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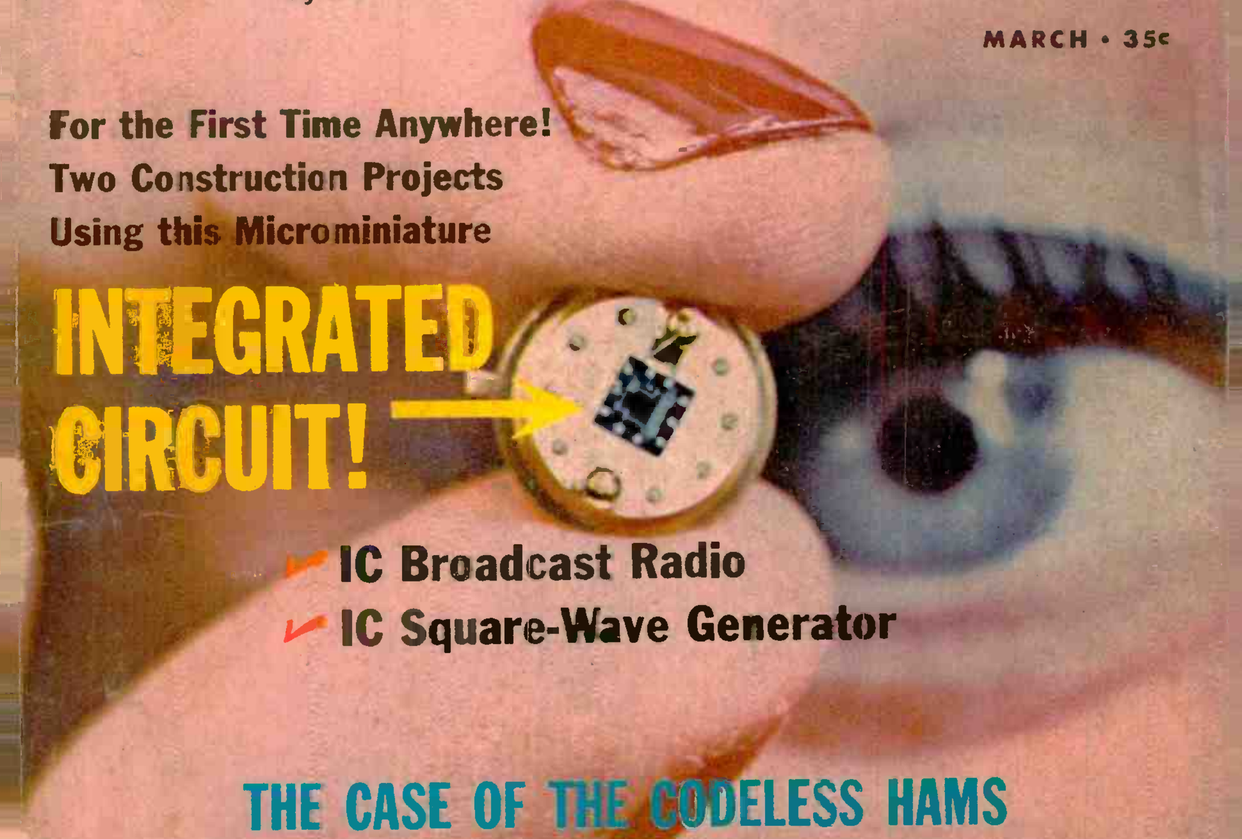

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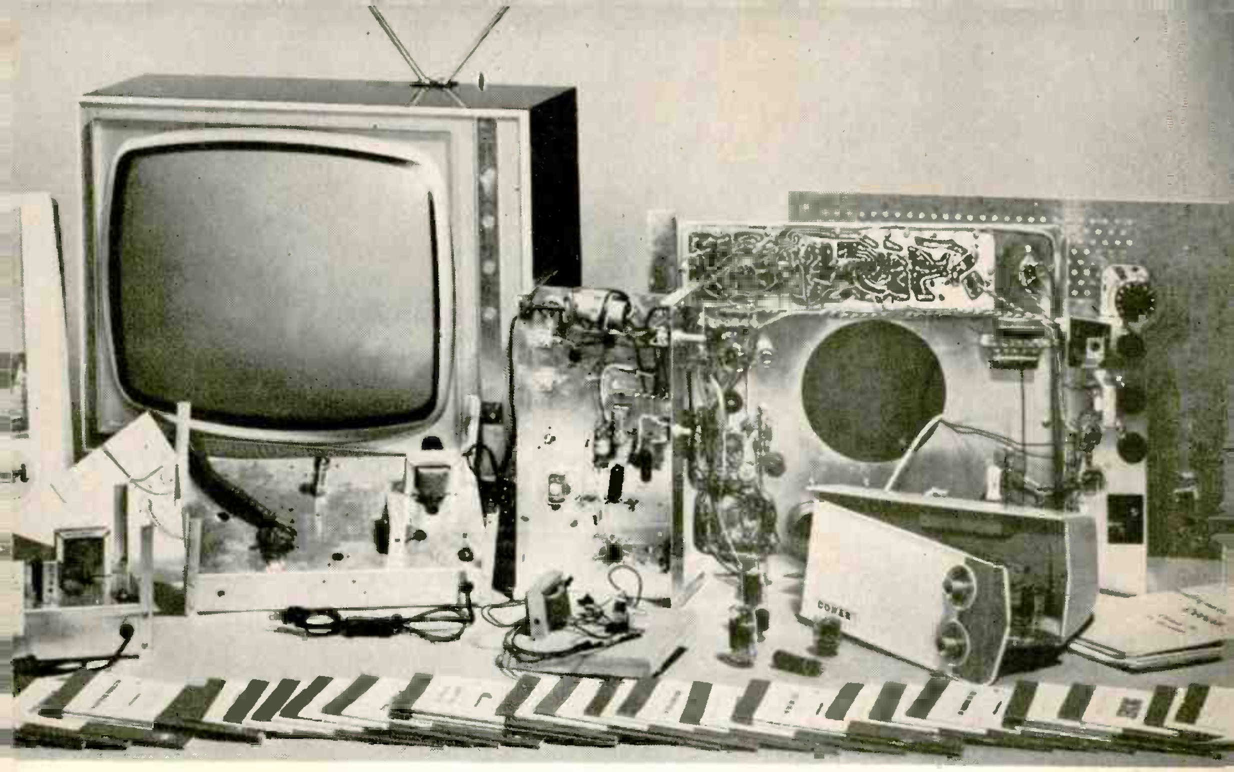

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DON HOUSE, Lubbock, Texas

"Many thanks to NRI for the Electronics training I received. I hold a first class FCC License and am employed as a studio and master control engineer/technician with KXJB-TV."

RONALD L. WOOD, Fargo, N.D.

"I am a Senior Engineering Aide at Litton Systems, in charge of checkout of magnetic recording devices for our computers. Without the help of NRI I would probably still be working in a factory at a lower standard of living."

DAVID F. CONRAD, Reseda, Calif.

"NRI training enabled me to land a very good job as Electronic Technician with the Post Office Dept. I also have a very profitable spare-time business fixing Radios and TV."

NORMAN RALSTON, Cincinnati, Ohio

ELECTRONICS ILLUSTRATED

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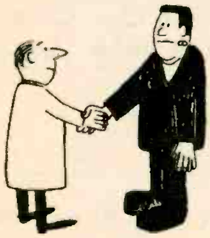
TROUBLE SHOOTING WITH THE SIGNAL TRACER

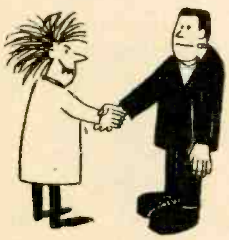
FEEDBACK
from our readers

Write to: Letters Editor, Electronics Illustroted, 67 West 44th Street, New York, N.Y. 10036

● MATCHMAKERS



I would imagine that you get some odd characters together who exchange some rather odd things in the new Swap Shop department you have started. But don't get me wrong. I'm all for it and I'd bet that most of the rest of your readers are, too. Swap Shop strikes one as the closest thing we've had to a real electronics grab-bag since the days when Bobby Baker got wind of hi-fi.



Paul Martinson
Chicago, Ill.

● GOOD PINCH

I enjoyed reading your article, HOW TO PINCH PENNIES ON PARTS, in the November '64 EI. Very interesting. In passing, I would like to mention our new WRL catalog, which is an annual publication and has been considered a good source for ham and CB equipment and parts for nearly 30 years.

Larry B. Meyerson, WØWOX
World Radio Laboratories
Council Bluffs, Iowa

To get a copy, EI readers should write to World Radio Labs, 3415 W. Broadway, Council Bluffs, Iowa 51504. Okay, Larry?

● ONE MAN'S MEAT

You people ought to give instructions on how to build a machine to supply the punch the jokes in your stories aint got (AMATEUR RADIO CONFIDENTIAL, Jan. '65 EI). Untold story, my foot. You should of left it untold.

Pete Mann
New York, N.Y.

● SILENT SINGER?

After suffering several times the frustrating experience of waiting for a DX station to identify, only to have a blast of QRM drown out the signal, I finally discovered the heart of my problem—a next door neighbor's sewing machine! I have heard of cures for birdies from TV sets, but what do you do for the birdies that like to sew?

Thomas Siolek
Brooklyn, N.Y.

That's life, Tom. As she sews, so shall ye weep.

● TYPO

You have an error in your description of our FS-23 CB transceiver in the November '64 EI. The correct price is $299.55.

Sonar Radio Corp.
Brooklyn, N.Y.

● TOUGH STUFF

I can tell you something that hasn't happened to home-study electronics (LOOK WHAT'S HAPPENED TO HOME STUDY ELECTRONICS, Jan. '65 EI) and that's an attention-getter to make you keep your mind on what you're supposed to be studying. Did you ever try to watch TV and study electronics at the same time?

Don Boyle
Chicago, Ill.

What's TV?

[*Continued on page* 8]

FEEDBACK

Continued from page 6

● YUP, BY GEORGE

In that nice, extremely simple circuit for your chicken-corn-fox game (OLD RIDDLE, NEW GAME, Nov. '64 EI), I think you managed to make a wiring error. The lead shown connected to the lower left lug on S3 should be connected to the lower right lug. I won't say anything more.

George Granger
York, Me.

All small favors are appreciated, George.

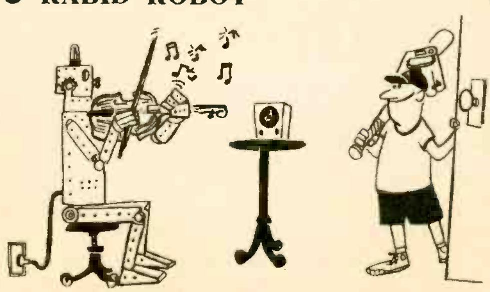
● SOAP OPERA

I am the harried housewife of a hubby whose hobby is electronics. Ironically this seems to have taken the charge out of our marriage (which took place in D.C.). Before your magazine started him building hier fi's, remoter controls and sundry, we were building a family. What I want to know, is: can a girl from a little mining town in the West find happiness as the wife of a . . .

