools, transistor socket, angle bracket for L3, Lucite strips to mount transistor sockets, hardware, etc.

wood or plastic; metal should not be used, since it would interfere with the action of the loop antenna. If you use a wooden box, fasten the antenna to it with wood screws as shown in the pictorial. If your box is plastic, the antenna may be installed with machine screws and nuts.

Coils L2 and L3 are wound on two identical spools. Each spool is made by passing a $\frac{3}{16}$ " dowel through the center of two $\frac{7}{8}$ "-diameter wooden discs. The spacing between the discs should be $\frac{1}{4}$ "

and, once this is adjusted, they may be cemented in place on the dowel. Coil L2 has 350 scramble-wound turns of No. 27 enameled wire; coil L3 consists of 200 scramble-wound turns of the same wire.

Capacitor C1, coil L3, potentiometer R1, and transistors Q1 and Q2 are mounted behind the box's front panel. The pictorial, once again, serves as a guide—and it should be followed fairly closely. Coil L3 is glued directly to the panel, while L2 is cemented to a 1" angle



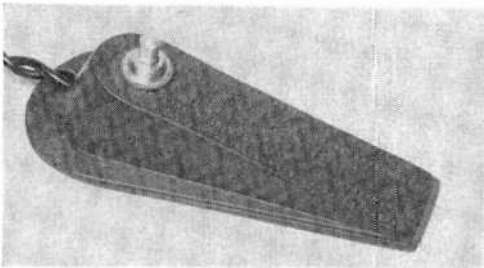
Schematic diagram of Junior's Portable. If set should fail to regenerate, reverse connections to L1.

Battery B1 is wired into the circuit without a holder and is supported by its own leads. In the absence of a metal chassis, the frame of C1 serves as a common ground point—a solder lug for this purpose is held in place by the same nut which secures L2's angle bracket. The remainder of the wiring is quite straightforward and needs no further comment.

Operation. To use the receiver, first plug in the phones. Set capacitor C1 about halfway out of mesh, adjust potentiometer R1 until regeneration begins, and tune in a station. Then readjust R1 for best results. If the circuit should fail to regenerate, reverse the connections to L1.

bracket. Attach the bracket to C1 with a machine screw and nut, positioning it so that L2 is as close as possible to loop antenna L1. The sockets for transistors Q1 and Q2 are installed on 3/8" x 3/4" strips of Lucite which are bolted to the panel through 1/4" spacers.

WORKSHOP TIPS



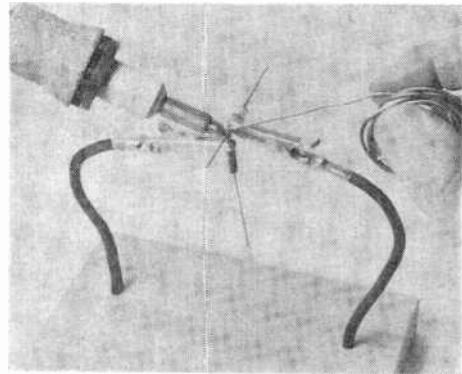
EASILY MADE FOOTSWITCH

It only takes a few minutes to make this economical and serviceable footswitch which has a variety of uses in the radio lab or workshop. The rubber housing makes it unbreakable and skidproof.

Drill or punch a hole in the beveled side of the doorstep to accept a push-button switch (Leviton, 3-amp., available at all electrical supply houses for about 25 cents). Use POSJ lamp cord to connect the switch to the device to be operated. Drill or punch a second hole in the back of the doorstep for the line cord exit.

Check your supplier for heavy-duty, momentary, or push-on/push-off switches. If you use a switch with exposed leads, cement a piece of "Non-Skid" to the bottom of the doorstep.

—Art Trauffer



UNIVERSAL HOLDER AND HEAT SINK

This simple gadget holds small radio parts together and leaves both hands free for soldering. The alligator clips serve as heat sinks when soldering transistors and diodes.

You'll need a 6" x 3" x 3/4" block of wood and two 5" lengths of plastic-covered #14 or #12 copper wire. To mount the wires in the base, bare their ends, drill a pair of holes, and push the wire ends firmly into the base. Then insert the free ends into the sleeves on the clips and clamp the sleeves shut.

—Carl Dunant

- Think you'd like
- an inexpensive Burglar Alarm
 - an invisible Mystery Switch
 - a Doorbell that thinks



Then build the **SENSOR-MATIC** —a one-tube capacity-operated relay

By **HARTWELL M. HUGHES**

HERE'S a neat little capacity-operated relay that operates from any 117-volt a.c. line. Easy as well as inexpensive to build, the "Sensor-Matic" may well make use of a few of the parts which have been "gathering dust" in your spare-parts box. In addition to operating the usual low-current devices, it will handle small motors and appliances drawing up to 5 amperes. And by substituting a heavy-duty relay for *K2*, even larger currents can be handled.

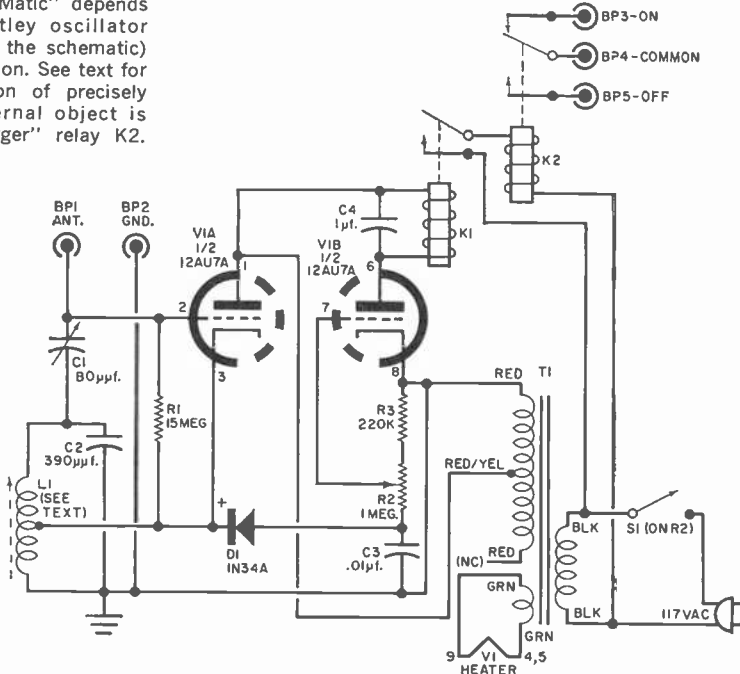
Parts placement and wiring aren't at all critical, and changes in layout will have little if any effect on operation. While the unit is relatively insensitive—the "intruder" must actually touch the door knob, window frame, floor mat, etc., to "trigger" the relay, this is not a serious drawback.

The "Sensor-Matic" is built on a 2" x 7" x 5" aluminum chassis, with tube *V1*, transformer *T1*, and binding posts *BP1* and *BP2* mounted on top. The 1-megohm potentiometer *R2* (the sensitivity control) and its associated switch (*S1*) are mounted on one side, and binding posts *BP3*, *BP4*, and *BP5* on one end. Oscillator coil *L1* consists of 60 turns of No. 26 enameled wire, wound on a CTC form (Cambridge Thermionic PLST-2C4L/H) and tapped at the 30th turn.

Setting It Up. To place the "Sensor-Matic" in operation, connect a length of wire or an aluminum or copper plate to *BP1*, and turn sensitivity control *R2* fully counterclockwise (this will put maximum resistance between the grid and cathode of *V1Lb*.)

Next, check to see if the oscillator is

The "Sensor-Matic" depends upon a Hartley oscillator (tube V1a in the schematic) for its operation. See text for an explanation of precisely how an external object is able to "trigger" relay K2.



PARTS LIST

- BP1, BP2, BP3, BP4, BP5—Insulated binding post
- C1—5 - 80 μ f. trimmer capacitor (Allied Radio 60 H 341 or equivalent)
- C2—390- μ f. ceramic disc capacitor
- C3—0.01- μ f., 200-volt paper capacitor
- C4—1- μ f., 200-volt paper capacitor (see text)
- D1—1N34A diode
- K1—Plate relay; s.p.s.t., normally-open contacts; 4000-ohm coil (Advance SO/1C/4000D or SV/1C/3500D with normally closed contacts unused, or equivalent)
- K2—General-purpose relay; s.p.d.t. contacts. 117-volt a.c. coil (Guardian Series 200 or equivalent)
- L1—Oscillator coil (60 turns of #26 enameled

- wire, tapped at 30th turn, close-wound on CTC form PLST-2C4L/H—Newark Electronics 40F3202 or equivalent)
- R1—15-megohm, $\frac{1}{2}$ -watt resistor
- R2—1-megohm potentiometer, linear taper
- R3—220,000-ohm, $\frac{1}{2}$ -watt resistor
- S1—S.p.s.t. rotary switch (on R2)
- T1—Power transformer; primary, 117 volts a.c.; secondaries, 6.3 volts @ 1.0 ampere, 250 volts CT @ 25 ma. (Stancor PS-3416 or equivalent)
- V1—12AU7-A tube
- 1—2" x 7" x 5" aluminum chassis (Bud AC-402 or equivalent)
- Misc.—Knob for R2, line cord and plug, terminal strip, socket for V1, rubber grommets, wire, solder, hardware, etc.

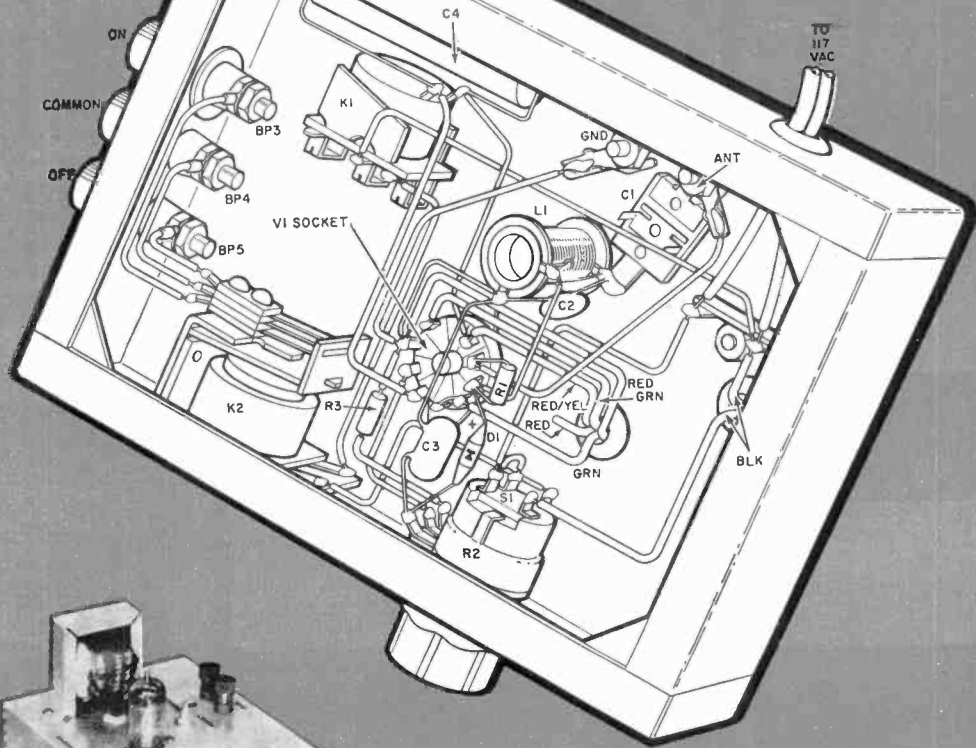
working by bringing a portable radio or the antenna lead from an ordinary broadcast set close to L1. You should pick up a "squeal" at about 1500 kc. with the slug turned approximately halfway into the form. If no "squeal" is heard, try adjusting capacitor C1. Actually, the setting of C1 is quite critical and optimum adjustment can only be reached by trial and error.

Once the oscillator is working properly, connect BP4 and BP5 in series with a

light bulb and the a.c. line, and bring your hand close to the antenna wire or plate. The bulb should light when your hand is near the "antenna" and go out when your hand is removed. Some further adjustment of C1 as well as R2 may be required: turning R2 clockwise increases the unit's sensitivity, while turning it counterclockwise decreases it.

About the Circuit. The capacity-operated relay incorporates a Hartley oscillator which is adjusted so that it just

Unit should be easy to wire with the aid of the pictorial diagram below. Note that only half the secondary of transformer T1 is used.



Decals were added to completed relay to identify binding posts and controls.

barely oscillates. The voltage appearing on the cathode of *V1a* is rectified by diode *D1*, filtered by capacitor *C3*, and applied to the grid of *V1b* through potentiometer *R2*. With the proper setting of *R2*, no plate current flows in *V1b*, there is no current through *K1*, the relay contacts are open, and no current can flow through *K2*. This results in an open circuit between *BP4* and *BP5*.

When an external object such as a human being changes the effective load-

ing of the "antenna," the oscillator is thrown out of oscillation. This removes the cutoff bias and causes the plate current to flow in *V1b*, which, in turn, closes the relay contacts and allows current to flow through *K2*. As a result, *BP4* and *BP5* will now constitute a closed circuit, and any device connected between them will be energized.

Capacitor *C4*, incidentally, prevents *K1* from "chattering." Since *K1* is a d.c. relay and its coil is in the plate circuit of *V1b* which operates from an a.c. rather than a d.c. supply, some smoothing is necessary. The optimum value for *C4* may vary from the 1 μ f. specified: if relay chatter is troublesome, other values should be substituted for *C4* until it is eliminated.

TRANSISTORIZED

This transistor-triggered B-C pack

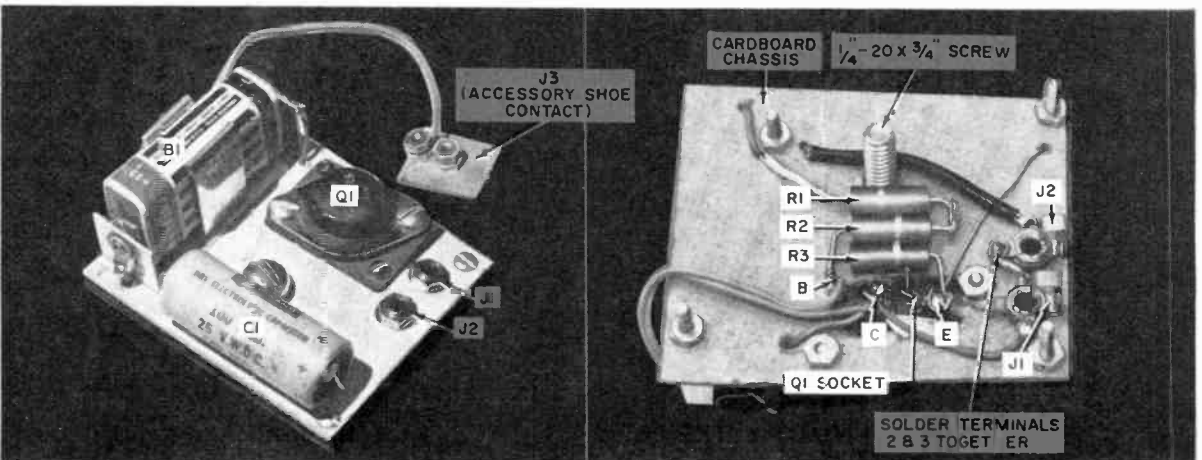


HAVE YOU EVER had a flash bulb misfire when shooting a "once-in-a-lifetime" picture? Flash-bulb failures are all too common, but you can stop them from happening by investing a few hours of your time and about five dollars of your cash in this simple transistorized "Power Flash" unit.

Why Flash Bulbs Don't Fire. By far the most common cause of misfiring is lack of current. Most of the older flash guns (and some of the inexpensive modern ones) were designed to fire bulbs by placing them in series, through the camera shutter contacts, with a pair of flashlight batteries. After batteries of this type have been used for a while, however, their internal resistance becomes high enough to make them undependable for delivering the large amounts of current needed to fire a flash bulb.

To overcome this problem, the battery-capacitor ("B-C") flash gun was developed. In these units, a capacitor is slowly charged to about 22 volts, then sud-

Top view of completed Power Flash is shown below, left. Underside, with protective cover removed, is shown below, right. The four small screws near the edges of the cardboard (see underside) hold the cover in place. Construction is extremely simple, but be sure to observe polarities of B1 and C1.



POWER FLASH

By **JIM KYLE**, K5JKX/6

makes flash bulbs fire every time

denly discharged through the flash bulb when the camera shutter is tripped. Plenty of firing current is assured, even with weak batteries. Just as in the straight battery system, however, all of this current must pass through the delicate shutter contacts. These contacts frequently become pitted after a little use, develop a high resistance, and operate erratically.