Judith M.
Cleveland, Ohio

Somebody's pulling somebody's . . .

● RABID ROBOT



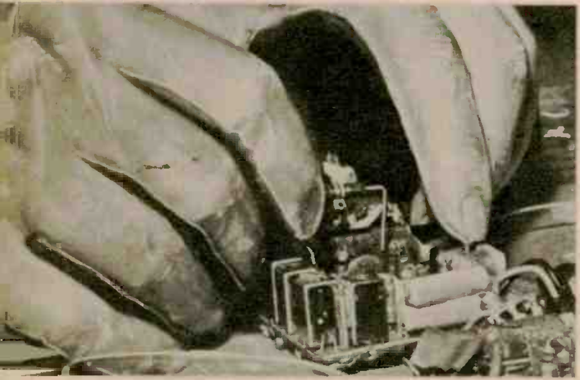
Randy, my robot, has been gathering dust for years but now he's gainfully employed at long last. I'd tried him on my violin practicing before but he had no sense of timing. Your metronome (MODULAR METRONOME, Jan. '65 EI) proved everything Randy needed.

J.P.C.
New Orleans, La.

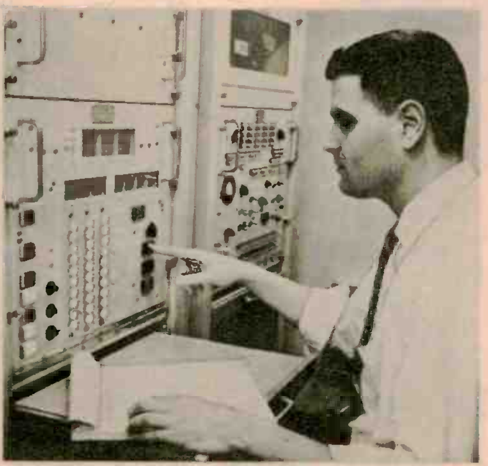
Everything?

PULSING PLASTIC . . . There was a time when anyone who argued that plastics could be made to conduct would have been suspect as a nut. But a plastic that conducts is just what is being held in the photo by a scientist at GE's Research Lab. The new material will require some additional research before it becomes available commercially but the groundwork seems to have been completed. And so, some day you may be reading about chassis that are hand-plasticized, and the hand-wired claim will be old-fashioned.

...electronics in the news



Skinless Grip . . . Handling modern electronic components demands a mighty light touch, and a dirt-, dust- and moisture-free one at that. One answer to the problem is some nifty mitts that well might be considered the counterpart of the rubber gloves surgeons wear. Developed by Plasticsmith, Inc., the gloves permit workers to retain the sensitivity of touch required for maximum manual dexterity. Simultaneously, they provide a barrier against moisture, dust and grit, not to mention chemicals and solvents. With such gloves available in a variety of special weights and materials, it looks as though electronics labs now can hold their own against most any hospital.



Robot Doc . . . Getting ready to give the U.S. Air Force's airborne equipment a head-to-toe checkup is this new digital diagnostician. A veritable electronic medic, the device can make up to 1,000 tests a second, tell an attendant what ails a complex system and even diagnose its own ills. Heart of the installation is a digital computer which draws from a memorized repertoire of more than 500 different instructions. Sperry, the manufacturer, says that the MSM-42 also can be adapted for use in large repair installations or on automated production lines.

...electronics in the news

Musical Modulator . . . Slower than a wink, the world's largest electronic tuning fork oscillates a mere two times per second.

Though the pretty miss in our photo seems to be having trouble synchronizing her winkens and blinkens, there's little cause for concern. The gadget is a model of other units made by Bulova to chop laser beams.

Super Solid-Stater . . . Looming above the man in our photo is one of three gigantic rectifiers now in operation for Project Haystack. Developed by Energy Systems, Inc., the rectifiers contain a total of 4,608 solid-

state diodes and will be used to fire up a 1-million-watt transmitter in the Haystack Facility. MIT Lincoln Laboratory currently is operating the Haystack Facility for the U.S. Air Force.

...electronics in the news

Instant Repair . . . Though it looks like a conventional ophthalmoscope, this compact device is designed to spot-weld damaged

eyes with an intense beam of laser light. Heart of the instrument is a ruby rod which is pumped to produce bursts of deep red light. A prototype is in use at the famed Mayo Clinic in Rochester, Minn.

Parabola Plus . . . Parabolas may be easy to draw with thread, pins and graph paper, but producing a true parabola to serve as an antenna reflector is a mule of a different molecular structure. Yet the Marconi Company has done just that, forming a surface that departs only 0.03 in. r.m.s. from true paraboloid. Our photo shows one of the antennas on test at the company's testing ground near Chelmsford, Eng.

Results of the tests have led Marconi engineers to conclude that the new resin bonded glass fiber reflectors achieve front-to-back ratios in excess of 65db at frequencies as high as 4,000 mc. Result is that transmitters used with such antennas should radiate practically all of their power in the forward direction.

BROADSIDES

Pamphlets, booklets, flyers, application notes and bulletins available free or at low cost.

For hobbyists who want to find out more about **negative-resistance diodes,** a four-page brochure gives theory of operation as well as descriptions of 24 circuits using the devices. Request your free copy of bulletin E-505 from ITT Semiconductors Inc., 500 Broadway, Lawrence, Mass. 01840.

When it comes to selecting hi-fi/stereo **speakers and earphones,** Jensen's new 24-page catalog may be right down your alley. The booklet offers useful hints for choosing a system to fit your needs and even includes data on designing your own enclosures. Ask for catalog 165-K from the Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago, Ill. 60638.

Anyone who wants to learn more about **thermistors** and their uses should get ahold of Capsule Thermistor Course #9. Copies are available from Fenwal Electronics, Inc., 63 Fountain St., Framingham, Mass. 01701.

Knowing as much as you can about **magnetic tape** is about the only way to select the exact tape you need. Bulletin RS-64-18 describes over twenty of tape's electromagnetic and physical properties in some six pages. A copy can be yours for the asking from Reeves Soundcraft, Great Pasture Rd., Danbury, Conn. 06810.

Going portable can be easy with the right battery. And bulletin GEA-7678 gives electrical ratings and physical dimensions for seven types of **nickel-cadmium batteries.** Ask for your copy from General Electric Co., 1 River Rd., Schenectady, N.Y. 12305.

Dozens of **electronic projects** are listed in a 28-page catalog from Parks Lab. Grouped according to degree of difficulty and design type (i.e., vacuum-tube, solid-state or electromechanical), the projects described can be built from the circuit diagrams, parts lists and notes the company will supply. Prices for such literature range from $1 up, depending on the complexity of the project. Catalog No. 8 itself costs 25 cents (refunded with your first order) and can be obtained from the Henry Francis Parks Laboratory, Box 1665, Seattle, Wash. 98125.

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ELECTRONIC MARKETPLACE

HIGH FLIER . . . In the air or on the ground, this three-band transistor portable is all it takes to keep in tune with

weather reports, aircraft and control towers or standard broadcast stations. Tuning VHF (108-136 mc), LF (200-400 kc), as well as the BCB, the Scot Air is powered by eight flashlight batteries housed in a leakproof compartment. $89.95, less batteries. Scot Air, Inc., 6451 Main St., Morton Grove, Ill. 60053.

Even Steven . . . More power with no more watts is the promise of Galaxy's compression amplifier, adaptable to SSB and AM transmitters alike. Microphone outputs up to 10

mv are amplified 10db, while strong peaks up to 1.8 V are compressed 20db. Result is greater voice power and increased transmitter range. The unit is powered by a 9-V battery. $24.95. Galaxy Electronics, 10 S. 34th St., Council Bluffs, Iowa 51501.

MARKETPLACE

Home-Base TV . . . No more can you blame the networks for dull TV programs. Wire the Model TV-110 camera to your television set, and the picture on the screen is one you yourself are responsible for. The transistor-

ized CCTV rig operates on standard 117 VAC and is small enough to be carried most anywhere. It offers a 4-mc frequency response and a composite video output of 1 V PEP. $299.98. Olson Electronics, Inc., 260 S. Forge St., Akron, Ohio 44308.

Signal Crazy . . . Just about any signal you'd want for servicing can be yours with the Model 1500 signal generator. Seven overlapping bands cover the range from 115 kc

to 110 mc and you can convert the generator's sine-wave RF output to 400-cycle AM at the flick of a switch. Housed in a metal case, the 1500 is line-isolated and thus safe to use with any type of equipment. $37.50. Mercury Electronics Corp., 111 Roosevelt Ave., Mineola, N.Y. 11501.

MARKETPLACE

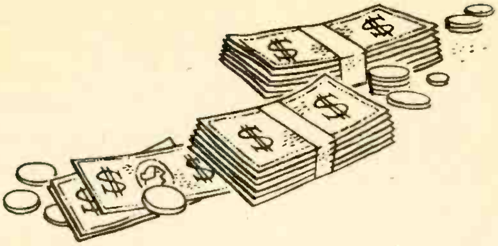
Multibutton Multimeter . . . Push-button switching and a double-jeweled meter movement are two reasons why the MPB-420 is a multimeter with a difference. The 6 x 4¼ x

2 in. VOM measures AC and DC voltages to 1,000 V; DC currents to 250 ma.; resistances to 10 megs; decibels from —10 to +62. Test leads and batteries are supplied. $23.95. Inter-Tech Instruments Corp., 125-08 84th Ave., Kew Gardens, N.Y. 11415.

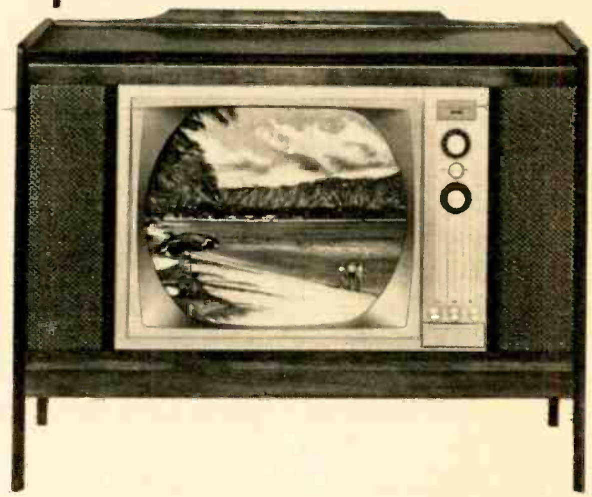
Tri-Tipper . . . Resistors, heavy wires or copper pipes are all the same to the new Model 450 soldering gun. Because of its special design, the gun delivers heats from 25

to 450 watts, depending on which of three tips you've chosen. The gun also features a focused spotlight to illuminate the work area. $13.95. Wen Products, Inc., 5810 Northwest Hwy., Chicago, Ill. 60631.