The Power Flash described here com-

PARTS LIST

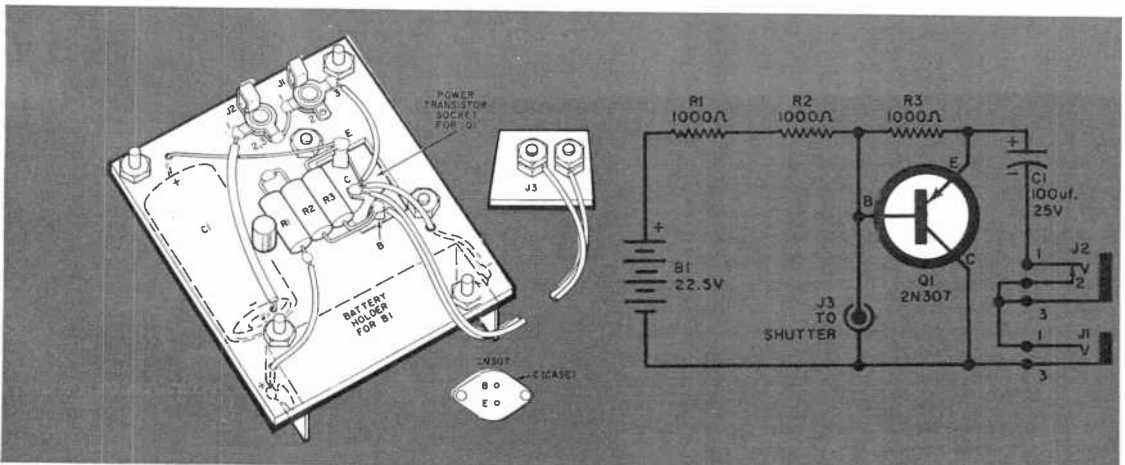
- B1*—Miniature 22½-volt battery (Burgess U15 or equivalent)
C1—100- μ l., 25-volt electrolytic capacitor
J1—Open-circuit phone jack, subminiature type (Switchcraft 41 or equivalent)
J2—Closed-circuit phone jack, subminiature type (Switchcraft 42A or equivalent)
J3—Accessory shoe contact (see text)
Q1—2N307 transistor
R1, R2, R3—1000-ohm, ½-watt resistor
I—Battery holder (Keystone 177, or equivalent)
Misc.—Perforated board or drafting cardboard, transistor socket—if used, plugs for *J1* and *J2*, hardware, etc.

binest a "B-C" unit with a transistorized electronic switch. All of the firing current passes through the transistor, and only about 1/100 of an ampere of control current passes through the shutter contacts. With this device, you can fire up to five flash bulbs at once through 100 feet of extension cord. The author tested it with a shutter which refused to fire a conventional flash gun at even the slowest speeds and was able to obtain perfect synchronization at 1/500 of a second.

About the Circuit. The shutter's synchronizing mechanism is connected to the Power Flash unit via jack *J3*. When the shutter contacts are open, the base of transistor *Q1* receives a positive bias through resistors *R1* and *R2*. The bias prevents current flow between the emitter and collector of the transistor. In this case, *Q1* is essentially out of the circuit and capacitor *C1* receives a charge through resistors *R1*, *R2*, and *R3*, and the flash bulb connected at jack *J1*. An additional bulb can be connected, if de-

It's not too much work to wire the Power Flash, as you can see from the pictorial diagram. Extra flash-jack can be added, if desired, to left of *J2*.

Schematic diagram of transistorized Power Flash. Transistor *Q1* is wired as electronic switch, controlling discharge of *C1* through flash-bulb circuit.



sired, at jack *J2*—but if only one bulb is used, *J2*'s self-shorting contacts remain closed to complete the circuit.

During the charging, not enough current passes through the bulb, or bulbs, to cause firing. When the shutter contacts close, however, *Q1*'s base is placed at collector potential, reducing the resistance between the emitter and collector to less than an ohm. Capacitor *C1* then discharges through the transistor, firing the bulb, or bulbs. The current through the shutter contacts, though, is never more than about 11 ma.

No on-off switch is included since, with no flash bulb connected, the only drain on battery *B1* is *Q1*'s base bias current—something less than 10 microamperes. It's possible, incidentally, to connect one more flash-bulb jack in series with *J1* and *J2*. Make sure that this jack, like *J2*, is of the closed-circuit type so that, if it isn't being used, the circuit will be complete. If only one flash bulb is employed, of course, it should be connected at *J1*.

Construction. To keep down both weight and cost, the author built the unit on a chassis made by sandwiching together two 2½" x 3" pieces of heavy drafting cardboard. You might, if you prefer, use sections of perforated phenolic board instead.

Capacitor *C1*, the battery holder, jacks *J1* and *J2*, and transistor *Q1* are mounted on one side of one of the cardboard pieces. Though a transistor socket was used by the author, it's not really necessary. Resistors *R1*, *R2*, and *R3* are installed on the other side, where all of the wiring is carried out.

The second cardboard piece, fastened to the first with four sets of 4-40 screws

and nuts, serves to cover the wiring. A small section is cut out of it to allow clearance for the two jacks; and extra nuts on the fastening screws, located between the two pieces, act as spacers.

A short length of zip cord serves to connect the Power Flash to the camera. On the author's camera, the shutter terminals were located inside the accessory shoe. A small square of cardboard, of the proper dimensions to slide into the shoe, was cut out and two 4-40 screws were mounted on it. The screws were spaced so that their heads would contact the terminals, and the two leads from the zip cord were attached under the nuts on the other side of the cardboard. Your camera may be fitted with a small coaxial jack instead of accessory shoe terminals; if so, pick up a plug to match it at your local camera store.

If you're not planning to mount your camera on a tripod while taking flash pictures, you can fasten the Power Flash to the camera's tripod socket with a ¼"-20 x ¾" screw as the author did. If you prefer not to tie up the tripod socket, an alternate mounting method can easily be worked out.

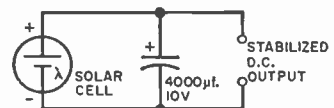
Operation. Just connect the Power Flash unit to your camera, install the battery (being careful to observe the proper polarity), and plug your flash gun into *J1*. The flash gun, of course, should be of the extension type—such as the "Accura Extension Flash" or the "B-C Pocket Flash Extension." It should have no batteries or circuitry of its own.

After a bulb is inserted in the flash-gun socket, capacitor *C1* charges within half a second and the unit is ready for use. -50-

CAPACITOR STABILIZES SOLAR CELL

If you're using energy from the sun to power a piece of apparatus, here's a way to keep your solar cell's voltage output more constant. Just connect, in parallel with the cell, a 4000- μ f., 10-volt electrolytic capacitor (Mallory 1040A or equivalent). During periods of illumination, the large capacitor charges to the cell's output voltage. Then, if the light is dimmed (by a cloud passing in front of the sun, for instance), the capacitor slowly discharges through the circuit, maintaining the output voltage near the original level. Don't try

to use this idea with miniaturized equipment, though: the Mallory capacitor specified measures 1 7/16" x 3 3/8", and the dimensions of equivalent capacitors will be about the same. When connecting the capacitor, be sure to observe the proper polarity. —Rufus P. Turner



DX'ing the Broadcast Band

By C. M. STANBURY II

Tips for tuning in on distant stations
in the exciting land of BCB DX

TUNE SHORT WAVE and listen in on the world," runs the decades-old slogan of the SWL. And while there's much truth in this slogan (thousands of avid DX'ers and SWL's find the short-wave bands a source of endless pleasure), keep this fact in mind: regional politics, local emergencies, even the really intensive propaganda campaigns make use of the *broadcast band* as their primary media.

It is, in fact, the local stations operating on the broadcast band which play the leading role in reporting much that is going on in the world. And for the DX'er, these stations represent an even better source of first-hand news than the short-wave bands—provided, of course, that you can hear them.

Ringside Seats. For any skeptical SWL's we may have on hand, let's take a specific example—the article "Castro's Radio Voice" which was in the March, 1961 issue of *POPULAR ELECTRONICS* and described Cuban Station CMBN. Before press time, the general public outside Cuba hardly knew that *La Voz del INRA* was on the air. But broadcast-band DX'ers—BCB'ers, as they are popularly called—knew it was on with power to spare. In fact, CMBN had "bossed" the 1160-kc. spot in the Eastern U.S. for months.

Then there was Earl Long, fabulous or notorious (take your pick) Louisiana politician, descendant of Huey Long. During Earl's last and wildest campaign,

his voice could be heard first-hand throughout North America via "clear-channel" Station WWL in New Orleans.

That summer, many a BCB DX'er stopped dial-twisting to listen spellbound on the 870-kc. spot. Governor Long had won a lunacy court fight and was running in the Democratic primary for Lieutenant Governor, since the



Disc jockey Jack Lazare holds down the midnight to 6 a.m. spot on New York's WINS. Although not a clear-channel station, WINS is heard widely throughout the U.S. on 1010 kc.



Another nighttime disc jockey BCB DX'ers often pick up is WCBS's Bob Hall of the "Music 'Til Dawn" show. Bob is on hand during the "wee hours" every morning except Sunday on 880 kc.

Louisiana constitution prevents a governor from succeeding himself. As it happened, Long lost this one, but in 1960 he was nominated for the U. S. House of Representatives just before his sudden death. Needless to say, BCB DX'ers enjoyed a ringside seat.

"Border" Stations. Current and even more "fascinating" listening are the Mexican "border" stations. Granddaddy of these was XER, founded in 1930 by John R. "Doc" Brinkley of the infamous "goat-gland" fraud. Located at Villa Acuna just across the Rio Grande from Del Rio, Texas, XER broadcasted almost entirely in English and for a United States audience—yet it was beyond the jurisdiction of the Federal Communications Commission.

Station XER subsequently became XERA, only to be torn down by the Mexican army in 1941—partly because of its Nazi sympathies. But on February 4, 1947, it went back on the air again

as XERF, operated by former Brinkley associates.

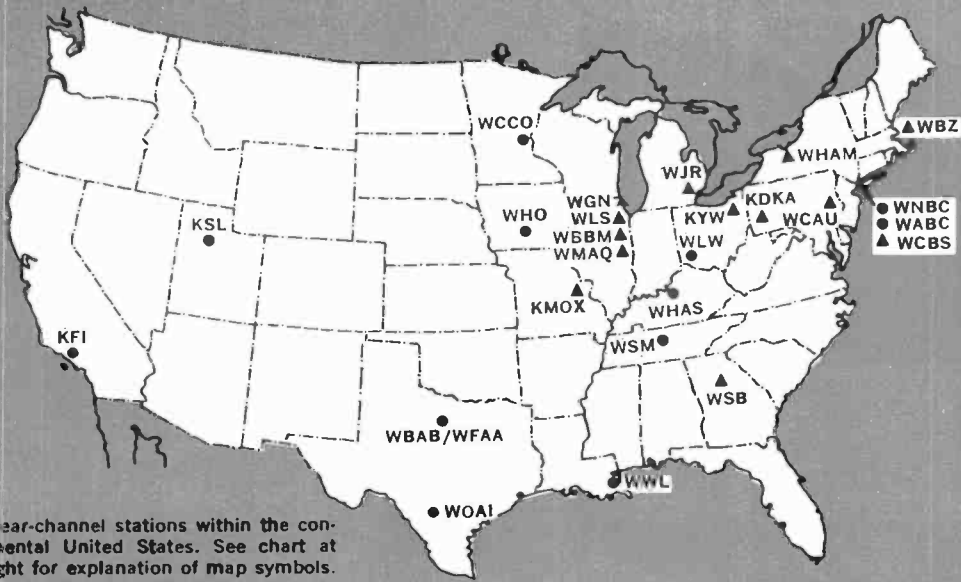
In addition to XERF (1570 kc.), the major "border" stations on the air now are XEG, Monterrey, on 1050 kc.—the old XER spot, and XERB (1090 kc.) at Rosarito Beach, Lower California. Bread and butter for these stations are blood-and-thunder evangelists and faith healers—one of the most "colorful" faith healers being J. C. Bishop, who began his radio career as the Lonesome Cowboy singer on Brinkley's XER. While some of the programs on these stations are entirely "religious" in purpose, others reflect various hidden "political" influences—with the notable exception of communism. All make for exciting listening!

Tricks of the Trade. Before you can explore America's hidden corners via the broadcast band, you'll have to know what makes BCB DX tick. First, you'll probably have to change your DX'ing methods.

Most DX'ers log as many stations as possible in order to build up an impressive QSL collection. While fascinating and rewarding, this form of DX'ing doesn't yield much insight into distant areas. The most interesting DX listening requires extensive monitoring of only a few stations at a time. (For example, in gathering data on Castro's propagandist machine, the author spent many hours listening to CMBN while constantly bucking QRM from *Radio Swan*. Later, he began a painstaking track-down of other Cuban channels.)

Obviously, such an approach will require all your DX'ing skill. For a QSL, a distant station need only be heard for a few minutes. But to "DX'plore" will take *at least* an evening or maybe a session in the early a.m., say from 2:00 a.m. until 5:00 a.m. or so when the stations in your locality begin to sign on. Where there is QRM, you will have to patch bits and pieces into a whole picture.

During the day, it's seldom possible to hear more than semi-local stations. But as soon as the sun sets, the broadcast band comes alive, and many stations throughout the country appear on your dial. In fact, if you were to leave your receiver at one frequency, you might well hear stations come and go



all evening! When one station fades out, another one, perhaps a thousand miles away, often takes its place.

For the beginning BCB DX'er, a list of clear-channel stations has been included. These are the "giants" of the broadcast band, and have been given nighttime control of a group of frequencies in order to provide radio service for rural areas having no local stations. Among this group are such well-known stations as WLW (Cincinnati), WWL (New Orleans) and KSL (Salt Lake City). Because of their clear channels and the fact that these stations operate at maximum power (50,000 watts), they are usually easy DX catches.

Your Receiver. Almost any AM receiver you might have around the house will be suitable for BCB DX'ing and is capable of picking up many of the clear-channel stations, including powerful "border" stations. After you've gained a little BCB experience, you'll no doubt pick up other, lower-powered stations in many less populous areas, especially in the early a.m. hours.

However, you'll soon discover major defects in ordinary BCB receivers. Not only is the sensitivity often poor, but the selectivity and signal-to-noise ratio leave much to be desired. The remedy, of course, is to use a communications

U.S. CLEAR-CHANNEL STATIONS

Key ●

Call-Sign	Location	Frequency (kc.)
KFI	Los Angeles, Calif.	640
WSM	Nashville, Tenn.	650
WNBC	New York, N.Y.	660
WLW	Cincinnati, Ohio	700
WABC	New York, N.Y.	770
WBAB/WFAA	Fort Worth/Dallas, Tex.	820
WCCO	Minneapolis, Minn.	830
WHAS	Louisville, Ky.	840
WWL	New Orleans, La.	870
WHO	Des Moines, Iowa	1040
KSL	Salt Lake City, Utah	1160
WOAI	San Antonio, Tex.	1200

Stations Subject to Shared Operation

Key ▲

Call-Sign	Location	Frequency (kc.)
WMAQ	Chicago, Ill.	670
WGN	Chicago, Ill.	720
WSB	Atlanta, Ga.	750
WJR	Detroit, Mich.	760
WBBM	Chicago, Ill.	780
WCBS	New York, N.Y.	880
WLS	Chicago, Ill.	890
KDKA	Pittsburgh, Pa.	1020
WBZ	Boston, Mass.	1030
KYW	Cleveland, Ohio	1100
KMOX	St. Louis, Mo.	1120
WHAM	Rochester, N.Y.	1180
WCAU	Philadelphia, Pa.	1210

receiver or one approaching communications standards.

To boost overall sensitivity, the important thing is to have a good outdoor
(Continued on page 93)

Magnetic Phenomena Quiz

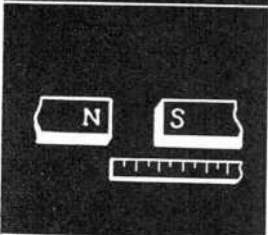
Neither magnets nor magnetism are mysteries to the experimenter. But this quiz will test your knowledge of the basic principles of magnetic phenomena. Mark each statement "True" or "False" and check your answers with those on page 97.

By ROBERT P. BALIN



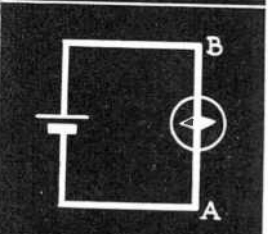
1 The north pole of a compass points to the earth's north magnetic pole.

TRUE FALSE



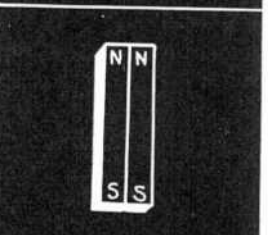
2 If the separation between two unlike magnetic poles is reduced by half, the attraction between them will become four times as great.

TRUE FALSE



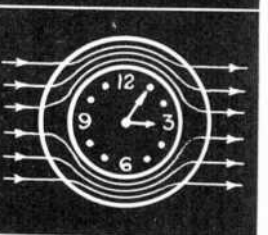
3 If a compass is placed beneath a wire passing electrons from A to B, its north pole will point to the right.

TRUE FALSE



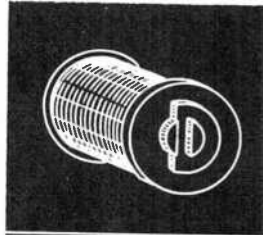
4 Bar magnets should be stored by placing them so that like poles are side by side.

TRUE FALSE



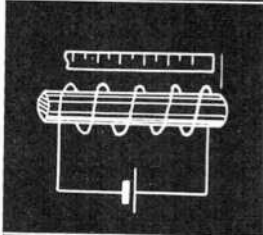
5 There is no insulator for magnetic fields. Some metals simply offer more resistance to magnetism than others.

TRUE FALSE



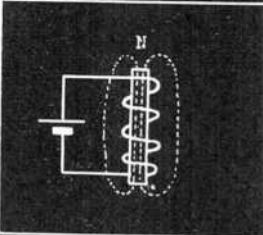
6 A "D-ring" is usually found on d.c. electromagnetic relay coils.

TRUE FALSE



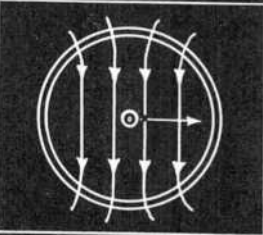
7 When a nickel-iron rod is magnetized, it will grow shorter in length.

TRUE FALSE



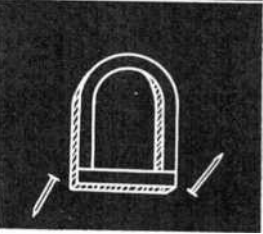
8 The electromagnet shown here will have its north pole located at the top of the coil.

TRUE FALSE



9 An electron passing through the deflection yoke magnetic field and out of the page will be deflected to the right.

TRUE FALSE



10 A "keeper" is placed across the poles of a horseshoe magnet to prevent the magnet's field from passing through nearby ferrous objects.

TRUE FALSE

On the Citizens Band

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



YOUR CB Editor recently had the pleasure of receiving an honorary membership in the Confederate Citizens Band Corps, as you can see from the handsome certificate at right. Located in Shelby, North Carolina, this new Corps already has members in most of the 50 states, and is dedicated to the betterment of the Citizens Radio Service. The Corps' emblem, shown in black and white directly at right, is actually a striking blue, red and gold combination.



The specific aims of this organization are to help promote Citizens Band clubs in every city; to foster a national calling channel, emergency channels, and other needed services; and to work out a Citizens Band annex to the National Civil Defense communications plan. Honorary memberships have also been presented by the Corps to both the publisher and editor of **POPULAR ELECTRONICS**, Messrs. Phillip T. Heffernan and Oliver P. Ferrell, respectively, and are very much appreciated.

Conelrad Compliance. On a recent visit to the 11-20 of a CB'er who shall remain nameless, for reasons which will become obvious, we casually asked how he complied with Conelrad regulations. His answer was a blunt, "Conelrad? What's that?"

Fortunately for this particular CB'er, he did know that he was supposed to cease transmissions immediately when an alert was announced over the radio. He was also fortunate in having a teenage daughter who, while at home, continuously "monitored" the local radio station. At least he would be aware of a Conelrad alert if one took place—but his

THE CONFEDERATE CITIZENS BAND CORPS



To all who shall see these presents, greeting:

Be it known that in recognition of his having manifested an unusually high regard for improved citizen band communication and help to his fellow man,

DICK STRIPPEL

is, as of this date, hereby appointed member in the
Confederate Citizens Band Corps

This member will, by virtue of this appointment, therefore, be obliged to faithfully and diligently discharge the duties of the office to which appointed by doing and performing in accordance with all FCC rules and supporting our National Goals to make Citizens Band a pleasure for everyone to use.

As evidence of his good faith in accepting this appointment the member named herein will continue to observe our national calling channel, our emergency channel, our business channels for business, cooperate with all citizen band users, cooperate with and support local and the national club, and work to the general overall betterment of citizen band users.

As president of this corps I strictly charge all members of the corps to render such courtesies as are due a member of this distinguished organization.

Done at the City of Shelby, North Carolina, in the heart of Zone III, 17th day of November, 1960, in the year One Thousand Nine Hundred and Sixty One.

Charter Member



J. H. Field
President of the Corps

method is definitely not what the FCC has in mind.

The rules and regulations governing CB are quite clear in stating that each CB licensee shall comply fully with Conelrad regulations, and the CB rules include the necessary references to the Conelrad regulations.

The word "Conelrad" stands for *Control of Electromagnetic Radiation*. It is a plan whereby, in the event of a regional or national emergency, all stations—AM, FM, TV, commercial, amateur and CB—are required to cease transmitting immediately. Then certain selected stations, operating at low power

on the AM frequencies of 640 and 1240 kc., will broadcast official messages in a "round robin" technique designed to confuse any radio direction-finding gear.

There are numerous ways in which you, as a CB licensee, can tell when a Conelrad alert is in force. The simplest way is to tune in any AM, FM or TV station to determine whether it is operating normally. Then, while operating your CB rig, you continue monitoring the radio or TV station to make certain its broadcasts are not interrupted by Conelrad.

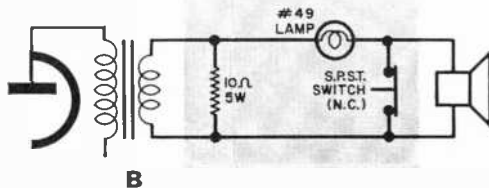
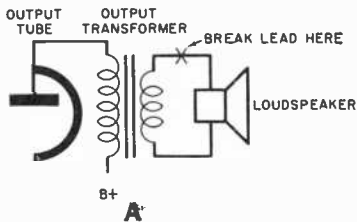
This method poses some restrictions, since the FCC takes a very dim view of any station "re-broadcasting" the program material of another station—which would be the case if your "monitor" receiver were located within earshot (or should we say mikeshot?) of your CB rig. A good way to avoid such "re-broadcasting" is to have someone in an adjoining room listening to the radio or watching TV while you operate—someone who is under instructions to inform you when a Conelrad alert begins.

Other, more electronic, means have been devised too. A number of manufacturers have units that attach to ordinary a.c.-d.c. radios and will light a lamp, ring a bell, or automatically cut off transmitter power when a local station stops broadcasting. Prior to actually stopping broadcasts, certain "key" stations transmit a series of tones to warn other stations, and some Conelrad "detection" devices will respond only to these tones.

The FCC does not prescribe how a CB licensee should determine when a Conelrad alert is in progress, but it is quite specific in stating that some fail-proof method must be used.

Tech Notes. While we're on the topic of Conelrad regulation compliance, here's a simple monitor you can build into a standard a.c.-d.c. broadcast receiver. If you do not already have an extra receiver in the vicinity of your 11-20, you can buy one—any four- or five-tube superhet will be suitable. If you do a little shopping around, you should be able to pick one up for less than \$15.00.

After you have determined that the set is capable of ear-splitting volume on a local station, obtain the following parts from your regular distributor: a 10-ohm, 5-watt resistor; a s.p.s.t., normally-closed



push-button switch; a #49 panel lamp and a suitable lamp mount with a lens-type glass jewel, preferably green.

For a really professional job, mount the lamp and switch on the front panel of the broadcast set, wiring them—together with the resistor—to the loudspeaker of the radio.

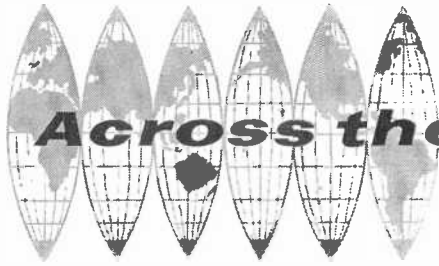
In the diagram above, a typical a.c.-d.c. broadcast receiver output stage is shown in A, and X marks the spot where the original wiring should be broken. The added components appear in B in the gray area.

To operate your Conelrad monitor, first plug the set into a power outlet and turn it on. Depress the push-button switch and tune in a powerful local station (which is not on 640 or 1240 kc.). Then release the switch and turn up the volume control to the point where the lamp flickers and glows brightly. The audio voltage from the set causes the lamp to light; at full brightness, it represents about .12 watt of audio power—easily obtained from any standard type set.

To provide a "fail-safe" feature for your monitor, simply consult the pilot lamp already in the set. If it's on, but the green lamp isn't flickering or glowing, you know that either the station is off the air or the green lamp is defective. (If your set doesn't have a pilot lamp, you can install one by wiring in a #47 lamp, using long insulated leads, across pins 4 and 6 of a 35W4 rectifier or pins 2 and 3 of a 35Z5, and mounting the lamp behind a red lens.)

If both lamps fail to light, your moni-

(Continued on page 107)



Across the Ham Bands

By
HERB S. BRIER
W9EGQ

HOW TO GET MORE QSO'S PER CQ

DO YOU EVER have days when you can't make a contact no matter what you do, while the other hams on the band seem to be working everything under the sun? You call and call, you retune your transmitter, you check to make sure your antenna hasn't fallen down, and you call some more, still with no reply. At long last, you do make a contact and get an extra-fine signal report! This kind of thing probably happens to all of us, whether we are Novices operating in the low-frequency c.w. bands, Technicians operating in the v.h.f. bands, or General Class high-power DX chasers. The big question is . . . why?

A plausible-sounding explanation advanced by some hams is that, in some mysterious manner, the ionosphere allows distant signals to reach a particular antenna but prevents a signal from making the return trip. Actually, except in

cases of temporary fading, this so-called "one-way skip" is extremely rare. At times, though, signals between your location and another area might be good, but signals between that area and another section of the country could be even better. When that is the case, every station you call answers a station from the other part of the country. (Ask any midwestern, 15-meter DX chaser about the east-coast "iron curtain" between him and Europe!) At other times, conditions are just the reverse.

If we got an answer every time we pressed our transmitting keys or spoke into our microphones, ham radio would become about as exciting as picking up the telephone to call the butcher. On the other hand, it's no fun to have trouble making contacts for a long period. If this is your problem, the chances are good that you can overcome it regardless

Novice Station of the Month

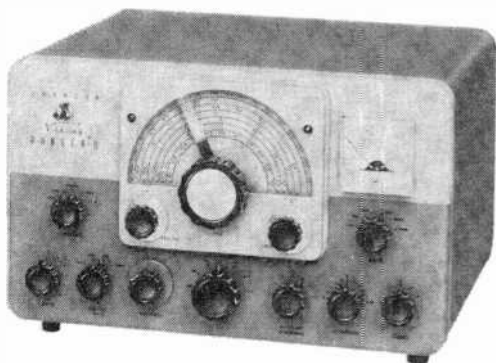
The winning photo in this month's contest came from Fred Erickson, KNØEH, 1156 Fifth Ave., Anoka, Minn. Fred, shown operating his Heathkit DX-60 transmitter, covers the three low-frequency Novice bands. He uses a Knight-Kit R-100 receiver, and his antennas include 40- and 80-meter dipoles and a home-built, 2-element beam for 15 meters. Fred has worked 35 states and Canada, and has received QSL cards from 31 states.

Fred will be awarded a 1-year free subscription to POPULAR ELECTRONICS for his photo. If you would like to try for a similar award, send us a picture of your station—preferably with you at the controls, and be sure to include some information about yourself, your equipment and your activities. Maybe you'll be one of the lucky winners. And even if your picture is not chosen as "Novice Station of the month," it will be published if space permits. Send all entries to Herb S. Brier, c/o POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana.



of the cause. The following paragraphs contain some helpful suggestions.

Improving Your Results. The first step is to evaluate your equipment realistically, then change your operating habits to take full advantage of its capabilities. For example, suppose your station consists of an inexpensive receiver, a 40-watt transmitter, and an antenna strung between your shack window and the garage—a common set-up. Naturally, you can't expect it to be as effective as a station equipped with a super-sensitive, super-selective receiver, a de luxe transmitter, and an antenna 50 feet high. But, by using your equipment intelligently, you can get good results.



De luxe transmitter, the Viking Ranger II, covers ham bands between 1.8 and 54 mc. It runs 75 watts input on c.w., 65 watts on phone.

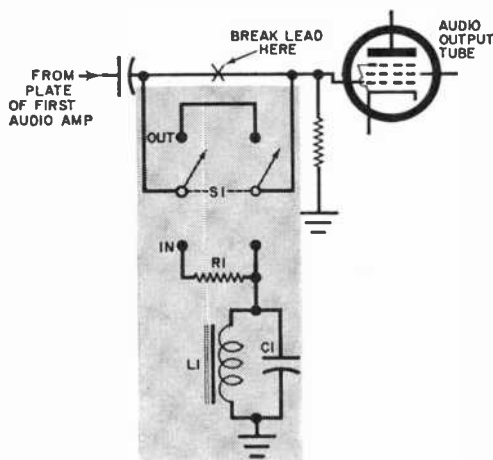
You'll probably decide, to continue the example, that your inexpensive receiver and poor antenna will make contacts on 15 meters come few and far between. On 40 and 80 meters, however, both the antenna and receiver will do well when interference is not too heavy. Since these bands are always crowded during the evening hours, you can avoid interference by doing most of your operating after midnight and in the daytime. Some hams say that 5:00 to 8:00 a.m. is the very best time to operate on 40 and 80 meters; signals are usually strong and QRM is light.

Another thing to watch is your c.w. sending. Obviously, no ham sends poorly on purpose. Nevertheless many calls—

especially CQ's—go unanswered because call letters are difficult or impossible to decipher. Calling CQ in the Novice bands at speeds faster than most Novices can copy is another good way to cut down on the number of replies received; it's a temptation to call CQ at top speed, but you'll be better off if you take it easy.

De Luxe Transmitter/Exciter. If you're interested in obtaining some de luxe ham equipment and improving your results that way, we suggest that you look over the new Viking Ranger II transmitter/exciter recently announced by the E. F. Johnson Company, 116 Second Ave., Waseca, Minnesota. Rated at an input of 75 watts on c.w. and 65 watts on AM

Schematic of audio filter which will improve c.w. selectivity of your receiver is shown in shaded area. See text for parts values.



phone, the Ranger II covers the seven ham bands between 1.8 and 54 mc. using either crystal control or a highly stable, built-in VFO. On c.w., keying is clickless and chirpless, and time sequenced for full "break-in" operation; on phone, 100% plate modulation is easily obtained from any standard high-impedance "communications" microphone. Careful shielding and extensive lead filtering reduce possible TVI to a minimum.

Either as a high-quality, low-power c.w./phone transmitter or as a driver for a high-power modulator and/or r.f.

amplifier, the Ranger II should appeal to the serious Novice, Technician, and General Class amateur. It is available factory-wired at \$359.50 and in kit form at \$249.50.

IMPROVING C. W. SELECTIVITY

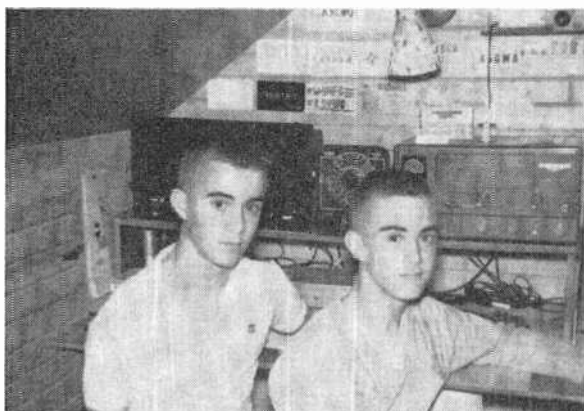
Hams who operate on the low-frequency short-wave bands realize that anything which improves the usable selectivity of a receiver will increase the percentage of successful QSO's. This little audio filter will do just that. Using just four components, it can be added to your receiver in about an hour and will do a good job of separating interfering code signals. As shown in the schematic

cycle signals are passed on to the grid while higher and lower frequencies are bypassed to ground.

Resistor *R1* isolates the plate of the first audio amplifier from the shunting effect of the L/C circuit. If the resistance of *R1* is too high, though, the audio output of the receiver will be unduly decreased. Start with a value of about 10,000 ohms, then experiment with different values to determine the optimum one for your receiver.

D.p.d.t. switch *S1* cuts the filter in and out of the receiver's audio circuit. To use the filter, switch *S1* to the *In* position and slowly vary your BFO or Main Tuning controls. You should be

Two brothers, Jim (left) and Joe Ferguson, KNØIBX and KNØIKC, respectively, Sioux Falls, S. D., work 80, 40, and 15 meters. Using a 75-watt, homebrew transmitter, a "trap" dipole antenna, and a National NC-125 receiver, they've totaled 37 states-worked with 31 confirmed.



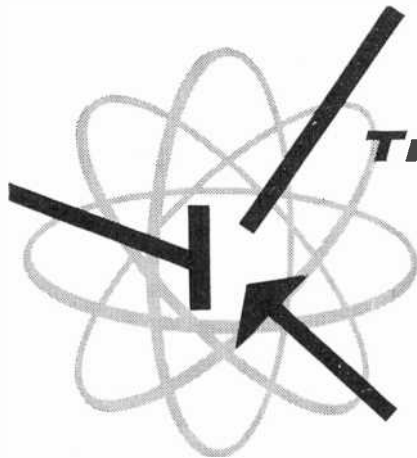
Orlando Oliva, CE3OE, is shown at the controls of his ham station in Santiago, Chile. Although his screen-modulated Globe Chief emits only about 30 watts on phone, Orlando works the United States regularly on 15-meter phone, receiving signal reports up to 20 db over 9.



diagram (see opposite page), a 1000-cycle resonant circuit consisting of *L1*, a 3.5-henry filter choke (Stancor C1080 or equivalent), and *C1*, a 0.0068- μ f. fixed capacitor, is employed. The circuit is connected between the grid of the audio output tube and ground, so that 1000-

able to eliminate, or greatly attenuate, the offending station—without affecting the station you're trying to copy. There is some volume loss when the filter is used, but this can be compensated for with the receiver's gain control.

(Continued on page 114)



Transistor Topics

By LOU GARNER

WHEN the transistor was first introduced, it was a very expensive component. Prices of \$75 and \$100 or more were common for single units at a time when the purchasing power of the dollar was greater than it is today! When an "under \$50" unit was announced, it represented an important price break. Then Raytheon rocked the industry back on its heels with the introduction of a low-cost "experimenter's" transistor at *only* \$7.50—the now-famous CK722, which currently sells for less than a dollar.

This downward zoom in prices is hardly surprising if you keep in mind that most really new components carry a substantial initial price. (Think of the early console radios!) This state of affairs is due to a number of factors, including

(a) high engineering and development costs, (b) the use of production techniques which involve considerable hand labor and testing, (c) limited production—since there is no immediate mass-market, and (d) the high cost of initial advertising and merchandising. As a general rule, prices drop gradually as production techniques are refined and as the manufacturer starts to receive fair-sized orders, with major "price-breaks" occurring when new production methods are developed or when large-quantity orders are received.