Regardless of what you pay for other Color TV



it can't perform as well as this one...



and yet a Heathkit® set costs as little as $399!

Exclusive Heath Features For Unequalled Performance! That's right. No matter how many of your hard-earned dollars you pay for another brand of color TV, *none* can equal the performance of the Heathkit All-Channel, High Fidelity 21" Color TV! Why? *All* color sets require minor periodic adjustments to maintain peak picture performance. The Heathkit GR-53A is the *only* set with a "built-in service center" that provides facilities for perfect picture adjustments. Heath's simple-to-follow instructions and detailed color photos show you exactly what to look for and how to achieve it . . . quickly, easily! You become the expert! Results? Beautiful, true-to-life color pictures day in and day out . . . and *no* costly color TV service calls for simple picture alignment.

But don't take our word for it. See the special articles on the Heathkit GR-53A in the May issue of **Popular Electronics,** June issue of **Radio-TV Experimenter,** February issue of **Popular Mechanics,** April issue of **Science & Mechanics,** and the August issue of **Radio-Electronics.**

Then tear out the coupon and order yours now!

Kit GR-53A, chassis, tubes, mask, VHF & UHF tuners, mounting kit, speaker, 127 lbs. $399.00

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MINNEAPOLIS-HONEYWELL 24-channel recorder, other items. Want FM tuner, CB or ham equipment. John M. Hicks, 1136 Margray St., Pittsburgh, Pa. 15207.

KNIGHT T-50 transmitter, other equipment. Make swap offer. William Ringleben, 305 E. Elm St., Hazleton, Pa. 18201.

RADIO PHYSICS COURSE by Ghirardi, dated 1932. Will trade for 4-section, 365-mmf variable capacitor (not miniature). Jakob DeHaan, 5814 Sagewood Dr., Murray, Utah. 84647.

BC-654 TRANSCEIVER, other surplus items. Will swap for ham gear. Tom Woods, 6203 Jessamine St., Apt. 209, Houston, Tex. 77000.

VENUS R/C transmitter, other equipment. Need ham gear. Alan S. Owens, 1859 Country Club Rd., Ann Arbor, Mich. 48105.

TWO-METER TRANSMITTER, other ham gear. Make swap offer. Jim Strayhorn, 290 Fraser St., Smyrna, Ga. 30080.

EUROPEAN TUBES with sockets. Want tube tester. Jack Silverberg, 737A De L'Epee Ave., Montreal 8, Que.

HAM TRANSMITTER, home brew. Will trade for CB transceiver. Robert E. France, 16247 Denley St., Hacienda Hts., Calif. 91745.

EICO 368 TV-FM sweep and marker generator and 315 signal generator. Make swap offer. Robert J. Bloete, 2236 29th St. S.W., Calgary, Alta.

AIRCRAFT TRANSMITTER, less tubes and power supply. Will exchange for two CB walkie-talkies. C. Olsen, 3240 Metropolitan Way, Salt Lake City, Utah. 84109.

EICO HFT-94 AM tuner. Will swap for square/sine-wave generator. Mack Owen, 206 Barron Ave., Thomaston, Ga. 30286.

HEATH RF signal generator. Want signal tracer, wide-band scope or color-bar generator. Floy J. Fein, Box 72, Hopedale, Ill. 61747.

WURLITZER piano accordion, other items. Want Hallicrafters or National SW receiver. William Wozniak, Sr., 5315 Daley Pl., Gary, Ind. 46403.

CB PREAMPLIFIER. Will swap for transistor preamp or radio handbook. Don Memberg, 678 W. Milton Ave., Rahway, N.J. 07065.

OLD TUBES: 26's, 71A's, others. Make swap offer. Ira Stoler, 729 Ave. T, Brooklyn, N.Y. 11223.

HEATHKIT HW-30 transceiver. Will trade for Knight-Kit KG-250 amplifier. Ronald L. Sutherland, Rte. 3, Windsor, Mo. 65360.

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[*Continued on page* 26]

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ELECTRONIC SWAP SHOP

Continued from page 24

transistor checker. Want audio sine- or square-wave generator. Jay Smith, 5452 W. Augusta Blvd., Chicago, Ill. 60651.

KNIGHT Star Roamer receiver. Will trade for Lafayette HE-80 or Knight R-55A receiver. Thomas Kooch, Carolyn Dr., Jefferson City, Tenn. 37760.

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HALLICRAFTERS S-107 receiver, also 3-6 mc receiver. Will trade for CB transceiver. Marty Kugelman, 2084 E. 5th St., Brooklyn, N.Y. 11223.

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NATIONAL electric Hawaiian guitar. Want CB base or mobile unit. Don Ramsey, 508 Edmond Dr., Dyer, Ind. 46311.

BC-696 RECEIVER. Will trade for Tesla-coil transformer. Stephen Weatherspoon, Rte. 2, Centerville, Tenn. 37033.

CLEGG 6-Meter Transceiver, Sony 464CS four-track stereo tape deck, other equipment. Will swap for either Viking Ranger II transmitter or Hammarlund HQ-110 receiver. Michael Bender, 61 Millrock Rd., New Paltz, N.Y. 12561.

BC-348-Q SW RECEIVER. Will exchange for CB transceiver. Chris Ross, 151 W. Hopson St., Bad Axe, Mich. 48413.

KNIGHT T-50 ham transmitter. Want CB or test equipment. L. D. Bunch, Rte. 2, Wilder, Idaho 83676.

KNIGHT R-100A communications receiver. Will trade for CB transceiver or test equipment. Dave Sprague, 1075 Stewart, Reno, Nev. 89502.

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KNIGHT Space Spanner with case, Heath MW-33 CB transceiver, other items. Want ham or SWL gear. Harold H. Blesy, 1918 W. Wolfram St., Chicago, Ill. 60657.

HALLICRAFTERS S-119 SW receiver. Want Novice transmitter. Carl S. Nutty, 1634 Georgia, Connersville, Ind. 47331.

HALLICRAFTERS SX-140 receiver. Will swap for CB transceiver or walkie-talkies. L. R. Scott, Rte. 3, Box 343, Saraland, Ala. 36571.

DEVRY 5-in. oscilloscope. Would like flyback tester, CRT checker or intercom. Darian Gray, Box 51, Cambridge, N.Y. 12816.

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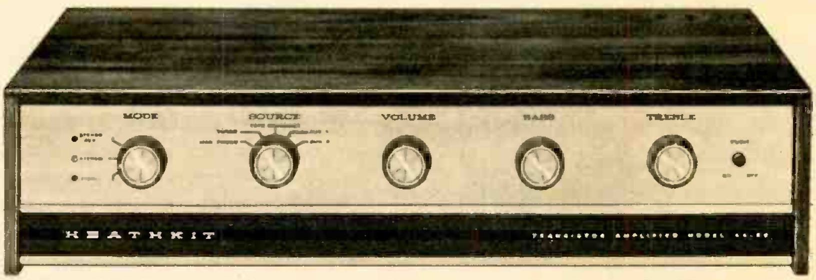

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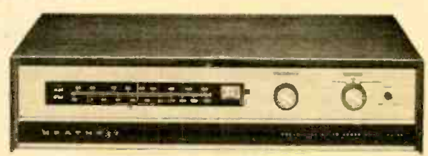

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ELECTRONICS ILLUSTRATED
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By FRED B. MAYNARD, 11Q0846
Motorola Semiconductor Products, Inc.

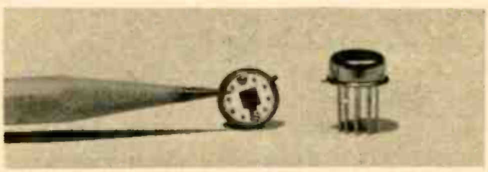
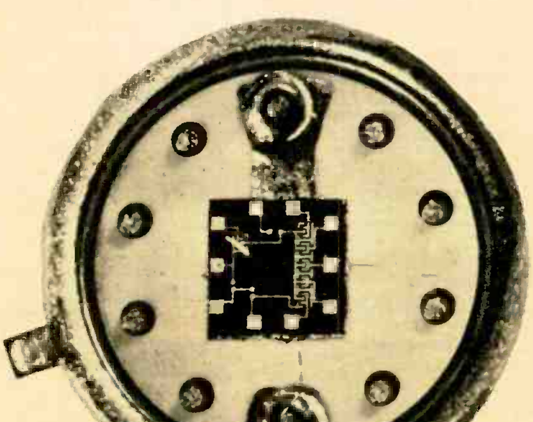


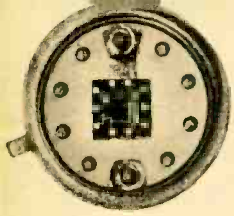
Fig. 1—A typical Motorola integrated circuit is shown actual size above. The diameter of the cover is about 5/16 inch. The chip in the center, which is shown in greater detail below, is about 1/10-inch square. In the MC356G IC we use, the chip contains six transistors and eight resistors.



A NEW electronics technology has taken shape in the last two or three years, centering on the concept of extreme miniaturization and the development of the integrated circuit. The IC is fast becoming as important to electronics as was the introduction of the vacuum tube and the transistor. Integrated circuits make it possible to reduce the size and weight of electronic equipment to the proportions of a gnat and, in the long run, they will reduce equipment prices to a drastic degree.

IC prices already have fallen to the point where hobbyists now can afford to use them for experimental projects. Ten different inexpensive Motorola IC's are on the market and are available from electronics parts distributors. The cheapest is $2.45 for a quantity of one.

Almost all of them are in the logic class. That is, they are special circuits designed to build up logic systems of all kinds. An example of such a system is a high-speed digital computer which may contain thousands of IC's.



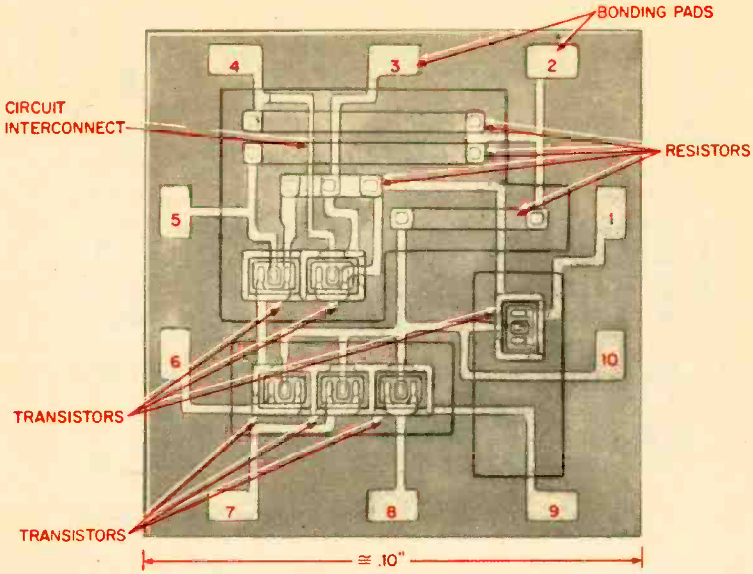


Fig 2—Take a chip like the one shown in Fig. 1, put it under a microscope and you will see all the components of the IC. This is the MC356G, the complete schematic of which is shown in black in Fig. 4.