Today, we can observe a similar pattern in the pricing of multiple semiconductor circuit assemblies. When we discussed these devices a few months ago (see *Transistor Topics*, July, 1961), unit prices ranged from \$125.00 up. Recently, however, a major manufacturer, Fairchild Semiconductor (545 Whisman Rd., Mountain View, Calif.), announced a two-transistor differential amplifier assembly at less than half the earlier prices. . . . \$60.00 each in 1 - 99 lots, and \$40.00 in 100 - 999 quantities.

An interior view of the new assembly, designated as Type 2N2060, appears in Fig. 1, while its schematic symbol and

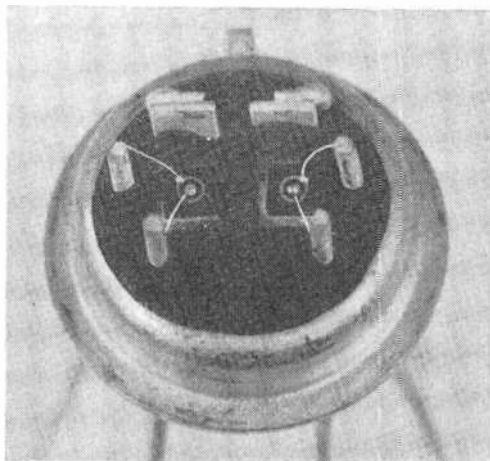
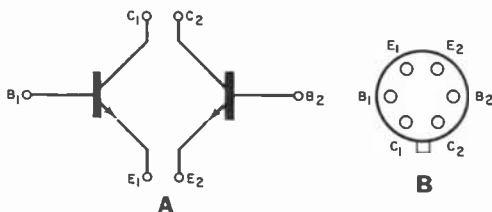


Fig. 1. Interior view of Fairchild's new Type 2N2060 differential amplifier, containing two transistors in a single enclosure.

Fig. 2. Schematic diagram (A) and lead connections (B) for 2N2060 differential amplifier.



lead connections are illustrated in Figs. 2(A) and 2(B), respectively. The unit is made up of two low-noise, closely matched, and highly stable silicon Planar transistors assembled in a single six-lead TO-5 enclosure. The pair's *betas* are matched to within 10% at 0.1 ma. and 1.0 ma. collector currents, with the maximum base-emitter voltage differential kept to within 5 millivolts at these points.

The two elements making up the 2N2060 are *nnpn* units, with a maximum collector-to-base voltage of 100 volts, a maximum operating junction temperature of 200°C, and a maximum power

signed for use an an output device in high-frequency transmitters. Any or all of these assemblies may one day be manufactured as "stock" items, just like the new 2N2060.

Looking to the future, industry officials predict that circuit assembly prices will continue to drop, and that prices in the "under \$10.00" range may be feasible within two or three years. If and when this happens, these interesting and versatile units will fall well within reach of the average experimenter and hobbyist.

Reader's Circuit. With transistor prices at an all-time low, the serious hobbyist needn't confine himself to one- and two-

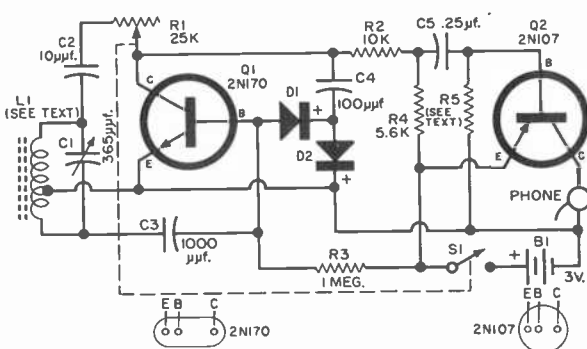


Fig. 3. Reader S. A. Sullivan's novel two-transistor receiver. Resistor R5 may or may not be needed, depending on the particular transistor selected for Q2.

transistor projects for economic reasons. However, there are many experimenters who derive considerable satisfaction from obtaining maximum performance out of a minimum of components. For these, reader S. A. Sullivan, W6WXU (20565 Fifth East, Sonoma, Calif.), suggests the receiver circuit shown in Fig. 3.

dissipation of 1.5 watts (per side) at 25°C. Minimum *betas* range from 50 at 1 kc. to 3.0 at 20 mc., while a noise figure of 8 db maximum is specified for both narrow- and wide-band applications.

The 2N2060 can be used in any application requiring a pair of closely matched, medium-power *nnpn* transistors. But it finds its major use as a differential amplifier, since it is capable of amplifying extremely small signals under conditions where it was previously necessary to use feedback amplifiers with mechanical choppers.

A few of the dozens of circuit assemblies that Fairchild Semiconductor has produced on special order during the past few years include such relatively diverse items as a two-transistor chopper; a high-gain, three-stage Darlington amplifier; and a four-transistor r.f. amplifier. The latter unit is made up of four r.f. transistors in parallel and is de-

Tuning the AM broadcast band, Mr. Sullivan's circuit employs two transistors and two diodes and is designed for operation on a pair of penlight cells connected in series to supply 3 volts. W6WXU claims that it provides the performance of a four-stage set and has a sensitivity and selectivity adequate for the reception of local stations without an external antenna.

Referring to the schematic diagram, Q1 is an *nnpn* unit serving as a combination regenerative r.f. stage and reflex audio amplifier. A *pnp* transistor, Q2, is used as the audio output. The common-emitter arrangement is used throughout.

According to W6WXU, circuit operation is as follows. Signals are picked up and selected by tuned circuit L1/C1 and coupled to Q1's base-emitter circuit through C3, with an amplified r.f. output signal developed across load resistor R2. A portion of this signal is coupled

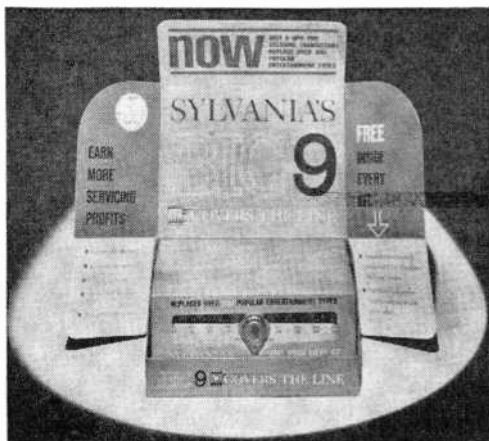


Fig. 4. The "Big 9" transistor "kit" put out by Sylvania contains nine transistors and sells for \$20.60 list.

back to the tuned circuit through $R1$ and d.c. blocking capacitor $C2$ to provide the feedback necessary for regenerative operation. The remaining part of the signal is coupled through $C4$ to the dual-diode detector, $D1-D2$.

The resulting audio signal is applied to $Q1$, with an amplified output signal (audio) developed across $R4$. From this point, the detected and amplified audio signal is coupled through $C5$ to the output amplifier, $Q2$, and, after further amplification, is applied to the earphone. Transistor $Q1$'s base bias is supplied by $R3$, $Q2$'s by $R5$; the latter resistor may not be required in all cases.

Standard, readily available components are used throughout. Coil $L1$ is a ferrite core antenna coil (Lafayette MS-166 or equivalent); $C1$ is a 10-365 μf . miniature variable capacitor (Lafayette MS-274 or equivalent). Capacitors $C2$, $C3$ and $C4$ are small mica or disc ceramic units; their working voltage is not critical. A 0.25- μf . miniature tubular capacitor is used for $C5$. Resistor $R1$ is a small 25,000-ohm potentiometer, but W6WXU indicates that values from 10,000 to 100,000 ohms can be used here. Resistors $R2$, $R3$, $R4$, and $R5$ (if used) are $\frac{1}{2}$ -watt units; $D1$ and $D2$ are 1N60 crystal diodes. The s.p.s.t. "power" switch, $S1$, is ganged to the regeneration control, $R1$, and the earphone is an 7000-ohm dynamic unit (Lafayette MS-260 or equivalent).

Reader Sullivan suggests that the circuit be "breadboarded" for experimental tests before final assembly. He indicates that maximum performance is obtained

when the transistors and bias resistors ($R3$ and $R5$) are chosen experimentally on the basis of actual performance. For example, he found that two out of five different 2N170 transistors gave far superior performance. Similarly, he found that $R5$ was required with some 2N107's and not with others; where needed, $R5$'s value can be between 100,000 ohms and 1 megohm.

Once the circuit has been checked and final components determined, the receiver can be assembled in a small plastic box. Neither layout nor lead dress should be overly critical, but good wiring practice should be followed, with special care taken to observe battery and diode polarities. A pair of long-nose pliers should be used as a "heat sink" when soldering the diode and transistor leads to prevent damage.

"Transistor Kits." Sylvania Electric Products, Inc. (Woburn, Mass.) has announced two interesting "transistor kits." Both contain an assortment of transistors at a price well below the cost of the individual units if purchased separately. Both are available through regular distributors.

One of the kits, known as the "Big 9," includes nine *npn* and *pnp* transistors, a replacement guide, and a coupon worth \$12.50 towards enrollment in a correspondence course on transistor servicing. The transistors included in this kit were chosen to meet the needs of the serviceman and the experimenter, and are capable of replacing more than 300 popular types. (See Fig. 4.)

The second kit was designed for the practical design engineer and more advanced experimenter. Known as an "Epitaxial Transistor Evaluation Kit," it includes six 2N782 transistors, 12 application circuits, and a book-style reference folder with detailed electrical and mechanical data. The selling price is the same as that of three 2N782's, purchased individually.

Product News. Allied Radio Corp. (100 N. Western Ave., Chicago 80, Ill.) has announced a fully transistorized
(Continued on page 101)



Short-Wave Report

By **HANK BENNETT**
W2PNA/WPE2FT

WHAT KIND OF DX'ER ARE YOU?

THE TERM DX'er has been popularly adapted to fit just about anyone who tunes a radio to any wavelength, long or short. In reality, "DX'er" cannot be properly applied to those who listen to the short waves for the sheer enjoyment of various programs or to those, for instance, who live behind the Iron Curtain and want to hear newscasts from the Free World. So, your Short-Wave Editor hopes to remove some of the confusion regarding this term by defining the various species of DX'ers.

True DX'er—one who will spend countless hours at the dials searching for that elusive and very rarely heard station. This DX'er is one of the most valuable to the hobby because of his diligence in obtaining information on hard-to-pick-up stations.

Active DX'er—one who will tune one or more of the short-wave bands regularly, keeping abreast of current schedule and/or frequency changes. His efforts are equally as valuable as those of the true DX'er because his alertness enables

the editors of radio club bulletins and DX programs to keep their schedule listings up to date.

Average DX'er—one who tunes many, if not all, of the short-wave bands and reports on general activities. This DX'er is indispensable because his findings provide us with data on almost 100 per cent of the scheduled stations. His routine reports also let us know whether the stations are maintaining or changing their current schedules and frequencies.

Novice DX'er—one who, new to the thrills of DX'ing, is apt to tune hastily through frequencies, pausing at points where only the strongest signals are heard. With time and patience, this fellow will move up into the higher DX ratings. The novice DX'er may often become discouraged at the QRM in the regular short-wave bands and turn to the off-beat frequencies where he will be lucky enough to find a clandestine station or an unreported one.

Utility DX'er or Specialist—one who
(Continued on page 108)

Alan Schneider, WPE2FLL, Bronx, N. Y., listens on a National NC-98. His antennas include a home-made 300-ohm dipole, a CB and an Army surplus whip. He also uses a transistorized tape recorder.



Gene C. Kitamata, WPE6BOS, Richmond, Calif., DX'es with a Hallicratters SX-110. A 20-meter folded dipole antenna and a Heath QF-1 Q-multiplier helped him get 39 verifications from 23 countries.



By
JOHN T. FRYE
W9EGV



Carl and Jerry

Wrecked by a Wagon Train

CARL AND JERRY were sitting in the office of the Psi Kappa Psi fraternity house on the campus of Parvoo University listening to short, wiry Police Captain Dirkson seated behind the desk.

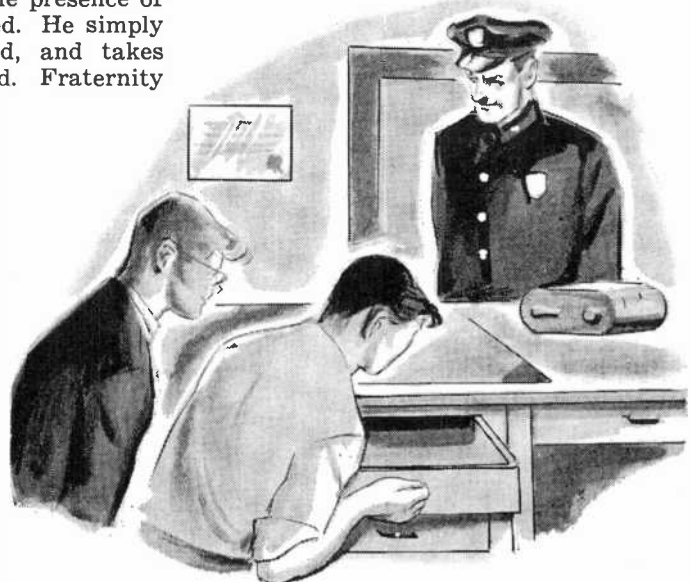
"Last week at an FBI school I was talking over a problem of mine with Police Chief Morton of your home town," the captain explained, "and he suggested that you two might be able to help me. Here's the deal.

"In the past few weeks the campus has been hit by a series of fraternity house thefts. Last weekend it was the Sigma Chi house; the week before it was the Sigma Phi Epsilon. All the thefts apparently are the work of one man young enough to pass for a college student and with plenty of savvy of fraternity house living. He only works on weekends when there are likely to be guests in the house and the presence of a strange face isn't noticed. He simply walks in, saunters around, and takes whatever cash he can find. Fraternity

brothers trusting each other the way they do, that's likely to be plenty. He never takes watches, jewelry, billfolds, or anything else that can be identified.

"Obviously we can't keep a constant watch on all the fraternities; so I've decided to do the next best thing and set a trap in a likely place. Sooner or later I figure he'll try it here at Psi Kappa Psi, and when he does I want to be ready for him. This house has been picked for a reason. I have a nephew here, and he has two buddies we can trust. They use this desk, and one of the three is in the house practically all the time.

"Now here's where you fellows come in. My men can't work here without arousing suspicion and talk, but you boys can. I want an alarm of some sort fixed up on this desk so that when an unau-





thorized person starts going through the drawers the alarm will be heard all over the house; yet it will have no significance except to those in the know. I want this done quickly, before this coming weekend. Also, keep in mind that we can't put too much money into such a long shot. I realize that's a tall order, but what do you say?"

Before answering, Jerry pulled out a desk drawer and peered into the opening. Then he looked closely at the intercom unit resting on one corner of the desk. Finally he and Carl had a whispered colloquy in a corner of the room while Jerry did some sketching and figuring on the back of an envelope.

"Well," Jerry finally said, "if we can borrow that intercom unit for a few hours, if we can use your shop tonight, and if you will hold still for a cost of about twenty dollars, I think we can do it."

"The answer is 'yes' on all three counts; you have yourselves a deal!" Captain Dirkson said promptly.

"Okay. Suppose you have your nephew and his friends here tomorrow afternoon about this time so we can show them how the alarm works," Jerry suggested as he and Carl disconnected the transistorized paging unit and started for the door with it.

THE TWO electronics enthusiasts went straight to a radio store and bought several items which they took with them to the police station workshop. They spent a couple of busy hours at the bench and then dashed back to their room in the residence hall and, before turning out the lights, put in four more hours at their number one job: studying.

The next afternoon they got to the Psi Kappa Psi house an hour before their appointment with the captain, and by the time he showed up with his nephew and the other two youths everything was ready. The desk looked just as it had the day before.

"Behind each drawer is a leaf-type Micro Switch held open by the closed drawer," Jerry began, as soon as the introductions were over. "When the drawer is pulled out, the switch closes. All drawer switches are in parallel and are in one side of a line running from a low-voltage power supply to a pair of war-surplus relays inside the case of the intercom unit. The power supply, fastened beneath the desk top, consists of a bell transformer, a silicon rectifier, and an electrolytic capacitor. It delivers about 25 volts filtered d.c. from the half-wave rectifier circuit. A switch just under the edge of the desk turns this power supply on and off.

"When a drawer is opened with the power on, it actuates a multi-pole relay in the intercom that takes over all functions of the push-to-talk switch and at the same time transfers the input circuit from the regular microphone to a tiny hearing-aid microphone also inside the case. Still another pair of contacts actuates a second relay. A heavy springy wire soldered to the armature of this relay strikes a little bell mounted beside the hearing-aid mike. The sound goes out over the paging system to any speakers connected to the output.

"When no one is at the desk, the power supply should be switched on and the intercom left in the 'Call All Stations' position. When anyone is using the

(Continued on page 88)

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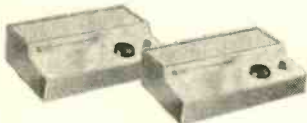


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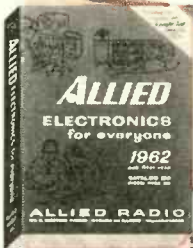
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Carl and Jerry

(Continued from page 83)

desk, the power supply is switched off and the intercom is used normally. That's all there is to it. If you fellows will kind of scatter around over the building, Captain Dirkson can try it out."

After giving the three youths a couple of minutes to take up positions, Captain Dirkson walked over to the desk and gently eased open the long top drawer. Instantly a single musical note echoed throughout the building. He closed the drawer, reached under the edge of the desk and switched off the little power supply, and opened the drawer again. Nothing happened.

"Looks good to me, boys," he approved. "All we can do now is wait for our rat to take the bait. This is Wednesday; so we'll probably see no action at least until the weekend, but I'll keep in touch."

CARL AND JERRY were sitting in their room after supper that evening preparing for a chemistry quiz the next day when the telephone buzzer sounded for Jerry. He went to the telephone booth in the hall and picked up the receiver.

"Get over to the fraternity house right away!" Captain Dirkson's voice urged. "The thief crossed us up and tried it this evening. I'll meet you there."

The boys ran all the way to the fraternity house and arrived just as Captain Dirkson's car, its red light flashing, stopped at the curb. His nephew came running out the door and down the steps.

"I was up in my room studying when that bell sounded off like Big Ben," he explained excitedly. "I made a dash for the stairs and was just in time to see this guy running out the door. He must have gotten suspicious when he heard that bell. I didn't get a good enough look to be able to recognize him, but when I ran outside I saw him take off in a green Chevy coupe. As he went under the street light, I got his license number. It was SS7351. I was so rattled I forgot to tell you that when I called."

"How long after you saw him drive off did you call me?" the captain snapped.

"Just as long as it took me to run back

inside and dial your number. I guess it couldn't have been more than a minute."

"Your call was logged in at 7:46; so he must have driven away at 7:45, give or take thirty seconds. It's straight up eight now; so he's had fifteen minutes." The captain picked up the mike of his car transmitter and ordered an all-points bulletin on the car. Then they all went inside to see if they could pick up any clues.

The detectives who had come with Captain Dirkson were still dusting the desk for fingerprints when the telephone rang. It was for the captain.

"Come on you two," he called over his shoulder to Carl and Jerry. "A cruiser has just found the car at a restaurant near here, and they are holding the owner of the car there. He denies having anything to do with the robbery attempt."

IT TOOK less than ten minutes of driving to reach the restaurant. Two uniformed officers were sitting in a booth with an angry-looking young man.

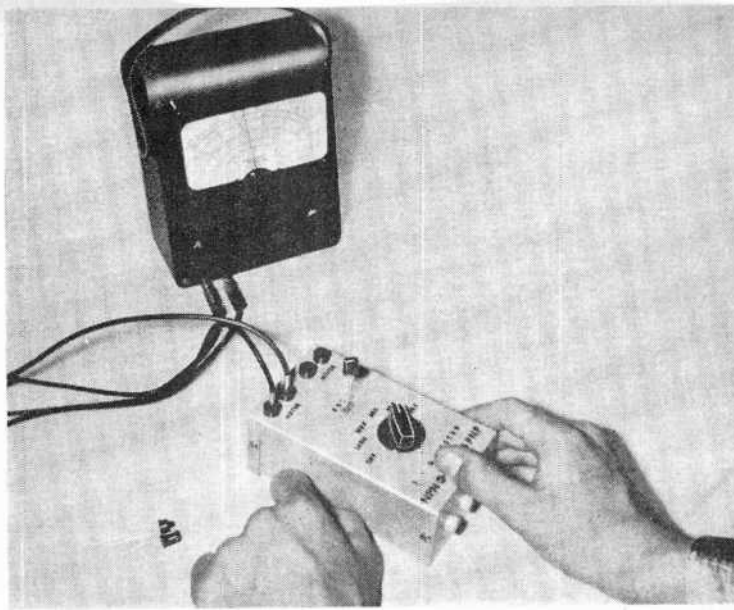
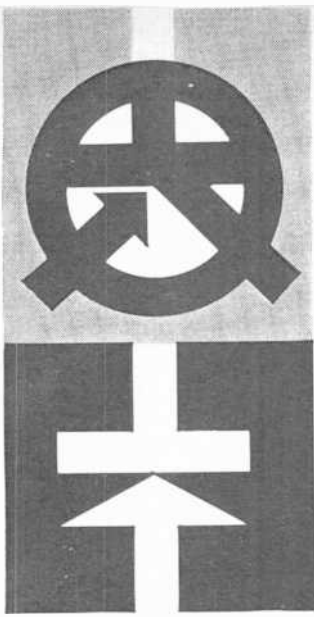
"If you're the big wheel of this outfit, I wish you'd tell me what this is all about," he demanded of the captain. "Your Little Boy Blues have been asking a lot of pretty personal questions. What am I supposed to have done, let the air out of the dean's tires or painted a mustache on the statue of John Parvoo?"

"I suppose you weren't anywhere near the Psi Kappa Psi house at 7:45, now were you, Buster?" one of the detectives who had come with the captain said sarcastically.

If looks were lethal, the one Captain Dirkson gave this detective would have dropped him in his tracks. The young suspect instantly gave an exaggerated sigh of relief and said, "I most certainly was not. I've been right here since 7:40. I had a date at 8:15—which you've made me late for—and I remember glancing at my watch and noticing I had about 25 minutes to kill as I was driving by the restaurant; so I came in for a cup of coffee. The counterman may remember when I came in."

The captain glanced at the chubby man behind the counter. He shook a close-cropped head that looked as round as a bowling ball.

(Continued on page 96)



THE Q-D TESTER

A welcome addition to the workshop of any experimenter, this instrument checks most transistors and diodes for gain and/or noise and leakage

By RONALD K. BUREK

DESIGNED for maximum versatility, this low-cost "Q-D" (transistor and diode) tester will accommodate almost any semiconductor. With it, you can test and compare transistors for leakage and gain. Diodes can also be checked for leakage, and the built-in "noise amplifier" enables you to quickly select a "quiet" transistor or diode. Since the tester is used in conjunction with an existing VOM or VTVM, it's inexpensive to build and quite compact.

About the Circuit. The transistor under test is connected into the test circuit as shown in the schematic diagram. With selector switch *S1* set for "Leakage" (position 2), the base of the transistor is open and a milliammeter connected across jacks *J4* and *J5* reads the leakage current in the emitter-collector circuit. When *S1* is set at one of the gain positions (3-6), the base of the transistor being tested is biased (through one or through a combination of resistors *R1 - R4*) with a known current. Biasing the transistor causes a change in the collector current (as read on the milliammeter across *J4* and *J5*) which is directly proportional to the gain of the transistor. From these readings and the known base bias current, it is possible to compute the *beta*, or d.c. current gain, of the transistor (see "Operation" section).

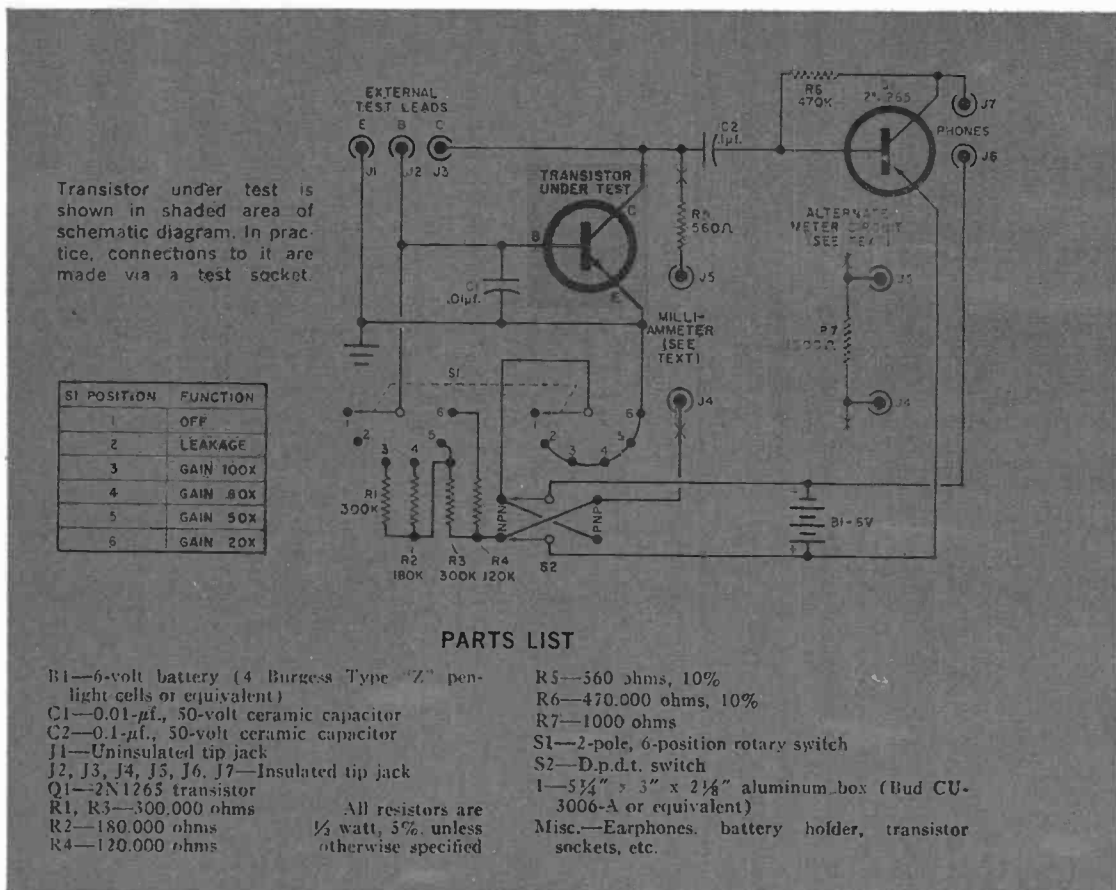
The tester has a built-in socket which accepts most transistors. Diodes or transistors without wire leads, however, can be checked

via test leads plugged into jacks *J1*, *J3*, and/or *J2*. Power for the test circuit is supplied by battery *B1* through switch *S2*. This switch changes the polarity of the applied voltage to accommodate either *pnp* or *nnp* transistors.

A high-resistance voltmeter can be used instead of the milliammeter discussed above. In this case, the portion of the circuit between the points marked

is wired as an amplifier. The amplified noise can be heard through a set of high-impedance headphones connected across jacks *J6* and *J7*. Plugging in the headphones, which also serve as a collector load for *Q1*, automatically applies power to the amplifier circuit.

Construction. The unit is housed in a 5¼" x 3" x 2⅛" aluminum utility box. All components (see pictorial diagram)



"X" on the schematic should be rewired according to the alternate meter circuit (also shown on the schematic), with resistor *R7* used instead of *R5*. The voltmeter connected to the alternate meter circuit will read directly in milliamperes—if one volt is indicated on the meter, for example, one milliamperere is flowing in the circuit.

Any noise from the transistor being tested is coupled to transistor *Q1*, which

are mounted on the front panel with the exception of the battery clip and jacks *J1*, *J2*, and *J3*. Although this parts arrangement was found by the author to be a workable one, parts layout is not critical, and any other convenient arrangement may be followed.

Make a small aluminum bracket to hold the socket for transistor *Q1*. This bracket is mounted under the retaining nut for jack *J6*. All of the jacks except

J1 should be insulated from the chassis; jack *J1* must be grounded, so its insulating washer is removed. And it's a good idea to use a heat sink while soldering in resistors *R1-R4* and resistor *R7*—the values of these resistors are critical and may be changed by the application of too much heat.

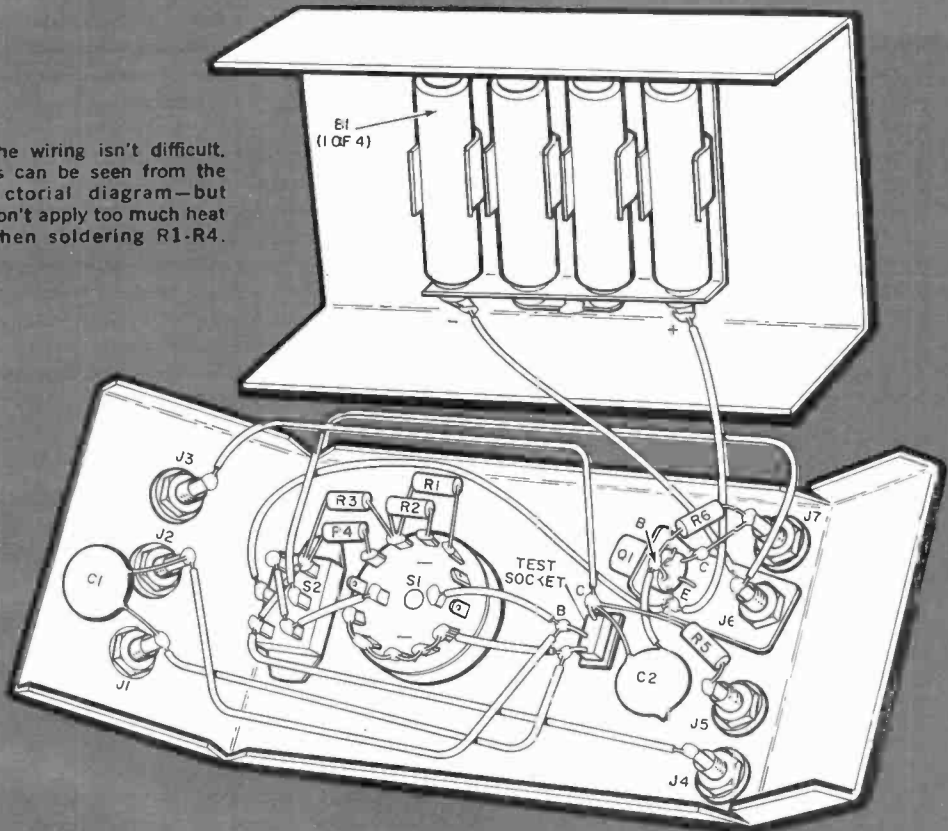
Operation. If you've wired the tester for use with a milliammeter, set your

ceed with the testing, reverse the meter leads. The polarity of the meter jacks will change according to whether a *pn*p or an *np*n transistor is being tested.

Before testing a transistor, make certain that switch *S2* is set at the proper position ("pn

" or "npn"). Next, plug the transistor into the test socket, or connect it to jacks *J1* (emitter), *J2* (base), and *J3* (collector) with a set

The wiring isn't difficult, as can be seen from the pictorial diagram—but don't apply too much heat when soldering *R1-R4*.



VOM for at least 10 ma. and plug it into jacks *J4* and *J5*. If you've used the alternate voltmeter circuit, set a VTVM or high-resistance (at least 20,000 ohms/volt) VOM for at least 10 volts and plug it into the same jacks. The high initial settings will safeguard the VOM or VTVM against burn-out but, once the tester is in operation, they may be reduced to a more appropriate value. Should you get a down-scale deflection as you pro-

of test leads. Throw *S1* to the "Leakage" position and note the meter reading, then move the switch to a gain position which gives a good meter deflection and again note the reading. When checking gain, it's best to start with the "100X" range and work towards the "20X" range, making sure the meter reading never exceeds the maximum recommended collector current for the transistor you are testing. Should you

get no deflection at all, the transistor is probably open; if the deflection is very large, it's probably shorted.

Assuming that the transistor is neither open nor shorted, you're now ready to calculate its d.c. current gain, or *beta*. The *beta* of the transistor is the difference between its "gain current" and its "leakage current," divided by the base bias current which was applied during the gain test. On position 3 of *S1*, 1/100 of a milliampere is applied to the base of the transistor under test; on position 4, the current is 1/80th of a milliampere; on positions 5 and 6, the currents are 1/50th and 1/20th of a milliampere, respectively.

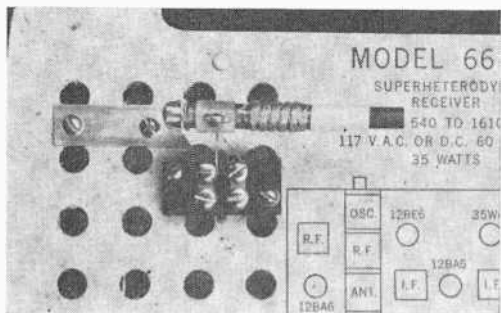
To take a concrete example, assume that the current reading of a transistor increases by 1 milliampere when *S1* is switched from position 2 ("Leakage") to position 6 ("Gain 20X"). The *beta* is then 1 divided by 1/20, which is the same as 1 multiplied by 20—or 20. Using the same reasoning, if position 5 had been used to take the gain reading, the current increase would have been multiplied by 50 to get the *beta*. The multi-

pliers for positions 3 and 2 are 80 and 100, respectively.

To check a diode, set switch *S2* at either position and *S1* at any position except "Off." Then connect the diode between the emitter and collector terminals (jacks *J1* and *J3*) and note the meter reading. If the meter should read backwards, reverse its leads or switch *S2* to the other position. Next, reverse the connections to the diode and again note the reading. The higher of the two readings is the forward current of the diode; it should be close to 10 milliamperes if you're using the milliammeter circuit—6 milliamperes if you're using the voltmeter circuit. The lower reading is the reverse current and should be close to zero with either indicating circuit.

The "noise amplifier" is automatically turned on, as mentioned earlier, when a set of headphones is plugged into jacks *J6* and *J7*. Make the noise test on a transistor at the same time you're checking its "gain current." Diodes should be checked for noise while both the forward and reverse current measurements are being made. —50—

Souping Up AM Receivers



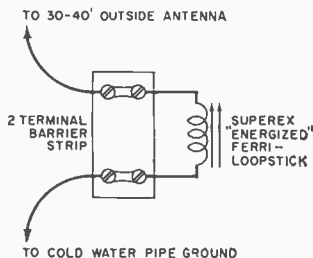
Does your *All-American Five* broadcast receiver lack sensitivity? Sure, it pulls in stations 10 - 15 miles away, but what about stations 30 - 50 miles away? You could probably triple the sensitivity if you had an outside antenna.