To get another idea of how IC's can save space, consider an ordinary five-tube AC/DC radio. It contains about six basic circuits composed of 20 to 30 components.

Take a look at Fig. 1. The top photo shows the actual size of open and enclosed IC's. The enlargement below shows greater detail of the IC chip and its mounting. Now, take a look at Fig. 2, a detailed enlargement of the $3.55 IC we use in our projects. Though not much larger than the head of a match, this 1/10-inch square contains eight transistors and four resistors.

And this isn't the limit to the number of parts that can be put on a single chip. The day soon will be here when one or two IC's will constitute a complete radio that is equivalent in performance to that five-tube AC/DC job.

How is an IC made? It all starts out with a conventional schematic of a circuit. An example of this is the schematic of a Motorola MC356G three-input logic gate shown in black in Fig. 4 (this is the IC we use in our square-wave generator and radio).

In the next step all the components in the schematic are rearranged mechanically so that connections can be made to them from the pins on the header. The photo at the bottom of Fig. 1 gives you a clearer idea of this. (Not all leads are connected to the chip.) The rearrangement of the components in the schematic of Fig. 4 is shown in Fig. 2.

Actually, this mechanical layout of components starts out as a drawing about 2 feet square. Next, a series of large masks, or overlays, are made. The masks and overlays are then optically reduced in size for use in the manufacturing steps that include etching, diffusion, metallization and oxidation.

The IC chip, which is about 6/1,000 of an inch thick, is then cut from a larger sheet and mounted on what is called a header. Short wires are connected from the header pins to the circuit elements on the chip. Lastly, the IC is sealed hermetically and subjected to several tests.

The finished IC may contain several transistors, resistors, diodes, zener diodes and capacitors. The finished unit is shown at the top, right in Fig. 1 and is somewhat smaller than a TO-5-size transistor.

Let's get to the square-wave generator project now to see what one of these mighty midgets can do. After that we'll build a broadcast radio.

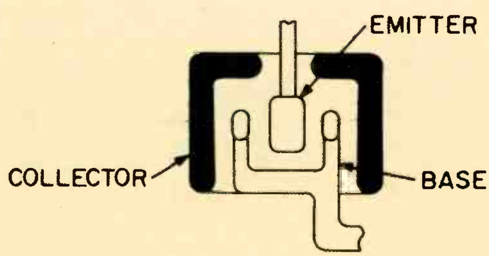
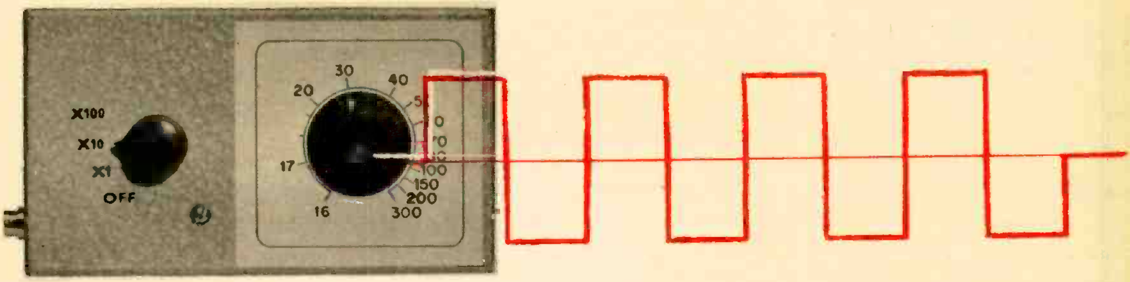


Fig. 3—Enlarged drawing of one of the transistors in Fig. 2 shows arrangement of the elements.



IC SQUARE-WAVE GENERATOR

THE circuit in Fig. 4 shows a square-wave generator that is useful for audio testing, as a musical-tone generator or as a code-practice oscillator. The black schematic is of the MC356G IC. The schematic in color is what we added to make the generator. The frequency range is about 16 cps to 30 kc. Peak-to-peak output is about 0.8 V.

But first, let's examine the MC356G IC which is shown in black in Fig. 4. The circuit contains three paralleled input transistors, Q1,Q2 and Q3; a common-emitter amplifier stage, Q4; and two output emitter-followers, Q5 and Q6. The IC was designed for OR-NOR logic functions, but it easily can be converted into an amplifier.

Now look at Fig. 5, a simplified schematic (black) showing only those parts of the MC356G IC that are used for the square-wave generator. Notice that we use only transistors Q1, Q4 and Q6. Q1 is an emitter-follower which drives the emitter of Q4 through unbypassed common-emitter coupling resistor Re. Q4 is a grounded-base voltage amplifier stage which provides amplification across its collector load resistor, RC2. Q6, an emitter-follower, is driven directly from the collector of Q4.

The positive-feedback loop which produces oscillation is composed of either C2,C3 or C4; R1 and R2. The bases of Q1 and Q4 are biased at an intermediate level with respect to the positive and negative power supply levels.

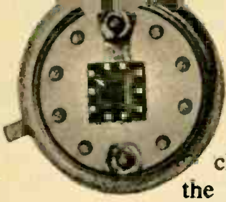
Positive feedback, which produces oscillation, is obtained in this circuit in much the same manner as in more conventional transistor and vacuum-tube amplifiers. In this circuit, the input and output happen to be in phase. Let's see why.

Look at the circuit shown in black in Fig. 5 as a straight amplifier. A positive-going signal at the base of transistor Q1 produces a positive-going signal at its emitter. Since Q1's emitter is connected directly to Q4's emitter, the signal at Q4's emitter also will be positive-going. Now, a positive-going signal at Q4's emitter is equivalent to a negative-going signal at its base, which is at AC ground. And if you apply a negative-going signal to the base of a transistor in a common-emitter configuration, the signal at the collector will be inverted, or positive-going. Therefore, the positive-going signal at Q4's emitter produces a positive-going signal at Q4's collector. Still with us? Okay, let's go on.

The positive-going signal at Q4's collector is direct-coupled to the base of Q6. Since Q6 is an emitter-follower, the signal at its emitter will be positive-going—just as it was at the base of Q1. The signal at pin 4 of Q6, the emitter, is fed back through either C2, C3 or C4 and C1 to the base of Q1. This positive feedback sustains oscillation.

When power is applied to the circuit, either C2, C3, or C4 (depending on which is selected by S1) begins to charge. The charging path is from the positive side of B1 through R1, R2, C2,C3 or C4, Ro,Re, R4 and ground. When the voltage on Q1's base reaches a certain level, Q1 switches on very rapidly and conducts heavily. Because of the fast response time of Q1 and Q4, and what is called a toggle effect that occurs in the conductance state, a complete square wave is produced, C2,C3 or C4 discharges and the cycle repeats.

The oscillation frequency of the circuit is controlled by R1 and either C2,C3 or C4. However, the frequency is also affected somewhat by shunt resistance within the IC. And



because of interaction between components on the chip, there will be a slight tilt to the square wave. However, this is not serious for routine servicing of audio equipment.

Variable resistor R1 controls the basic frequency of oscillation. Capacitors C2, C3 and C4 are decade multiplers of the fundamental oscillation frequency. That is, set S1 to the ×1 position and you will generate a fundamental frequency. Set S1 to ×10 and the output frequency will be multiplied by 10.

Construction

You can use just about any layout and cabinet you want for the generator. Placement of parts isn't critical and performance won't be affected if you build your model differently from ours.

Our model, as you can see in Figs. 5 and 6, is built in a 5¼x3x2⅛-inch Minibox. We mounted the IC socket and R6 on a small piece of perforated board and used flea clips for tie points. Note in the pictorial that we used two selected parallel-connected capacitors for C3. Reason for this was so the capacitance C3 would be exactly 1/10 the capacitance of C4. If the values C2,C3 and C4 are not related to each other by an exact multiple of 10, decading will not be accurate. That is, if S1 is set to ×1 and R1 set for say 100 cps, setting switch S1 to ×10 may not produce an output that is exactly 1,000 cps. The closer the values of C2,C3 and C4 to what we specify, the greater the accuracy.

PARTS LIST

B1—Five 1.5-volt penlite cells
C1—25 mf, 25 V electrolytic capacitor
C2—.05 mf, 75 V or higher ceramic disc capacitor
C3—.5 mf, 75 V or higher ceramic disc capacitor
C4—5 mf, 12 V electrolytic capacitor
C5—50 mf, 15 V electrolytic capacitor
IC—Motorola integrated circuit type MC356G. Allied Radio Industrial catalog No. 650, pg. 15. $3.55 plus postage.
J1—Phono jack
R1—15,000-ohm potentiometer
R2—200 ohm, ½ watt, 5% resistor
R3—56,000 ohm, ½ watt, 10% resistor
R4—4,700 ohm, ½ watt, 10% resistor
R5—1,000 ohm, ½ watt, 10% resistor
R6—5,000 ohm, subminiature variable resistor (Lafayette 99 G 6143)
S1—Two-pole, five-position rotary switch (Lafayette 99 G 6164)
Misc.—Integrated-circuit socket: Cinch-Jones 10-ICS (Allied Industrial Catalog Stock No. 40 H 195. 65¢ plus postage), 5¼x3x2⅛-inch Minibox, battery holder, perforated board, flea clips

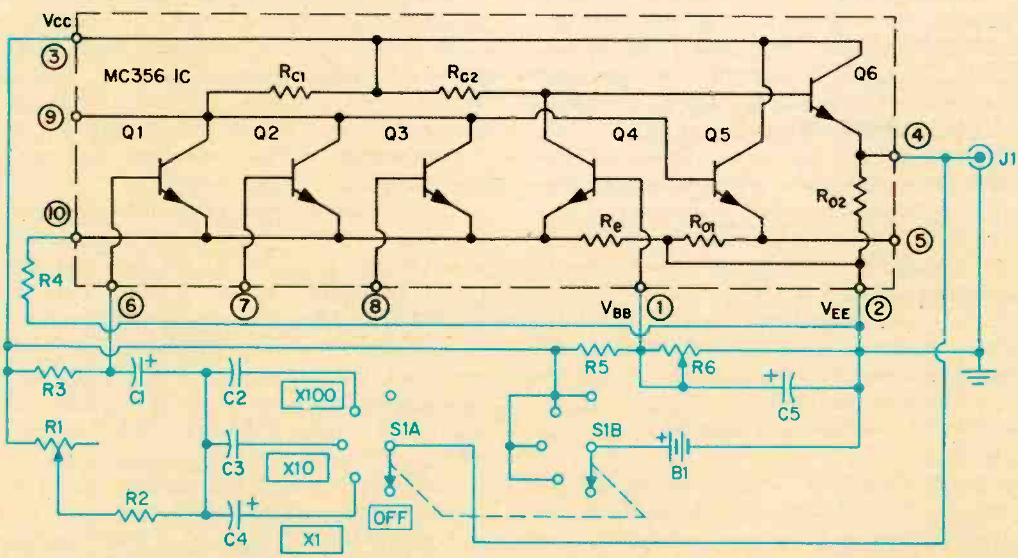


Fig. 4—The schematic in black is of the MC356G IC. The schematic in color is what we added to make a square-wave generator out of the unit. Q1, Q2 and Q3 are parallel-connected input transistors and are all emitter-coupled to transistor Q4. Transistors Q5 and Q6 are the IC's output emitter-followers.