To avoid a possible shock hazard when working with such a.c./d.c. sets and still whoop up the sensitivity, try resonating a ferrite rod antenna near the built-in loop or rod antenna within the AM receiver. A Superex "Energized" Ferrite Loopstick (about 90 cents) is ideal.

Mount the loopstick to the back of the receiver using the bracket supplied. Don't let the screws contact the receiver chassis or wiring. Also, mount a Jones barrier strip to provide easy connection to the external antenna and ground.

Slide the core in and out of the loopstick for peak response at any spot in the BC band. If you can only peak it with the core all the way in, the antenna is too short. If the core must be removed for peaking, the antenna is too long. A length of 30 - 40 feet is generally sufficient.

—Hartland B. Smith



DX'ing the Broadcast Band

(Continued from page 71)

antenna. In its simplest form, such an antenna need be nothing more than a single, well-insulated wire, strung as long and as high as possible. It's true, of course, that communications receivers are blessed with powerful circuits and are extremely sensitive, but without a good antenna they won't do the DX'er much good.

One other advantage of a communications set is its calibration, which makes it easy to know which channel is which. With such a set you'll be able to monitor many Latin American stations—areas which are just as much a part of "America" as the United States.

Station Listings. Whether you choose to DX domestic stations, the more difficult Latin American targets, or (preferably) both, good reference logs are indispensable. For one thing, they will help you complete numerous identifications (Latin American stations frequently announce call-signs without locations, sometimes give a slogan without call-sign or location). Even more important, when there is a "hot spot" you want to monitor, such logs will tell you which frequencies to try.

Three publications you should find valuable are:

● *Broadcasting Stations of the World*, listing all foreign stations, and available from the Superintendent of Documents, General Post Office, Washington 25, D. C. In Part I (\$2.00), stations are arranged by country and city, most useful when you want to pick targets in advance. Part II (also \$2.00) lists the stations by frequency, and Part III (\$2.00) by call-sign and slogan.

● *Broadcasting Yearbook*, giving complete information on all U. S. stations, and available for \$4.00 from Circulation Department, Broadcasting Magazine, 1735 DeSales St., N. W., Washington 6, D. C. (They prefer that you mention your occupation when ordering.)

● *Jones Listing*, which lists all AM, FM, and TV stations in both the U. S. and Canada. It's available for \$1.00, postpaid, from the Vane A. Jones Co., 3749 N. Keystone Ave., Indianapolis 18, Ind.

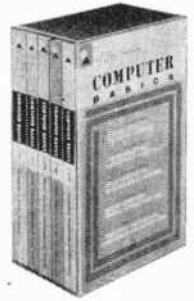
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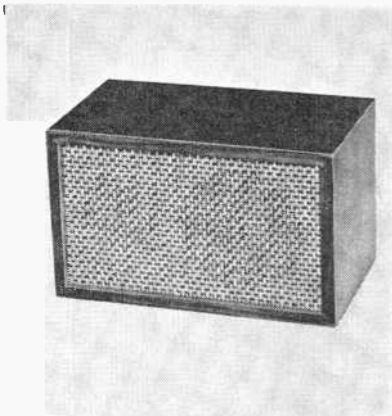
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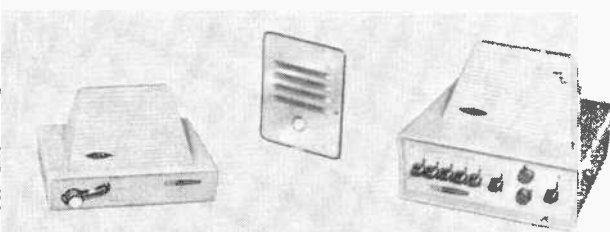
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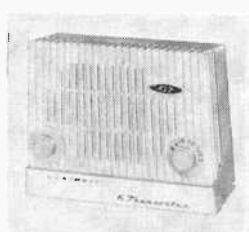
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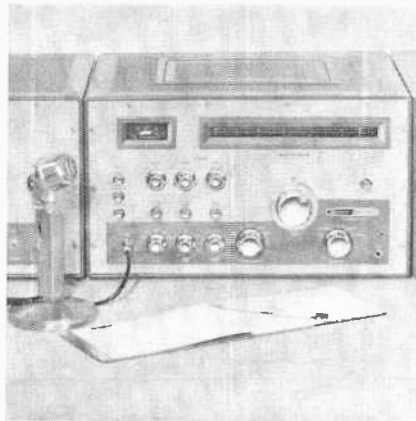
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Carl and Jerry

(Continued from page 88)

"Afraid not," he said. "I was interested in the "Wagon Train" story on the TV here in back of the counter, and it was getting real exciting when this fellow came in the door. A runaway wagon smashed into a boulder and upset at the very instant I heard the door close behind that guy. I remember because at first I thought the sound of the slam-



ming door, was the sound of the wagon wheel hitting the rock. Right after that a couple of out-of-towners stopped in to ask for directions on how to get out of here for Chicago. They were the stupid type, and it took me quite a while to straighten them out. I honestly couldn't tell you if that bird came in at 7:40 or eight o'clock. Sorry."

A dejected look started to spread over the captain's face, but when Carl leaned over and whispered in his ear he brightened up considerably.

"Take him down to the station and book him on suspicion of entry to commit a felony," he ordered the two officers who had located the car. "I'll be down as soon as I drop these boys off at their residence hall."

On the way Carl told Jerry what he had whispered to the captain: "You remember the counterman said the guy came in the door just as the wagon on the TV crashed into a rock. I suggested to the captain here that he call the TV station at Center City and ask them to hold a stopwatch on the *Wagon Train* tape as it ran through their monitor. Their log will show the exact second when the show started, and the timing of the tape is very precise. I'm confident they can fix the time that fellow entered the restaurant very closely."

"It's surely worth a try, anyway," Captain Dirkson said as he let them out in front of the H-3 building. "I'll put through a call to Center City as soon as I get back to the station, and I'll let you know if anything develops."

THE BOYS went up to their room and started again on the chemistry. After all the excitement, it was a little hard to settle down to studying, but they had learned you had to keep beating the books no matter what happened if you expected to stay in school; so soon they were concentrating on the job at hand. It was almost midnight when the buzzer sounded for Carl.

"Just thought you'd like to know your idea did the trick," Captain Dirkson's voice reported on the telephone. "The TV station established that the wagon-upsetting incident was aired at precisely 7:54 and eleven seconds. That knocked the restaurant alibi for a loop. When we laid it on the line for the guy, he cracked and confessed to all the robberies, some of which hadn't even been reported.

"Actually the fellow was in school last year at the university down state, and he lived in a fraternity house there. That's why he was so familiar with fraternity life. He pulled some jobs at *that* school and got away with them, then decided to favor *us* with his talents. If it hadn't been for you two, he'd probably still be running loose. I'll certainly tell Chief Morton what a help you've been, and I want you to know we appreciate it. Now you'd better go to bed. That's where I'm heading."

It was a good suggestion, and the boys took it. For a few minutes after the light was turned off, they lay there silent in their beds thinking about the other young man their own age lying in a jail cell. Finally, Jerry said slowly:

"You know, electronics was a nemesis for that poor guy. Electronics put the finger on him in the first place, and then a TV wagon train wrecked his alibi. His *second* mistake was transferring his operations from a liberal arts university to one with a strong accent on electronics."

"Well, you wouldn't expect a guy dumb enough to make the first mistake of starting to steal to be very bright," Carl muttered sleepily.

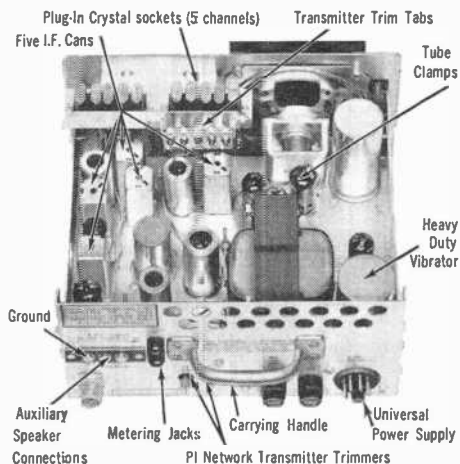
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Magnetic Quiz Answers

(Questions on page 72)

- 1 TRUE. The north pole of a compass points to the earth's north magnetic pole which is actually the south pole of a large magnet inside the earth.
- 2 TRUE. The force of attraction between unlike magnetic poles varies inversely as the square of the distance between them.
- 3 TRUE. The north pole of a compass always indicates the direction of the magnetic field in which it lies. To determine the direction of the magnetic field, grasp the wire with your left hand with the thumb in the direction of electron flow, from A to B. Your fingertips will point in the direction of the magnetic field.
- 4 FALSE. Bar magnets should be stored so that opposite poles lie adjacent to each other. The magnetic field from each bar will then have a closed magnetic circuit lying entirely within the bars themselves. Hence, the magnetic fields are least likely to go into nearby metallic objects.
- 5 TRUE. There are no materials which resist magnetic fields. However, magnetic shields made of high-permeability materials such as mu-metal are used to bypass magnetic fields around the devices to be isolated from the effects of the magnetic fields.
- 6 FALSE. The D-ring is a shorted turn of copper used on a.c. relay coils to prevent armature chattering. When the magnetic field set up by the coil starts to collapse on alternate half cycles, a circulating current in the D-ring builds up a magnetic field which holds the contacts closed.
- 7 TRUE. This is the principle of "magnetostriction" used in ultrasonic transducers for sonar and in ultrasonic cleaning devices.
- 8 TRUE. Electrons will enter the coil from the bottom and exit at the top of the coil. Grasp the coil with your left hand with the fingers wrapped in the direction of the electron flow. Your thumb will point to the north pole.
- 9 FALSE. Use your left hand to determine the magnetic field around a moving electron. The thumb points in the direction of electron flow and the curled fingers point in the direction of its magnetic field. Hence, the electron coming out of the page will have a clockwise field around it. The magnetic field to the right of the electron will have the same direction as the field of the deflection coil. Since magnetic lines which have the same direction repel each other, the electron experiences a force to the left.
- 10 TRUE. Almost all of the magnet's magnetic lines of force will pass through the soft iron bar. The "keeper" is usually employed when storing permanent magnets in order to preserve the magnetic strength.

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Introducing Aunt Minnie

(Continued from page 54)

across the relay coil doesn't increase linearly in proportion to the current through *L1*, due to saturation of the core by the combined a.c. current drawn by the load and the d.c. current drawn by the rectifier and relay. If a curve of d.c. relay coil voltage vs. a.c. load current were plotted, we would find that complete saturation occurs at somewhere around 12 volts d.c., a safe value for both the relay and the electrolytic capacitors.

At this point, the a.c. load current is about 3 amperes, a trifle heavy for continuous operation in view of the No. 20 wire with which *L1* is wound. Assuming a maximum safe load current of 2 amperes, many black-and-white TV tuners could also be operated in conjunction with the system. With the TV tuner drawing 2 amperes, 11.4 volts would appear across the relay coil, resulting from an a.c. drop of about 4.05 volts across *L1*. This small loss will not as a rule affect the operation of a device designed for a 105-125 volt or even a 110-120 volt supply.

Alternate Circuit. If it is necessary to include a heavy-drain device such as a color-TV tuner in the system, it is still possible to use the "Aunt Minnie" principle by modifying *L1* to an autotransformer having two taps; see the schematic diagram of this version of the circuit. Reactor *L1* now consists of three sections: one of 22 turns of No. 18 wire for the heavy-current receptacle *SO1*; an additional one of 53 turns of No. 22 wire, giving a total of 75 turns for the medium-current receptacles *SO2*, *SO3*, and *SO4*; and 82 more turns of No. 24 wire. This makes a total of 157 turns through which current to *SO5* must flow.

Since the rectifier and relay are connected across the entire winding, *SO1* handles loads of 50 to 360 watts; *SO2*, *SO3*, and *SO4* loads from 15 to 100 watts; and *SO5* loads from 7.5 to 40 watts. The result is an arrangement which takes care of almost any assortment of components that are likely to be encountered in a music wall. And the music wall, complicated and intricate as it may look, is so simple to operate that even Aunt Minnie can do it!

—50—



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Introducing Uncle Tim

(Continued from page 55)

3, 4, and 5 to *NO* contacts 3, 4, and 5, thus activating *SO1*.

Socket *SO2*, incidentally, is an optional receptacle that is wired to an unused relay pole in such a way that it is deactivated when *SO1* is activated. In the author's case, it is used to extinguish a lamp (2.5 amperes maximum) as the system goes on.

About the Circuit. Assume that relay *K1* and switch *S2* are in the position shown in the schematic diagram, but that *S1* is down (*NO*). Under these conditions, voltage from the power plug (*PL1*) is stepped down in the secondary of transformer *T1*; because the secondary circuit is open (at *NC2* of *S2*), no current will flow.

Now suppose that switch *S1* is thrown to the position shown. Control current will then flow through *NC* of *S1* to pole 1 and *NC1* of *S2*, and then to the pickup coil of *K1*, energizing it and lighting both indicators (*I1* and *I2*). As soon as *K1* closes, the control current flow to the pickup coil is broken, but the relay will remain in this position until the drop-out coil is pulsed. Instead of switch *S1*, switch *S2* (remote) could have been thrown to apply control voltage to pole 1 of *K1* via pole 2 to *NO2* of switch *S2*.

When either of the two switches is thrown again, a control current path through pole 2 to *NO2* of *S1* and to the drop-out coil exists, causing the relay to drop out and break the control current at pole 2.

-30-

The S-9'er

(Continued from page 51)

use coaxial cable between the output jack and the receiver. The chassis cover should be left off temporarily. Switch both the receiver and the *S-9'er* on and set the coupling for maximum, the regeneration control (*C2*) for maximum capacity, and switch *S1* to *Out*.

Tune in a signal on the receiver at about 6 mc. and set *S1* to *In*. Adjust capacitor *C1* (main tuning) for maximum signal volume, then slowly decouple coils *L1* and *L2* (keeping capacitor *C1*

peaked up) until, once again, you've reached the point of maximum volume. If regeneration occurs while you're adjusting the coupling, slowly vary the capacity of C3 until it stops. Now decrease the capacity of C2 until regeneration occurs, then back off slowly, keeping the coupling and main tuning peaked up, until the signal is loudest. This optimum point, ideally, should not be far from the minimum-capacity setting of C2; if C2's setting is much higher, it will be necessary to increase the capacity of C3.

Check the operation of the unit over several other frequencies within its range, making sure that all controls operate smoothly and that regeneration can be stopped, even with the coupling at minimum. Then install the cover—and your S-9'er is all set to go.

You'll find, incidentally, that it's best not to set the regeneration too high—or settings will require frequent changing as you tune a band. Though the controls do interact to some extent, a little practice will soon enable you to make adjustments quickly. —30—

Transistor Topics

(Continued from page 80)

stereo amplifier in kit form. Designated as the Knight-Kit KX-60, the unit employs a high-efficiency circuit utilizing 20 transistors and 4 diodes, and can deliver up to 25 watts per channel. Frequency response is ± 1 db, 20-20,000 cycles; harmonic distortion is less than 1.0% at full output. Measuring 2 $\frac{3}{4}$ " high by 11" wide and 9 $\frac{1}{4}$ " deep, the KX-60 weighs only 8 pounds. Catalogued as No. 83 YU 994, it sells for \$79.95, less case and postage.

A transistorized field strength meter, ideal for CB use, is now available from Lafayette Radio Electronics Corp. (165-08 Liberty Ave., Jamaica 33, N. Y.). Known as the Model TM-16, the instrument is powered by an inexpensive flashlight battery and equipped with an ear-phone jack for monitoring purposes. It sells for \$14.95, plus postage.

Looks like "thirty" for now, fellows. Have you started planning your Spring projects yet?

—Lou

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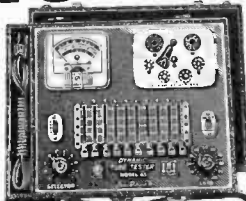
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• SYMBOL REFERENCES: Model 85 employs time-saving symbols (A, B, C, D) in place of difficult-to-remember letters previously used. Repeated time-studies proved to us that use of these scientifically selected symbols speeded up the element switching step. As the tube manufacturers improve the release of new tube types, this time-saving feature becomes necessary and advantageous.

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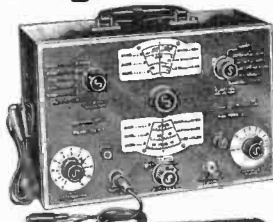
SPECIFICATIONS: D.C. VOLTS: 0 to 2.5 / 15 / 75 / 150 / 750 / 1,500. A.C. VOLTS: 0 to 15 / 30 / 45 / 75 / 1,500 / 3,000. D.C. CURRENT: 0 to 1.5 / 15 / 150 Ma. • 0 to 1.5 / 15 to 1.5 / 15 / 150 Ma. • RESISTANCE: 0 to 1,000 / 100,000 Ohms • 0 to 10 Megohms • CAPACITY: .001 to 1 Mid. ohms • REACTANCE: 50 to 1 to 50 Mid. 2,500 Ohms to 2.5 Megohms • INDUCTANCE: .15 to 7 Henries. DECIBELS: —6 to +18, +14 to +38, +34 to +58.

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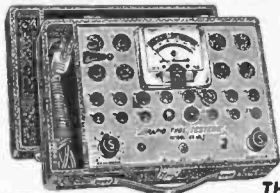
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Multi-Socket Type

TUBE TESTER



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10 SECONDS FLAT!

- 1 Turn the filament selector switch to position specified.
- 2 Insert it into a numbered socket as designated on our chart (over 600 types included.)
- 3 Press down the quality button—

THAT'S ALL! Read emission quality direct on bad-good meter scale.