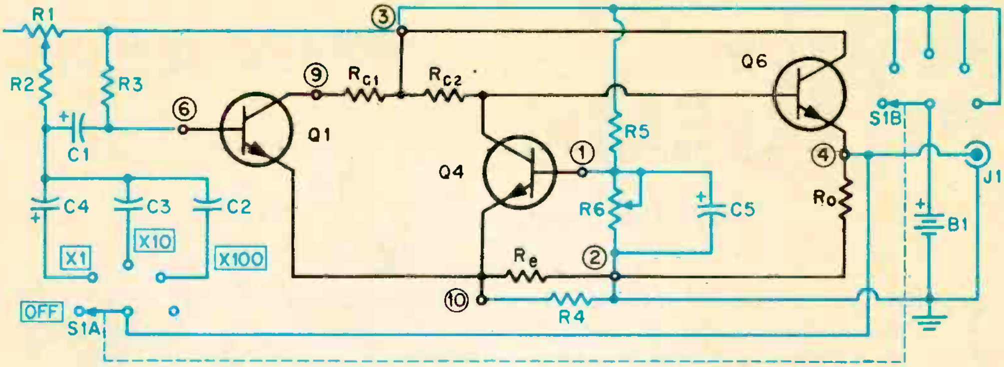
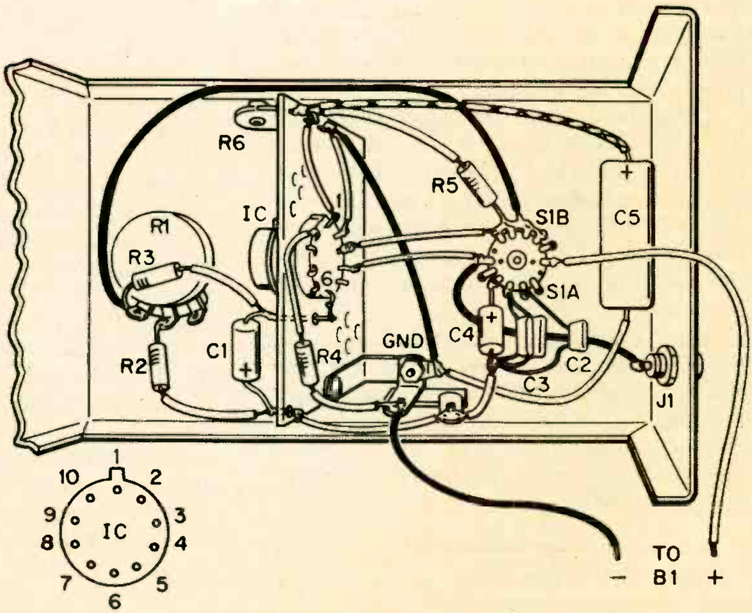


Fig. 5—Only the elements of the IC we used for the square-wave generator are shown (black) above. Charging path for capacitors in R-C timing circuit is from B1 through R1; R2; C2, C3 or C4; Ro; Re and R4 to ground. Positive feeding back path is from emitter of Q4 back through C2, C3, or C4 to the base of Q1. Construction is easy in the size box we specify. Mount the IC socket on a piece of perforated board as shown. Five penlite batteries are mounted in holders on rear of Minibox.



Calibration

After the wiring has been checked, turn on power. Observe the waveform with S1 set to ×10 and R1 set to mid position. Then adjust R6 until the square wave is perfectly symmetrical. That is, the width of the upper or lower portion of the waveform should be the same as the distance between two upper or lower waveforms.

The waveform should have perfectly vertical sides and will have small amount of tilt at the top and the bottom. That is, the top of the square wave will gradually slope down to the right. One of the best ways to calibrate the generator's dial is with a calibrated oscillator and an oscilloscope. The technique requires that you feed the output of our oscillator to the scope's vertical input and the output of the other oscillator to the scope's horizontal input. Then, by using Lissajous patterns, it's easy to determine when both oscillators' frequencies are the same.

Or, you can feed the oscillator's output to an earphone or amplifier and compare the tone with different notes on a piano or organ.

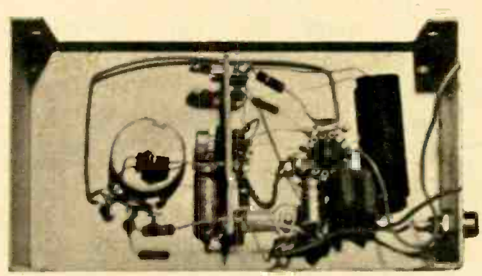
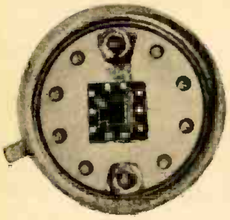
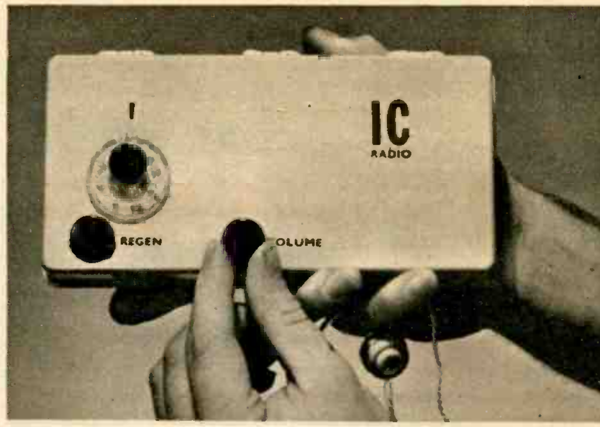


Fig. 6—We allowed ourselves plenty of room but you could build the generator in a smaller cabinet.



IC RADIO

By HARRY KOLBE



ALTHOUGH the Motorola MC356G integrated circuit is designed primarily for use in computers, it also is possible to build a broadcast radio with the component. The project is an interesting one and lends itself well to the advanced hobbyist/experimenter who likes to modify circuits to improve their performance.

There are problems in designing and building a radio with an IC. The headaches are caused by the close proximity of the transistors and resistors on the IC chip. This unavoidable togetherness produces undesirable leakage paths between circuit elements that are operating at both radio and audio frequencies.

After several experimental designs, we hit upon one that has a decent amount of sensitivity, selectivity and audio output. Compromises had to be made, of course. But the finished product does work and offers you the opportunity to dig into the circuit to soup things up a little.

How the Radio Works

Take a look at Fig. 7. The part of the schematic in black is the portion of the IC we used for the radio. The section of the schematic in color is what we added. Circled numbers identify the IC pins to which external connections are made.

The signals picked up by the ferrite loopstick antenna (L2) are tuned by variable capacitor C2. The loopstick we used will pick up enough signal for satisfactory reception if you live in a strong-signal area. However, if signals are weak, connect a long-wire antenna to J1 to improve reception.

If the antenna is too long, the signal fed to transistor Q4 will be excessive and Q4 will be overloaded. This will cause crossmodulation and will result in the stations being spread out over wide sections of the dial. If this happens try shorter antennas for best, or compromise, performance.

The selected signal is then fed to the base of transistor Q4. Resistors R2 and R3 establish Q4's bias. Resistor RC2 (approximately 300 ohms) is Q4's collector resistor and is part of the integrated circuit. The signal is amplified by Q4 and direct coupled to transistor Q6. Transistor Q6 is an emitter-follower (unavoidably), therefore the signal at its built-in emitter resistor (RO2, pin 4) is not amplified.

The RF signal at pin 4 is fed to a voltage-doubler detector consisting of diodes D1 and D2. The RF signal is also fed back through C3 and regeneration control R1 to tickler coil L1 to produce added gain and selectivity. L1 is wound over one end of the ferrite loopstick as shown in Fig. 9.

The audio signal produced by diodes D1 and D2 is fed back to Q4 which operates as a reflexed amplifier. That is, Q4 is both an RF and AF amplifier. The audio signal is now amplified by Q4 and direct coupled to Q6, which is also a reflexed stage.

Audio at Q6's emitter is coupled by RF choke L3 to volume control R4. The audio signal then goes through C6 to the base of audio amplifier Q3. Resistors R5 and R6 establish Q3's bias. Resistor RC1 is Q3's collector resistor and is part of the IC. Capacitor C7 bypasses stray RF on the IC chip to ground.

The amplified audio at Q3's collector is direct coupled to the base of transistor Q5—also an emitter follower. Capacitors C8 and C10 bypass stray RF to ground. The audio output at Q5's emitter (pin 5) is coupled by C9 to phone jack J2.

Construction

Even though the IC contains four of the transistors and resistors that are used in the

[*Continued on page* 38]

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Safety Engineering Tech.
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Petroleum Production
Petroleum Production Engineering
Petroleum Refinery Oper.
Pipeline Engineering

PLASTICS
Plastics Technician

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Air Conditioning Maint.
Domestic Heating with Oil & Gas
Domestic Refrigeration
Gas Fitting
Heating
Heating & Air Conditioning with Drawing
Plumbing
Plumbing & Heating
Plumbing & Heating Contractor
Plumbing & Heating Estimator
Practical Plumbing
Refrigeration
Refrigeration & Air Conditioning
Steam Fitting

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Paper Making
Pulp Making
Pulp & Paper Engineering
Pulp & Paper Making

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Creative Salesmanship
Real Estate Salesmanship
Sales Management
Salesmanship
Salesmanship & Sales Management

SECRETARIAL
Clerk-Typist
Commercial
Legal Secretary
Medical Secretary
Professional Secretary
Shorthand
Stenographic
Typewriting

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Drill Operator
Foundry Practice
Industrial Metallurgy
Lathe Operator
Machine Shop Inspection
Machine Shop Practice
Machine Shop Practice & Toolmaking
Metallurgical Engineering Technology
Milling Machine Operator
Patternmaking
Practical Millwrighting
Reading Shop Prints
Rigging
Tool Engineering Techn'gy
Tool Grinder
Toolmaking
Turret Lathe Operator
Welding Engineering Tech.
Welding Processes

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Industrial Building Engineer
Power Plant Engineering
Stationary Diesel Engines
Stationary Fireman
Stationary Steam Eng.