SPECIFICATIONS

- Tests over 600 tube types
- Tests OZ4 and other gas-filled tubes
- Employs new 4" meter with sealed air-damping chamber resulting in accurate vibrationless readings
- Use of 22 sockets permits testing all popular tube types
- Dual Scale meter permits testing of low current tubes
- 7 and 9 pin straighteners mounted on panel
- All sections of multi-element tubes tested simultaneously
- Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms

Model 82-A—TUBE TESTER
Total Price \$36.50
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Model 82A comes housed in handsome, portable case. Only **\$36.50**

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 per month for 6 months if satisfactory. Otherwise return, no explanation necessary.

• Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test.

• Free-moving built-in roll chart provides complete data for all tubes. All tube listings printed in large-easy-to-read type.

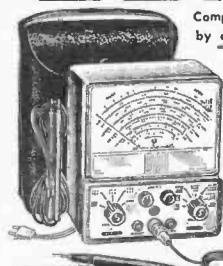
• NOISE TEST: Phono-Jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

• SEPARATE SCALE FOR LOW-CURRENT TUBES—Previously, on 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.

The Model TW-11 comes housed in a handsome, portable, saddle-stitched Texon case. **\$47.50**

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

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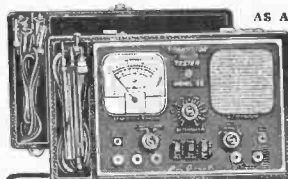
- DC VOLTS—0 to 3/15/75/150/300/750/1500 volts at 11 megohms input resistance.
- AC VOLTS (RMS)—0 to 3/15/75/150/300/750/1500 volts.
- AC VOLTS (Peak to Peak)—0 to 8/40/200/400/800/2000 volts.
- ELECTRONIC OHMMETER—0 to 1000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms.
- 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.

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AS A TRANSISTOR TESTER

The Model 88 will test all transistors including NPN and PNP, silicon, germanium and the new gallium arsenide types, without referring to characteristic data sheets. The time-saving advantage of this technique is self-evident. A further benefit of this service is that it will enable you to test new transistors as they are released!

Comes housed in a handsome portable case. Complete with a set of Clip-On Cables for Transistor Testing, an R.F. Diode Probe for R.F. and I.F. Tracing; an Audio Probe for Amplifier Tracing and a Signal Injector Cable—Only. **\$38.50**

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On the Citizens Band

(Continued from page 74)

tor is defective. If the green lamp goes out for more than a second or so, stop operating and push the switch on the monitor. If a broadcast stoppage is due to a station break or malfunction at the station, you'll know about it after listening for a few seconds. If you think it may be due to a Conelrad alert, try other stations, but avoid transmitting with your CB set until you have determined what caused the silence.

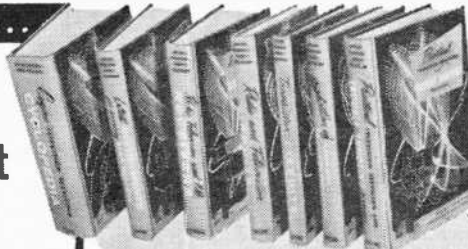
Don't worry about the monitor "blasting" when you push the switch—the #49 lamp in series with the loudspeaker makes a very effective output limiter, keeping the audio at a reasonable level. And be sure to operate your CB rig *only* when the green lamp is lit.

Club Notes. The CB Pioneers (Elkhart, Ind.) recently filed papers to incorporate their club. Any club will find such a move worth contemplating, because it can afford many legal advantages. If your club is firmly established and not

already incorporated, you might want to check on this matter with an attorney. . . . The Kenosha (Wis.) Citizens Band Club has designated channel 7 as the "calling" channel for the area it serves. If you're traveling in that region and need assistance, the members of this club will be glad to help you. . . . The Citizens Radio League (Chicago, Ill.) provided communications for sports car races at Meadowdale International Raceway in Carpentersville, Ill., not too long ago. Fourteen members in ten mobiles operated the system. . . . When a 45-foot Canadian sailing schooner broke up on the rocks near Ocean City, Md., recently, a mobile unit of the Eastern Shore Marine Radio Club (CB) was on the scene, calling its base station in an effort to obtain the necessary emergency and rescue equipment from the local authorities. . . . Back last fall, the Racine (Wis.) CB Club sponsored Red Cross First Aid Courses to prepare its members for emergencies. . . . The Midwest DX-Shortwave Radio Club (2100 W. William St., Decatur, Ill.) has added a CB section. Although originally an SWL club, the or-

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ganization now considers CB an important part of its operations. Write Dave Gants (WPE9ABA) at the above address for full details. . . . The Tri-State Flea-Watters, Inc. (Sioux City, Iowa) proved to be a pain for youngsters with malice in mind on Halloween. The club's mobile units, cooperating with local police, patrolled the streets of Sioux City, noting and reporting all suspicious activities. As a result, only a fraction of the usual disturbances took place.

Ignition Interference? Looking for a good reference work on eliminating mobile unit ignition interference? The Champion Spark Plug Company has recently published a 16-page booklet, written in "low-voltage" language and titled, "Giving Two-Way Radio Its Voice." The booklet is profusely illustrated and contains a special spread on outboard motor noise suppression. Address your request for a copy to Mr. R. J. Gail, Service Editor, Technical Services Department, Champion Spark Plug Co., Toledo, Ohio. -30-

Short-Wave Report

(Continued from page 81)

will tune only certain *classes* of stations (aero, amateur, coastal, or c.w.). He may also confine his listening to stations in certain areas of the world. The specialists, especially those with working knowledge of foreign languages, are particularly valuable in reporting non-English stations.

Listener—one who tunes strictly for pleasure. He cannot be called a DX'er as such. But he, too, may be found tuning deeply for words and music from foreign lands.

How would you classify yourself? Regardless of your category, you are partially responsible for the continuing growth and success of your favorite radio club column or bulletin. As we have pointed out, each of the various categories contains DX'ers who, in their own way, contribute needed information.

The following item originally appeared in the February, 1952, issue of the "United 49'ers" club bulletin, and was recently passed on to us by Anson Boice, WPE1BD, New Britain, Conn., former editor for the club:

"Keep digging! Keep digging for your DX the way this old hen does. Ill fortune means nothing to a hen. She keeps digging worms and laying eggs regardless of what the papers say or what the present threat appears to be. If the ground is hard, she scratches harder. If it is dry, she digs deeper. If she strikes a rock, she works around it. But she always digs worms and turns them into hard-shelled profits. She does not starve to death waiting for worms to come to the surface nor does she cackle because of hard luck. She saves her breath for digging and her cackles for results."

Did you get the message?

Current Station Reports

The following is a resume of current 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 mail reports to your Short-Wave Editor, P. O. Box 254, Haddonfield, N.J., in time to be in our hands by the eighth of each month. This month we are featuring many items on new stations and schedule

changes as well as the usual assortment of both easy and difficult stations to log.

Algeria—A station on 4840 kc. was noted in Europe at 1320-1335 announcing in Eng. as "This is a test xmsn from Algiers," followed by a BBC newscast. (SCDX)

Angola—The latest schedule from *Emisora Angola*, Luanda, reads: daily (exc. Sundays) at 1900-2230 on 4955 kc.; at 0000-0230 (Sundays to 0600) on 9765 and 4955 kc.; at 0630-1200 on 6025 and 4955 kc.; and at 1000-1200 on 17,547 kc. (WPE9DN)

Australia—As many DX'ers may already be aware, R. *Australia* has discontinued the use of its well-known VL call-signs. However, the interests of the SWL will not be overlooked and other widely known forms of identification will be retained. These include, among others, the IS "Waltzing Matilda," the laugh of the Kookaburra, and the chimes of the Melbourne Post Office clock. (DWDX)

Austria—Vienna has been heard well at 1900-2300 with music on 9525 kc., dual to 6155 and 9770 kc. The 7200-kc. outlet is scheduled for 0300-0600 and has been heard as late as 0400, though the signal was on the way out at that time. (WPEDKP, WPE3NF, WPE4BHG, WPE4CBV, WPE4FI, WPE6CMS, WPE8BQH, WPE8DKN, VE3PE1LA)

Belgium—Brussels is operating on a new frequency of 6140 kc. at 1615-1800 and 1815-2000 to N.A., replacing 9725 and 9705 kc. (WPE1CQG, WPE4FI, WPE6CMS)

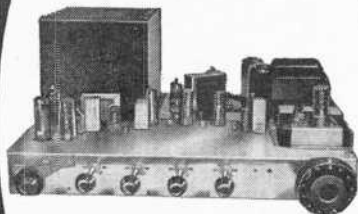
Bolivia—R. *Pio XII*, Potosi, was noted on 5949 kc. at 2130 with Spanish ID. The signal

BUILD THE FINEST

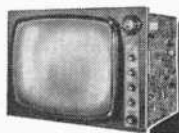
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INDIANA TECHNICAL COLLEGE

was fair but there was bad c.w. QRM. (WPE3NF)

Brazil—R. Guarani, a new station, has been observed on 6175 kc. at 2040-2100 with a sporting event. The exact location and address is requested. (MF)

Canada—This is the latest schedule from Montreal: to Australia and Asia on 9630 kc. at 0320-0405 daily (Eng.); to Europe on 17,820 and 15,320 kc. at 0625-0700 and 0730-1115 daily (Forces relay at 0700-0730 daily and to 0815 Sundays), on 15,320 kc. at 1115-1130, on 15,320 and 11,720 kc. at 1130-1330, news in Eng. and French at 1030-1045; to Africa on 15,320 and 11,720 kc. at 1332-1445, and on 11,720 kc. until 1458, with Eng. at 1333-1415; to Europe on 11,720 and 9630 kc. at 1500-1631, with Eng. from 1545; to Northern Canada, East and Central areas at 1658-1746 in French and Eng. and to Western areas at 1958-0205 in Eng., both xmsns on 9585 and 6060 kc.; to the Caribbean and Latin American areas on 11,760 and 9740 kc. at 1758-1946, with Eng. at 1800-1830. (WPE8MS, WPE9CVN, WPE9DN, R. Canada)

Canary Islands—R. Atlantico, Las Palmas, has Eng. on Saturdays at 1800-1900 on 9490 and 7000 kc. (SCDX)

China—Peking is operating, according to the schedule, in Eng. to N.A. at 2000-2200 (east coast) on 7480, 9480, 11,730, 11,945, 11,975, 15,030, 15,115, and 17,765 kc.; and at 2200-0000 (west coast) on 7350, 9457, 9785, 11,820, 12,055, 15,060, 15,250, and 17,745 kc. (WPE2DJE, WPE4DHH, WPE8MS, VE7PE5S)

Costa Rica—TIGG, R. Excelsior, San José, has moved from 6075 to 6225 kc. and is noted with a good signal at 1900-0000. (WPE4FI)

Cuba—Havana is now operating in the 49- and 31-meter bands as follows: on 5990 kc. at 1600-0100 (Eng. at 2200-2300 and 0000-0100); 6060 kc. at 2245-0100; and 9685 kc. at 1600-0100. (WPE2FGX, WPE2FHK, WPE2GJC, WPE3AG, WPE3NF, WPE4BC, WPE4DOR, WPE6AA, WPE8BQH, WPE8CNX, WPE8CQB, WPE8CVR, WPE8DKN, WPE8HF, WPE8ATE, WPE8VB, VE7PE1R)

Denmark—Copenhagen transmits to N.A. at 2030-2130 and 2200-2300 with a DX show on Tuesdays on 9520 kc. Operations on 15,165 kc. include a broadcast at 1730-1830 to South America; 0400-0500 to the Far East, Australia, and New Zealand; 0930-1030 to S. Asia; 1330-1430 to N. Africa and Middle East; and 1445-1545 to S. Africa. (WPE1ALM, WPE1AZL, WPE2DTO, WPE2FHU, WPE2FMH, WPE2FUU, WPE3CHO, WPE7IK, WPE8CUS)

Ecuador—HCJH1, R. Turismo, Otavalo, 3965 kc., has been noted with L.A. music and ID's at 0002, 0016, and 0023. (WPE2FGX)

R. Centinela del Sur, Loja, 6250 kc., is heard at 1900-2200, and R. Cariamanga, Cariamanga, is noted on 6234 kc. at 1900-2300. Both stations have fair signals. (WPE4FI)

Egypt—Cairo has been operating on 5705-5715 kc. and was noted around 1640-1715 with Arabic music and talks, in an apparent effort to block Damascus on 5705 kc. A similar effort is taking place on 7399 kc. around 1410, Damascus being on 7398 kc. (WPE3NF, WPE4BC)

England—London carries the following serv-

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ice to Canada, U.S.A., and Mexico: Special Services at 1030-1245 on 21,675 kc.; and at 1100-1300 on 17,810 kc. The General Overseas Service is at 1615-1715 on 9825 kc.; and at 1615-2200 on 6195 kc. (WPE3NB, WPE9DN)

Germany—The latest changes in the *Deutsche Welle* schedule include: to Japan at 0300-0430 on 17,815 and 15,405 kc. and at 0445-0745 on 17,815 and 15,295 kc.; to the Middle East at 0745-1045 on 21,705 and 17,875 kc.; to the Near East at 1100-1400 and to South American areas at 1530-1700, both on 11,895 and 9735 kc.; and to Eastern N.A. at 1715-1845 on 9605 and 6100 kc. (WPE2ENM, WPE9DN)

Ghana—Accra has been found on 15,212 kc. at 1540 with music; 1600 ID and Eng. news to 1612; music to 1720 ID and close. Another outlet has been tuned on 21,670 kc. at 1000-1010 with Eng. news; to 1018 with a commentary; music until past 1030. This latter xmsn is beamed to Africa. (WPE4BC)

Greece—The Forces Broadcasting Service, Athens, 6046 kc., was tuned at 1545 with Greek music and language. (WPE3NF)

The latest schedule from *R. Athens* reads: 0200-0315 (Sundays from 0045), 0400-0500 (Mondays), 0530-0800, 0830-1015, and 1100-1200 on 11,720 and 9605 kc.; 1215-1245 (Eng. and French) on 17,745 and 15,345 kc.; 1315-1345 on 11,720 and 9605 kc.; 1400-1445 on 17,725 and 15,345 kc.; and 1700-1730 and 1800-1830 on 15,345 and 11,720 kc. The Russian xmsn at 1030-1045 has been dropped. (WPE9DN)

Guinea—Conakry, 4910 kc., is now using its 100-kw. xmtr and is the strongest African sta-

tion in the 60-meter band. It's heard as early as 1450, with music. (WPE3NF)

Haiti—The latest schedule from 4VEH, Cap Haitien, reads: 6120 and 9770 kc. at 0600-0900 in Eng.; 1145-1400 in French and Creole; 1400-1530 with music (Eng. on Sundays); 1530-1600 in Chinese with music; 1600-1800 in Spanish; 1800-2000 in French and Creole; and 2000-2300 (Fridays, Saturdays and Sundays) in English. Reports go to Cap Haitien, Box 1, Haiti. Numerous DX'ers also report hearing the broadcast-band outlet on 1035 kc. during the evenings. (WPE1BD, WPE4DOR, WPE4DVB, WPE5BXT, WPE0TA, Radio 4VEH)

Iran—*R. Teheran*, 7024 kc., was noted from 1430 with Persian music; it is heard much better at 1545 when it opens in English. (WPE3NF)

Japan—Tokyo is currently scheduled to N.A. at 1930-2030 on 9505, 11,780, and 15,135 kc.; to N. and S. America at 2200-0000 on 6140, 9505, 11,780, and 15,235 kc.; and to Hawaii at 0030-0200 on 11,815 and 15,235 kc. (WPE4BC)

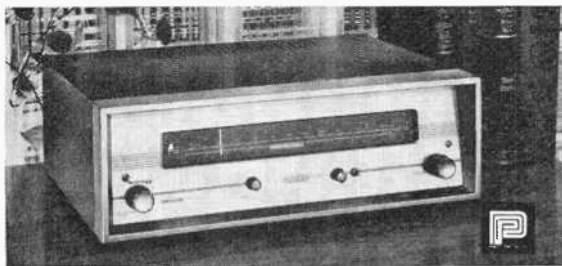
Lebanon—The Lebanese Broadcasting Station, Beirut, has been tuned on 9725 kc. as early as 1200 with Arabic flute music and Arabic announcements. The signal would indicate the power to be less than 10 kw. (WPE3NF)

Monaco—*Trans-World Radio*, Monte Carlo, has been found on 11,719 kc. at 1100 with a Russian religious program; there is an ID in Russian and Eng. at 1134. When closing, they use the same music-box ID as does *R. Monte Carlo*. (WPE3NF)

Netherlands—Hilversum operates to N.A. in

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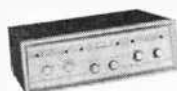
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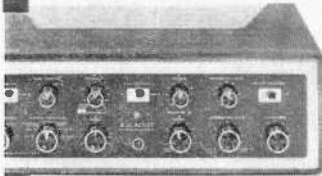


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Colorado

Eng. at 1630-1720 on 11,730 and 9590 kc. (on 6020 kc. to Europe) and at 2030-2120 on 9590 and 5980 kc., the latter frequency being a late change from 6020 kc. Dutch to N.A. is heard at 2030-2120 on 9715 and 6085 kc. Reports go