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Dyeing & Finishing
Loom Fixing
Spinning
Textile Designing
Textile Technology
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Warping and Weaving
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Motor Traffic Management
Railway Rate Clerk
Traffic Management

TV-RADIO-ELECTRONICS
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Electronic Fundamentals (Programmed)
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Radio Servicing with Radio Equipment Training
Radio & TV Servicing
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Sound Systems Specialist
Telephony, Electronics and Radio Communications
TV Receiver Servicing
TV Technician

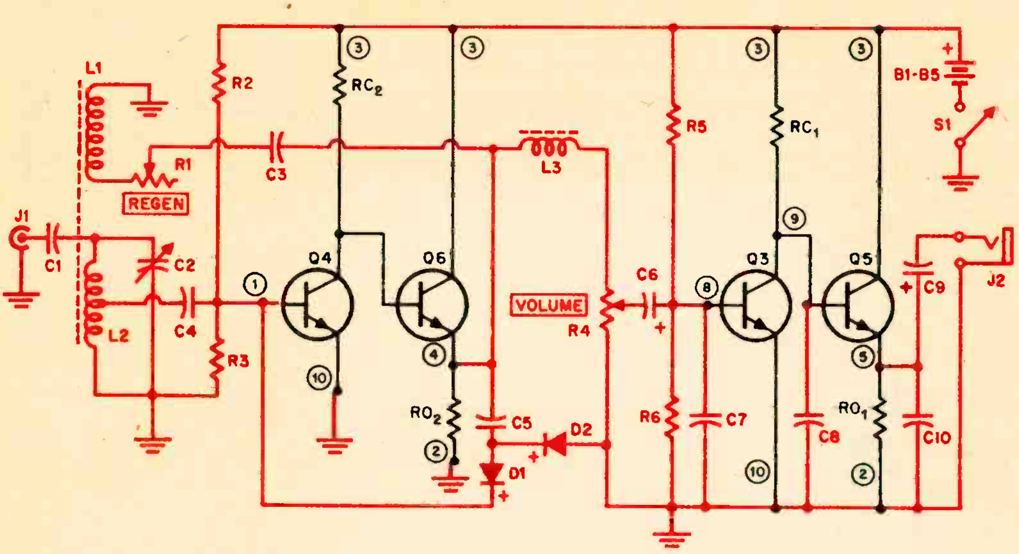


Fig. 7—Signals picked up by loopstick L2 are tuned by C2 and fed to Q4, which is direct coupled to Q6. RF is fed to voltage-doubler detector (D1, D2) and to regeneration coil L1. Audio from D1, D2 is fed back to Q4 where it is amplified and fed to Q6. Audio at Q6's emitter is amplified by Q3, Q5 to drive phones.

PARTS LIST

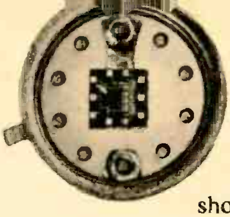
B1-B5—1.5 volt, alkaline energizer penlite battery (5 reqd.)
C1—10 mmf mica or ceramic disc capacitor
C2—10-365 mmf miniature variable capacitor (Lafayette 99 G 6217)
C3, C7, C8—.005 mf, 75 V ceramic disc capacitor
C4—500 mmf, 75 V ceramic disc capacitor
C5—100 mmf, 75 V ceramic disc capacitor
C6—25 mf, 25 V electrolytic capacitor
C9—100 mf, 6 V electrolytic capacitor
C10—.001 mf, 75 V ceramic disc capacitor
D1, D2—1N64 diode
IC—Motorola integrated circuit. See square-wave generator parts list
J1, J2—Miniature phone jack
L1—5 turns No. 28 enameled wire wound over narrow winding on L2 (see text)
L2—Ferrite tapped antenna coil (Lafayette 32 G 4105)
L3—10 microhenry miniature RF choke
R1—10,000 ohm miniature potentiometer (Lafayette 32 G 7356)
R2—43,000 ohm, ½ watt, 5% resistor
R3—15,000 ohm, ½ watt, 10% resistor
R4—10,000 ohm, miniature potentiometer with switch (Lafayette 32 G 7364)
R5—27,000 ohm, ½ watt, 10% resistor
R6—4,700 ohm, ½ watt, 10% resistor
S1—SPST switch on R4
Misc.—Plastic box, perforated board, socket for integrated circuit (see square-wave generator parts list), hardware, 2,000-ohm earphones (Allied 86 S 083)

radio, it will not be possible to build the radio in a matchbox because of the standard size of other components. Our model is built in a plastic box whose dimensions are 7x3½x1½ inches. All components are mounted on a piece of perforated board. Flea clips are used for tie points.

To be on the safe side, try to duplicate the layout we show (Fig. 9), especially around the loopstick antenna, tuning capacitor C2 and regeneration control R1. If these parts and wiring are shifted around and packed together too tightly, you may end up with uncontrollable oscillation. Gain of the input stage is fairly high and there is RF all over the place. Therefore, if after your radio is built there is oscillation that can't be stopped at any setting of R1, try relocating L2, C2 and R1.

Before winding L1, carefully examine the loopstick antenna. You'll notice two windings—one is about 3/16-inch wide and the other occupies the remaining space. It is the narrow winding over which you wind L1. Tickler winding L1 is five turns of No. 28 enameled wire wound tightly and evenly over the 3/16-inch wide winding of the loopstick. After the turns are wound, wrap them with tape to prevent them from unwinding. By the way, the tap on L2 that is connected to C4 is the twisted pair of wires at the extreme end of the loopstick. The wires from the loopstick are very delicate, so take care when handling them.

The IC socket can be mounted by bending its lugs outward, as shown in the pictorial, and soldering them to three or four flea clips.



After the socket is installed, proceed with wiring.

The diode leads must be very short. For this reason it is necessary to hold them with pliers when soldering to prevent heat damage. All ground connections should be made to one point. Therefore, run a length of buss wire from one end of the board to the other, as shown.

Because of the high current consumption of the IC, it will not be possible to operate the radio from an ordinary 9-volt transistor-radio battery. These batteries just cannot supply the necessary current. Furthermore if they could, nine volts would be too much for the IC to handle. Best source of operating power is five penlite cells (alkaline energizer type) connected in series.

When everything is in place, double check your connections to the IC socket. It is possible to install the IC in any position in the socket. The correct way is with the tab on the IC case directly over the nib on the side of the socket.

When you're sure everything is in order, turn on power, advance regeneration control R1, and try to tune in a station. If the radio is dead, reverse the connections of the leads from tickler winding L1. You should now hear something. Tune the radio and adjust the regeneration control to a point where oscillation starts. Then back off for best sound.

If you can't get sufficient pickup with the loopstick we specify and find a long-wire antenna causes overloading, try a larger loopstick. A little experimentation with tickler coil L1, such as adding or removing turns will produce optimum regeneration.

The impedance of the phones must be high—at least 2,000 or 3,000 ohms for top performance. Low-impedance phones won't give you much volume. You could try a transistor output transformer to couple the output to a low-impedance phone.

Then again you could add a transistor and the radio will drive a speaker.

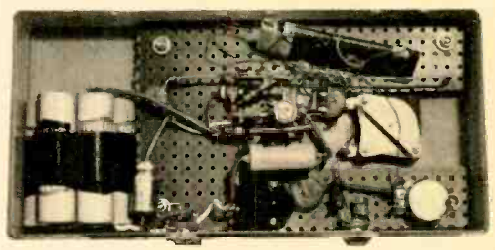


Fig. 8—Our layout was spacious but the wiring in the area around the IC's socket is very crowded.

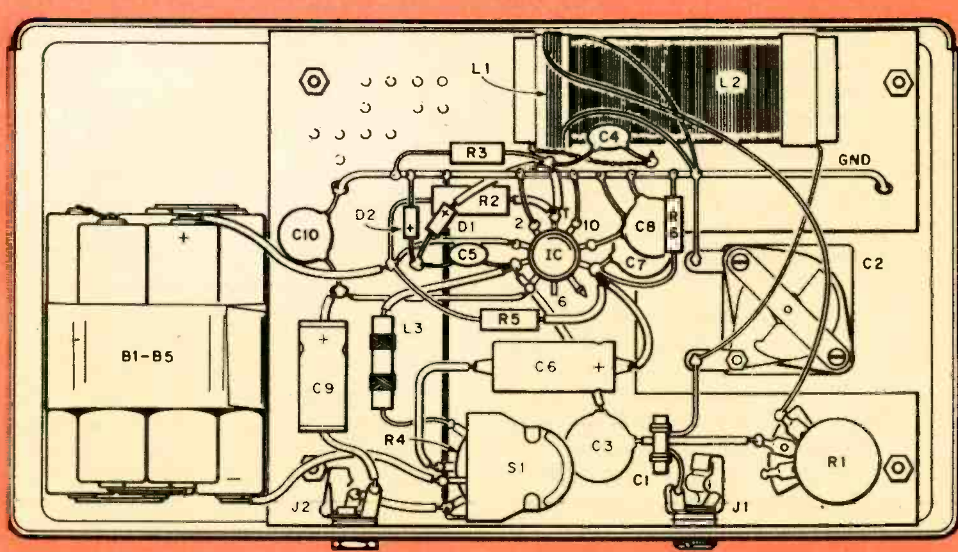
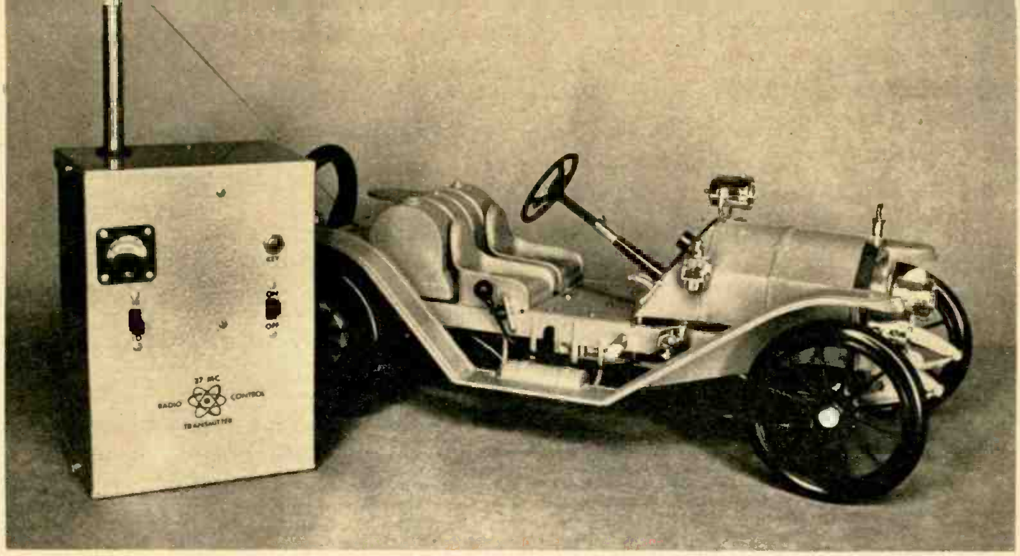


Fig. 9—The perforated board we built our model on is 5x3¼ inches. It is supported above the inside of the cabinet with spacers. Duplicate our layout and you will avoid undesirable oscillation problems.