SHORT-WAVE CONTRIBUTORS

Steve Colello (WPE1ALM), Portsmouth, N. H.
Stephen Ray (WPE1AZL), Stoneham, Mass.
Anson Boice (WPE1BD), New Britain, Conn.
John Culi (WPE1CQG), North Abington, Mass.
Rudy J. Vyhnanek, Jr. (WPE2DJE), Mellenville, N. Y.
Al Burzynski (WPE2DKP), Niagara Falls, N. Y.
Jim Marold (WPE2DRU), Lindenhurst, N. Y.
Ronnie Breiger (WPE2DTP), Englewood, N. J.
Raymond Hartmayer (WPE2ENM), Bronx, N. Y.
Dave Listort (WPE2FGX), Elmont, N. Y.
Fred Hill (WPE2FHK), Plainview, N. Y.
Henry Marbach (WPE2FHU), White Plains, N. Y.
Stephen Herman (WPE2FAH), Oceanside, N. Y.
Don Skemer (WPE2FUU), Flushing, N. Y.
Alfred Wirtenberg (WPE2GDS), Brooklyn, N. Y.
Richard Shannahan (WPE2GJC), Binghamton, N. Y.
Alfredo Gonzalez, Jr. (WPE2GKS), Bronx, N. Y.
Richard Hoag (WPE2GKX), Poughkeepsie, N. Y.
Robert Solliday (WPE3AG), Sellersville, Pa.
C. Vernon Hyson, Jr. (WPE3AGZ), Kensington, Md.
Dave Stiffler (WPE3CHO), Greensburg, Pa.
James McKechnie (WPE3CUY), Camp Hill, Pa.
John Wilson (WPE3NB), Wilmington, Del.
George Cox (WPE3NF), New Castle, Del.
Grady Ferguson (WPE4BC), Charlotte, N. C.
Johnny Martin (WPE4BHG), Cleveland, Tenn.
Robert Gayhart (WPE4CBV), Jeffersontown, Ky.
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Jerry Brown (WPE4DVB), Franklin, Tenn.
Billy Carter (WPE4DHH), Mt. Airy, N. C.
Jim Courtney (WPE4DOR), Knoxville, Tenn.
Roger Legge (WPE4FI), McLean, Va.
Earl Philips, Jr. (WPE5BXT), New Orleans, La.
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Richard England (WPE8FV), Columbus, Ohio
Dan Wilt (WPE8HF), Inglewood, Calif.
Mike Kander (WPE8MS), Columbus, Ohio
Bill Szatkowski (WPE9BSE), Chicago, Ill.
Thomas Musial (WPE9CMX), Green Bay, Wis.
Bruce Brown (WPE9CVN), Skokie, Ill.
Thomas Farr (WPE9DFK), Villa Park, Ill.
Marshall Gratz (WPE9DHW), Milwaukee, Wis.
Robert Zeller (WPE9DLV), Neshkoro, Wis.
J. P. Arendt (WPE9DN), Aurora, Ill.
Larry Pfeiffer (WPE9DVB), Crystal Lake, Ill.
Bill Holscher (WPE9ITE), Webster Groves, Mo.
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George Buchanan (WPE9VB), Webster Groves, Mo.
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Mike Petras (VE7PE5S), North Burnaby, B. C.
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Deutsche Welle DX Bulletin (DWDX), Cologne, Germany
Sweden Calling DXers (SCDX), Stockholm, Sweden
Radio VEH, Cap Haitien, Haiti
Radio Canada, Montreal, Quebec
Radio Switzerland, Berne, Switzerland

to Box 222, Hilversum. (WPE2FMH, WPE2GDS, WPE2GKS, WPE4CCO, WPE4FI, WPE8DPE, WPE9BSE, WPE9DHW, WPE9DN, WPE9OTA, VE3PE6D, VE4PE2U)
New Britain—VL9BR, Rabaul, started op-

erations on 4840 kc. last October 30 with a power of 250 watts. Their schedule reads 0255-0600 (from 0340 Saturdays and Sundays). Reports go to R. Rabaul, P. O. Box 71, Rabaul, New Britain, Territory of New Guinea. Has anyone actually heard this station yet? (WPE2DRU, WPE3CHO, WPE8FV)

New Caledonia—Noumea was noted (very weakly) on 3355 kc. at 0350, with instrumental

SHORT-WAVE ABBREVIATIONS

BBC—British Broadcasting Corp.
c.w.—Morse code
Eng.—English
ID—Identification
IS—Interval signal
kc.—Kilocycles
kw.—Kilowatts

L.A.—Latin America
N.A.—North America
QRM—Station interference
R.—Radio
SWL—Short-wave listener
xmsn.—Transmission
xmtr.—Transmitter

music and French announcements. Heavy QRM prevented good listening. (WPE3NF)

Nigeria—Lagos is tuned on 4990 kc. around 0035-0100 with Eng. news, some light pop music, and an ID at 0045. Kaduna on 3395 kc. is good around 1715, dual to 3326 kc., with Hausa chants. (WPE3AGX, WPE3NF)

Poland—The Polish Pathfinders Station SP5ZHP, Warsaw, broadcasts simultaneously on 6850 and 7310 kc. daily except Mondays at 0500-1100. (SCDX)

Senegal—Ziguinchor was tentatively noted on 3336 kc. at 1710 with West African music

but with much QRM. This one is weak and very irregular. (WPE3NF)

South Africa—A new frequency for Paradys is 21,690 kc., heard at fair level at 0700-1030. (WPE4FI)

Sweden—Stockholm operates in Eng. to N.A. at 2045 and 0900 to Eastern N.A. and at 2215 to Western N.A. on 9725 and 17,840 kc. Other Eng. xmsns include: 0730-0800 to Far East on 15,155 and 7230 kc.; 0945-1015 to S. Asia on 17,845 and 6065 kc.; 1115-1145 to Middle East on 15,240 and 11,705 kc.; 1245-1315 and 1445-1515 on 11,705 kc. and 1530-1600 on 7240 kc., both to Africa. (WPE1BD, WPE3CUY, WPE4FI, VE1PE2N)

Switzerland—Berne operates to N.A. daily at 2030-2215 (East Coast) and at 2315-0000 (West Coast) on 11,865, 9535, and 6165 kc. The DX program is on Fridays at 2105; "Melody Train" is aired Thursdays at 2115. (WPE2-DJE, WPE2GKX, WPE8CVR, WPE9CMX, WPE9DFK, WPE9DLL, WPE9DN, WPE9-DNH, VE5PE2E, R. Switzerland)

Tunisia—Tunis is operating on 17,700 kc., replacing 17,845 kc. and is heard well in Arabic at 0700-0900. (WPE4FI)

Turkey—TAR8, R. Erzerum. East Turkey, can be heard until 1430 on 7651 kc. Power is listed as 1000 watts. The schedule reads: 2330-0100; 0500-0630 (Sundays to 0700); and 1200-1230. (SCDX)

USSR—R. Tashkent, Uzbekistan, was noted at good level in English on the new frequency of 11,925 kc. at 0700, dual to 9600 kc. At present, the 11,690-kc. channel seems to be inactive. (WPE3NF)

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Across the Ham Bands

(Continued from page 77)

News and Views

Jim Fox, KNØGLQ, 4315 Springfield St., Sioux City 8, Iowa, lists his three most wanted states as Vermont, Idaho, and Alaska. He has worked the other 47 with his Heathkit DX-20 transmitter, 40-meter doublet antenna, and venerable Hallicrafters SX-24 receiver. In the process, Jim worked close to 900 stations and has over 200 QSL cards. . . . **J. Gary Firtick, KN8BSH**, 419 Brookfield Ave., Youngstown, Ohio, transmits with a Globe Chief 90 and receives on a Heathkit AR-3, plus a QF-1 Q-multiplier. A 40-meter dipole antenna 45'-high couples both transmitter and receiver to far-off places. In three months, Gary has worked 30 states and has QSL cards from 25 of them. A 15-wpm code certificate and a Ragchewers' Club certificate are already on the shack wall, and there is a space reserved for his General Class license which is on the way.

. . . **Mike Holman, KN5KWG**, 401 Dogwood Lane, Mt. Pleasant, Texas, really has found the secret of getting the most out of his ham equipment. His AR-3 receiver and DX-40 transmitter, plus 40- and 15-meter dipoles, have worked 48 states and nine countries in less than five months. Mike hopes to work North Dakota and Alaska before he loses the "N" in his call. If you need Texas, Mike is your man.

Bill Jacobs, WN8AGV/W8AGV, 5990 Glenwood Ave., Boardman, Ohio, says his "poor" record of only 14 states worked in three months is the result of his "poor" antenna, which he did not describe. The equipment in his shack includes a Johnson Adventurer transmitter and a Gonsset G-33 receiver with a Heathkit QF-1 Q-multiplier added. Bill is the president of the Boardman High School Radio Club and is a member of the Twenty Over Nine Radio Club. He sent us one of the club's QSL cards which shows a picture of an S-meter registering "40 db over nine." Apparently we have inflation everywhere. . . . **Sam Davis, KN9HTW**, 1948 William St., Gary, Ind., reports that since he has found out how much more fun and excitement

"G.E. HAM NEWS"

Have you seen the new, enlarged *G.E. Ham News* yet? It comes out bi-monthly, and you can pick up a free copy from your nearest G.E. tube distributor. The January-February issue describes the construction of a bandswitching SSB transceiver and the March-April issue will be a special 16-page DX log issue. If you want to subscribe to the *G.E. Ham News*, it costs \$1.00 a year; make your remittance payable to the General Electric's Receiving Tube Department, 316 tric Company, and mail your order to East Ninth St., Owensboro, Kentucky.

there is in the Novice bands than on 11 meters, his Citizens Band license is lying in a drawer unused. His Heathkit DX-35 transmitter feeds a 40-meter dipole, and he receives on a National NC-109. Sam built the low-pass filter described in the November, 1961, column; it cleared up all his TVI, so he celebrated by working his first WV6 (California). . . . Incidentally, I have been seeing an occasional QSL card on which the sender has pasted his ham call letters over his old CB call letters. Welcome, fellows; the water's fine.

James B. Potter, K3NSW, 225 Woodlyn Ave., Glenside, Pa., modified his old Heathkit DX-20 transmitter so often that he thinks he should call it a home-brew rig; no matter what you call it, its power is still 50 watts. A Hallicrafters S-40 and a Hallicrafters S-53A do the receiving, and a 40-meter dipole 15' high does the radiating. In a year as a Novice and General, Jim has worked 48 states and several countries. He prefers 80- and 40-meter c.w. but sneaks on 10- or 40-meter phone once in a while. On phone, he uses a home-brew modulator, employing a pair of 6L6's. . . . Going to South America, we meet **Orlando Escudero Oliva, CE3OE**, Caja Nacional de Empleados, Publicos y Periodistas, Vice-Presidencia, Santiago, Chile. Orlando uses a Globe Chief transmitter with a screen-grid modulator and is on 15 meters every night (the band is open) with his beam aimed towards the USA. He receives on a Hallicrafters S-40A plus a 1-tube, home-

brew preselector. The beam is a home-constructed, 2-element tri-band.

Norm Villasona, WV6SNJ, and **Jim Villasona, WV6SNK**, 421 Myrtle St., Glendale 3, Calif., father and son, respectively, transmit on a pair of war-surplus ARC-5 transmitters converted for crystal control. They like 80 meters best but go up to 40 meters on occasion to listen for a little DX. They do their listening with a Hammarlund HQ-100 receiver, and a trap dipole antenna is the swinging door through which signals come and go. Between the two of them, Norm and Jim have made about 200 contacts in 2½ months. . . . **Albert E. Marsden, KN1SFY**, 23 Allyn Place, Stamford, Conn., doesn't try to work a lot of different hams. Rather, he likes to make an occasional contact and do a lot of listening on his National NC-109 receiver as he relaxes on the turmoil and confusion of everyday life. Al also likes to build things, as evidenced by his Conelrad monitor, grid-dip oscillator, antenna coupler, and antenna relays which are fabricated from oil-burner controls. The transmitter is a Johnson Adventurer running 50 watts.

That's it until next month. In the meantime, let us hear from you. Remember, if you don't see anything in *Across the Ham Bands* from your state or about your favorite band, it may be because you haven't sent that letter. Write to: Herb S. Brier, W9EGQ, c/o POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana, 73.

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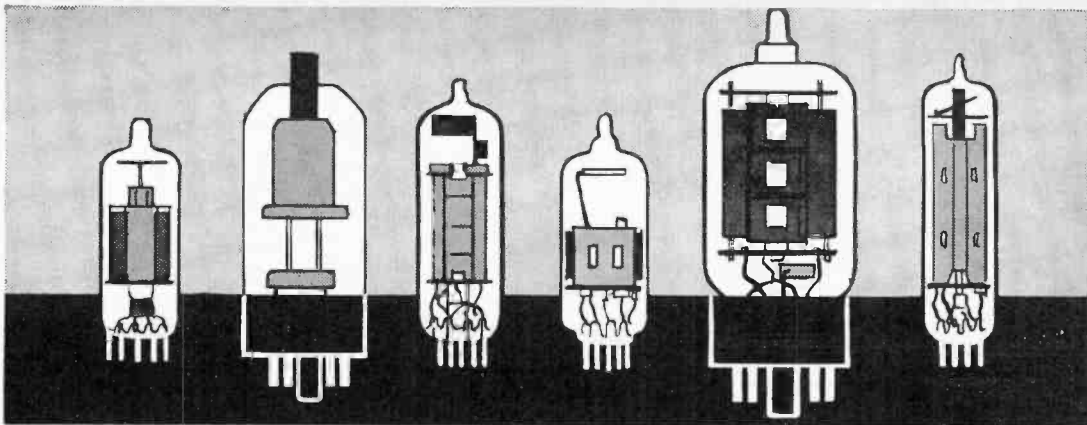
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	1AX2	.62		5CZ5*	.72		6BQ6	1.05		6BQ7	1.00
	1B3	.79		5EA8	.80		6BQ7	1.00		6BS8	.90
	1DN5	.55		5EU8	.80		6BS8	.90		6BU8	.70
	1G3*	.79		5I6	.68		6BU8	.70		6BX7	1.02
	1J3*	.79		5I8	.81		6BX7	1.02		6BY5	1.15
	1K3*	.79		5U4	.60		6BY5	1.15		6BY6	.54
	1R5	.62		5U8	.81		6BY6	.54		6BY8	.66
	1S4	.59		5V3	.90		6BZ6	.55		6BZ7	1.01
	1S5	.51		5V6	.56		6BZ6	.55		6BZ8	1.09
	1T4	.58		5X8	.78		6BZ7	1.01		6C4	.43
	1U4	.57		5Y3	.46		6BZ8	1.09		6CB6	.55
	1U5	.50		6A8G	1.20		6C4	.43		6CD6	1.42
	1X2B	.82		6AB4	.46		6CB6	.55		6CE5*	.57
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	6SJ7	.88		12AZ7	.86		12V6	.53		12W6	.69
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5AS8*	.86	6BD5	1.25	6EB5*	.72
5AT8	.80	6BE6	.55	6EB8	.94
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5BE8	.83	6BG6	1.66	6EU8	.79
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7A8	.68	12C5	.56	19C8	1.14
7AU7	.61	12CN5	.56	19T8	.80
7B6	.69	12CR6	.54	21EX6	1.49
7EY8*	.73	12CU5	.58	25AV5	.83
7F8	.90	12CU6	1.06	25AX4	.70
7N7	.90	12CX6	.54	25BK5	.91
7S7	1.01	12D4*	.69	25BQ6	1.11
7Y4	.69	12DB5	.69	25C5	.53
8AU8	.83	12DE8	.75	25CA5	.59
8AW8	.93	12DL8	.85	25CD6	1.44
8BQ5	.60	12DQ6	1.04	25CU6	1.12
8CG7	.62	12DS7	.79	25DN6	1.11
8CM7	.68	12DT5*	.76	25EH5	.55
8CN7	.97	12DT7*	.79	25L6	.57
8CS7	.74	12DT8*	.79	25W4	.68
8CX8	.93	12DU7	1.01	32ET5	.55
8E88	.94	12DW8*	.89	32L7	.90
8SN7	.66	12ED5	.56	35B5	.60
9CL8	.79	12ED5	.69	35C5	.51
11CY7	.75	12EG6	.54	35L6	.57
12A4	.60	12EK6	.56	35W4	.42
12AB5	.55	12EL6	.50	35Z5	.60
12AC6	.49	12EM6	.79	36AM3*	.36
12AD6	.57	12EN6	.78	50B5	.60
12AE6	.43	12EZ6	.53	50C5	.55
12AE7	.94	12F8	.66	50EH5	.53
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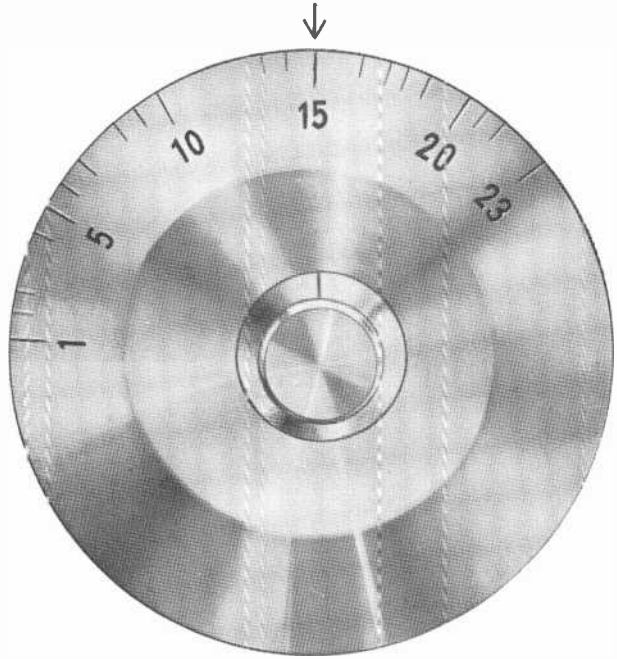
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