Blockbuster R/C Transmitter

By HOWARD G. McENTEE

THE track is clear, the weather is good and they're off to a flying start. A lot of radio-controlled models are out there competing for first prize and this means the channels are going to be jammed. Unless your signal can get through the interference you're likely to lose contact with your model and end up being just an also-ran.

But with the Blockbuster in your hand you'll have control all the way, for this transmitter puts out a real blast of a signal. It's more powerful than all hobby rigs now on the market. Power input to the final is a whopping .9 watt. This means you can maintain contact with your model, even though the transmitter batteries begin to weaken or the receiver in the model (whether plane, car or boat) becomes a bit detuned.

The FCC normally requires that you have an R/C transmitter whose input power is greater than 100 mw checked by a licensed commercial operator if you have made any adjustments that will shift frequency or cause spurious radiation. But you can change the operating frequency of the Blockbuster without such a check. This is because the Blockbuster uses a commercially manufactured oscillator-amplifier which establishes the operating frequency. It is an International Crystal Mfg. Co. Model TRT-1A low-power transmitter. The rig is supplied with a close-tolerance crystal (International Crystal type F-605: ± .0025 per cent) and with the oscillator factory tuned. Oscillator tuning should *not* be changed, but you can, and should, peak the amplifier stage of the TRT-1A to match it to the Blockbuster's driver stage (Q3).

Furthermore, you can operate on any of the six R/C channels (26.995, 27.045, 27.095, 27.145, 27.195 and 27.255 mc) merely by inserting another crystal. The crystal should be the type specified by International Crystal (F-605) for the unit. Oscillator tuning is broad enough so you won't have to retune for another crystal. But the following stages should be peaked when a channel change is made.

The Circuit. Because they are stable and efficient, common-base transistor configurations are used for both the driver (Q3) and the power amplifier (Q5). Q3 boosts the output from the TRT-1A module so it will drive Q5 to its maximum capability.

More drive from Q3 (its normal collector current is 20 ma) will put more power into the antenna, but it's tougher on the batteries. Transistor Q5 runs quite warm and a heat sink must be used on it.

Tone modulation is applied way upstream —to the TRT-1A module. Neither Q3 nor Q5 will draw current unless they are driven.

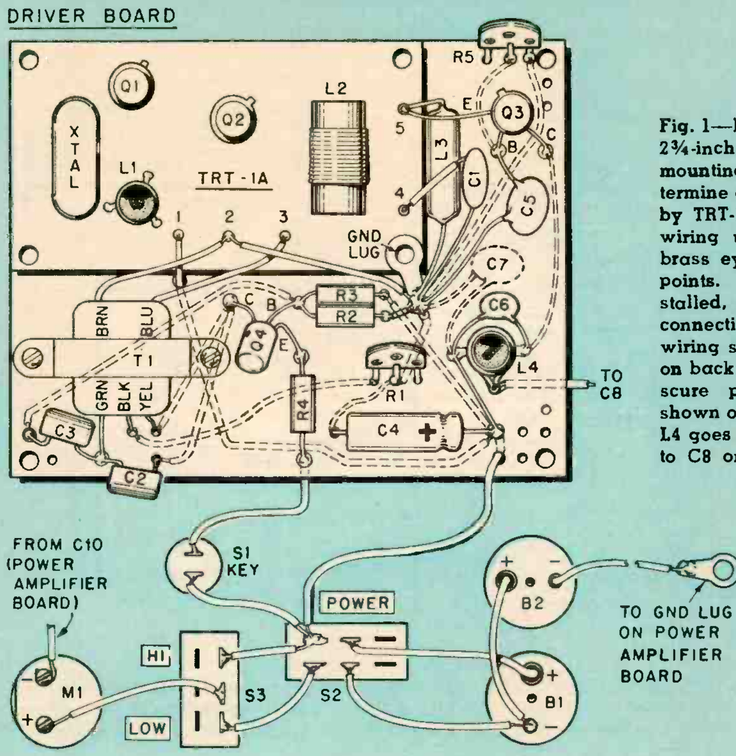


Fig. 1—Driver stage fits on a 3¾x2¾-inch perforated board. Before mounting components on it, determine area that will be occupied by TRT-1A module. Proceed with wiring using 3/32-inch diameter brass eyelets or flea clips for tie points. After all parts are installed, mount TRT-1A and make connections to it. Components and wiring shown in broken lines are on back of board. So as not to obscure parts, heat sink is not shown on Q3. Lead from the top on L4 goes back through shield plate to C8 on power amplifier board.

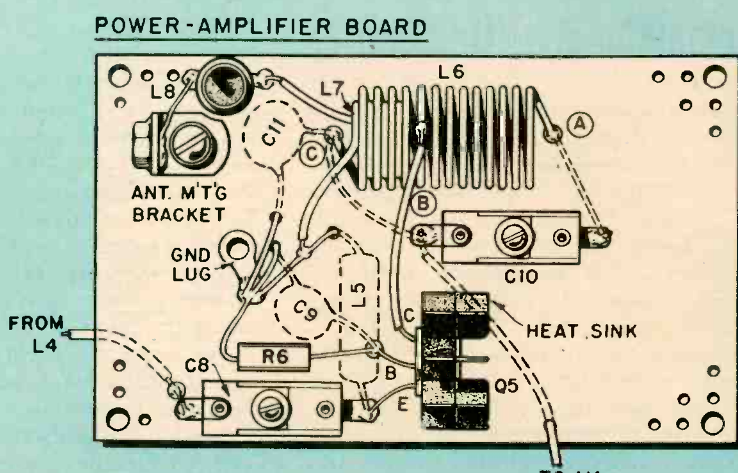
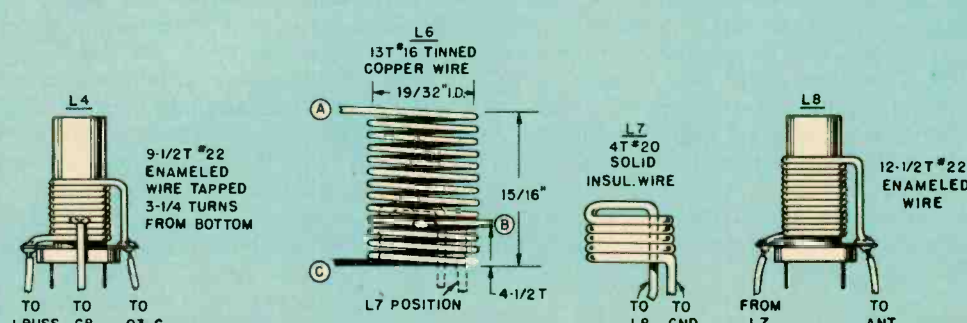


Fig. 2—Duplicate parts layout on 2 3/16x3¾-inch power amplifier board for optimum performance. Note how L7 is positioned within L6. To be sure of good heat transfer between Q5's case and its heat sink, put a light coat of silicone grease on Q5's case. Components and wiring in broken lines are on back of board.

Fig. 3—Coil details. Coils L4 and L8 are wound on forms available from Ace Radio Control (see Parts List). The outside diameter of coil L7 should be slightly less than the inside diameter of coil L6.



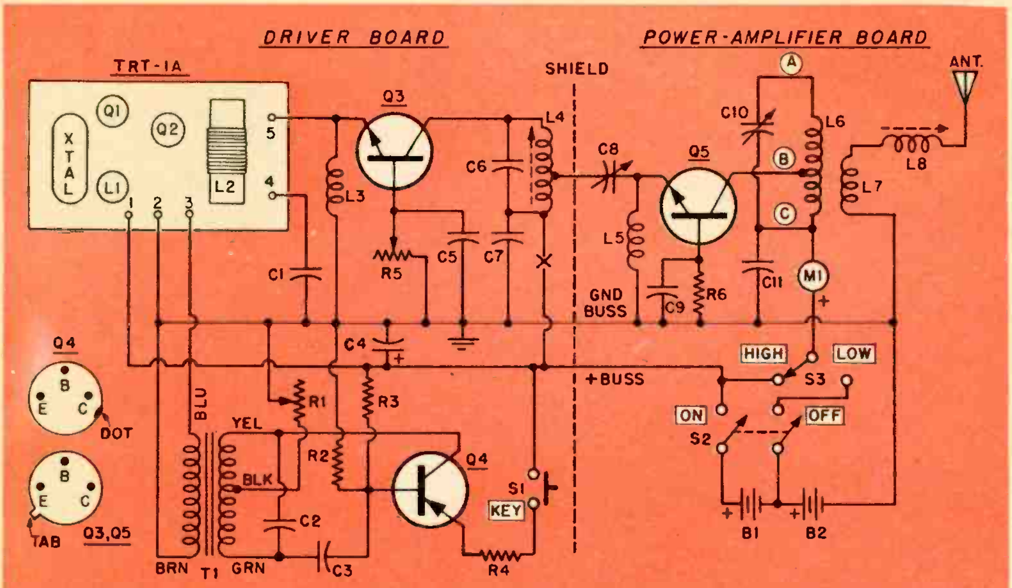


Fig. 4—Output of audio oscillator (Q4 and associated components) is applied to TRT-1A module at lug 3. RF output of module is fed to transistor Q3 which drives power amplifier Q5. S3 applies 7½ or 15 volts to final only; balance of circuit operates at 15 volts. Cross below L4 is test point.

Blockbuster R/C Transmitter

Thus, when the output of the TRT-1A module is driven down to zero by audio modulation from Q4, these two transistors (Q3 and Q5) will not produce output during modulation dips. This is called downward modulation. Q5's collector current will drop during modulation and a field-strength meter will show lower output. However, the RF carrier amplitude doesn't drop—it rises a bit. A field-strength meter shows reduced output because we chop holes in the output at an audio-frequency rate.

The method of antenna coupling and loading is such that Q5's collector current will not go sky-high if the transmitter is operated with the antenna collapsed. High-Low switch S3 applies either 7½ or 15 volts to Q5. The lower voltage reduces the output for shop testing or short-range operation, and should *always* be used when the antenna is collapsed.

Before you order parts, keep in mind that this is not a project for the beginner. Construction and wiring are not that difficult, but for perfect tune-up and testing it is helpful to have at least a VTVM with an RF probe, an oscilloscope, and some type of frequency meter. A VOM is a necessity, of course. We advise even the experienced builder to stick to the layout and parts shown. Changes might be all right—but we *know* our design and layout work.

Construction. Our construction should be duplicated to shield the power amplifier from the other circuits and prevent instability. Tuning is accomplished easily and there is plenty of room in the 3x5x7-inch Minibox for batteries (see Fig. 7). When collapsed, the antenna projects only 2½ inches above the top of the case.

The aluminum shield shown in Fig. 6 was tapped for the board mounting screws. However, you may use nuts and washers instead. The mounting hardware that comes with the TRT-1A module is used to hold it and the driver board to the shield plate. Details of how these are held together are also shown in Fig. 6. The power-amplifier board also is held to the shield plate with 2-56 screws.

Both the driver and power amplifier circuits are built on perforated phenolic board. we used 3/32-in. brass eyelets for tie points.

Cut the leads back from the upper left and lower right holes on the rear of the TRT-1A board to prevent shorts. Use fiber washers to space the board about ⅛-inch away from the driver chassis as in Fig. 6. The other two corners on the TRT-1A board are secured

PARTS LIST

B1, B2—7½-volt battery (Eveready 717 or equiv.)
C1, C5, C7, C9, C11—.01 mf, 75 V or higher ceramic disc capacitor
C2, C3—.1 mf, 75 V or higher mylar capacitor
C4—50 mf, 15 V electrolytic capacitor
C6—10 mmf, 500 V ceramic disc capacitor
C8—90-400 mmf midget trimmer capacitor (Allied 17 L 086 or equiv.)
C10—7-100 mmf midget trimmer capacitor (Allied 17 L 080 or equiv.)
L1, L2—On TRT-1A module
L3, L5—70-microhenry RF choke (Ace Radio Control, Box 301, Higginsville, Missouri. Stock No. 17A13)
L4—Coil: 9½ turns No. 22 enameled wire wound on Ace form No. 17A5 (See Fig. 3)
L6—Coil: 13 turns No. 16 tinned wire wound on 19/32-in. dia. form (See Fig. 3)
L7—Coil: 4 turns No. 20 solid insulated hook-up wire (See Fig. 3)
L8—Coil: 12½ turns No. 22 enameled wire wound on Ace form No. 17A5 (See Fig. 3)
M1—0-100 ma DC milliammeter
Q1, Q2—On TRT-1A module
Q3—2N696 transistor
Q4—2N2429 transistor (Amperex. Newark Electronics 21FX2679)
Q5—2N2194A transistor
Resistors: ½ watt, 10% unless otherwise indicated
R1, R5—1,000 ohm miniature potentiometer (Lafayette 99 G 6142)
R2—27,000 ohms R4—130 ohms, 5%
R3—4,700 ohms R6—120 ohms
S1—SPST pushbutton switch
S2—DPST slide switch S3—SPDT slide switch
T1—Transistor output transformer: primary and secondary 500 ohms, center tapped (Lafayette 33 G 8553)
TRT-1A—Transistorized transmitter (International Crystal Mfg. Co., Inc., 18 N. Lee, Oklahoma City, Okla. Catalog No. 200-129. $12.50. Specify R/C frequency when ordering)
Misc.—Heat sink for Q3 (Newark Electronics 58F530), heat sink for Q5 (Newark 58F531), 3x5x7-inch Minibox, 12-section, 52-inch antenna (Lafayette 99 G 3008), battery plugs, perforated board, flea clips

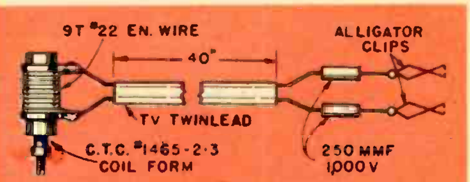


Fig. 5—To display modulation on scope, build this pickup probe which will couple RF near coil L6 to the vertical plates of scope.

with 2-56 screws and spacers. through the shield plate as shown in Fig. 6.

Note that all ground connections on both boards are made to lugs held under hex nuts on a 3-48x1½-inch-long headless screw which goes through both boards. This screw also is fastened firmly to the shield plate with a nut on each side.

Mount T1, L4, R1 and R5. R1 and R5 should be positioned so you can easily reach the screwdriver slot. Q3 is mounted by its leads only. Finish all wiring and make connections to the TRT-1A module.

Install a 1/16-inch-thick x ⅜-inch-wide brass angle bracket for the antenna on the power-amplifier board. Solder the nut supplied with the antenna to the bracket as shown in Fig. 2.

Wind L4, L6, L7 and L8 as shown in Fig. 3 and install them. Put narrow strips of cellophane tape on L7 to hold the turns together tightly. The position of L7 within L6 is shown in Fig. 3. We do not show the heat sink on Q3 as it would obscure other parts.

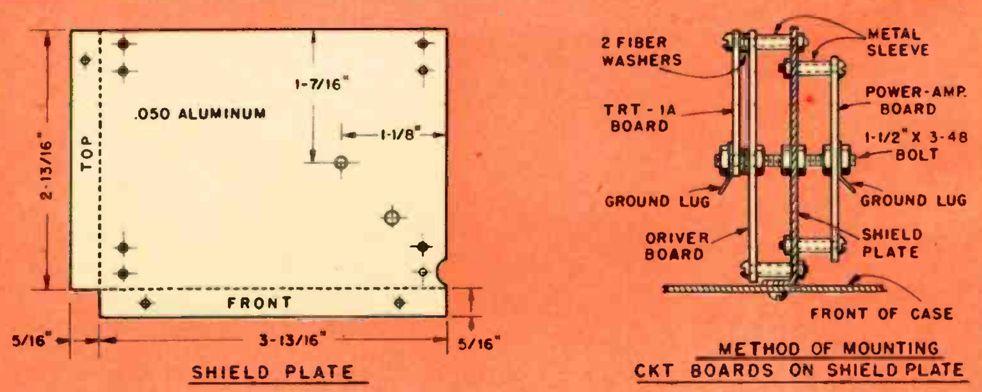
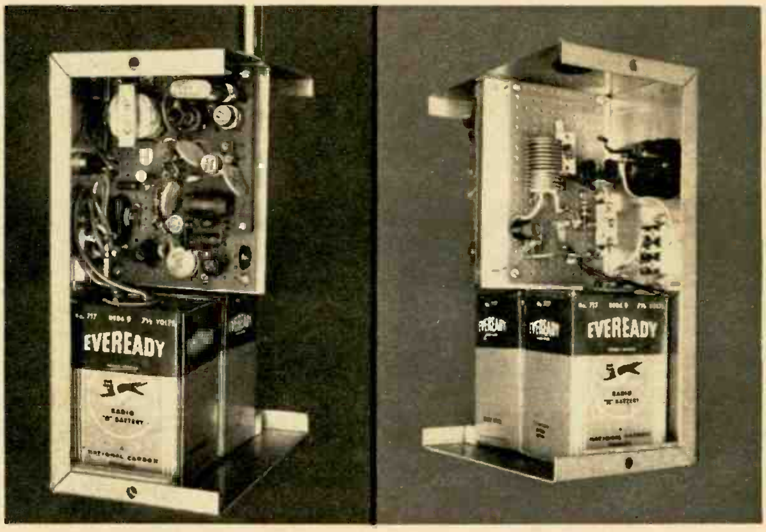


Fig. 6—Shield-plate dimensions and circuit-board mounting details. View of the shield plate is from driver-board side. The exact location and size of holes depends on individual construction.

Fig. 7—Photo at left shows driver board. Power-amplifier board, which is on other side of shield plate, is shown in photo at right. After boards are mounted determine where to drill hole in top of cabinet for antenna. Put grommet in hole so antenna doesn't touch the case.



Blockbuster R/C Transmitter

Tune Up. Use only 9 to 12 volts for the first tests. Temporarily remove the antenna and pull coil L7 out of L6. Next, solder a 50-ohm, 1-watt resistor from the ground end (C) of L6 to a winding 2½ turns above. Then connect your VTVM's RF probe across the resistor. The core in coil L2 on the TRT-1A module should be close to the center of the winding. The core in L4 should be about halfway into the winding and C8 should be about ½ turn from maximum capacity. Set R5 to about half its resistance. Press pushbutton S1 and tune C10 for maximum indication on the VTVM. All adjustments interact to some extent, so go over them several times again until you have peak output. Q5's collector current should be between 40 and 60 ma.

Now set S3 to high (15V) and tune up everything again for maximum output. A meter temporarily connected in the point below L4 (on the schematic) marked X should indicate no more than 20 ma. If the current is higher, increase the resistance of R5. At this point Q5's collector current should be 60 ma. You should be putting from 0.5 to 0.6 watt into the 50-ohm load resistor. The total current drawn by the TRT-1A module should be less than 15 ma. None of the stages gives maximum output at minimum current (as is often the case with tube circuits). Therefore collector current isn't a reliable guide to tuning or output. Meter M1 is an overload guide to warn you if Q5 is drawing too much current.

To check modulation, build the simple RF pickup probe shown in Fig. 5. The capacity of the twinlead across the coil tunes the pickup probe to 27 mc. Attach the clips directly to the vertical plates of your scope. Bring the coil near L6 and you'll be able to observe your modulation pattern. R1 should be adjusted so that you just start to get a bright narrow line between RF bursts.

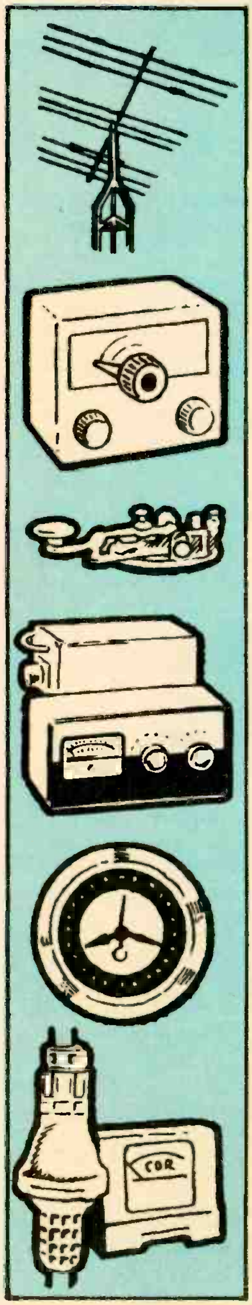
For a final tune up, remove the 50-ohm resistor, insert the antenna and extend it to full length. Since the transmitter will normally be held with both hands, it's best to make final adjustments holding it this way (you'll need an assistant to do this). With L8 properly adjusted and correct coupling between L6 and L7, you should be able to load Q5 up to about the same collector current (60 ma) as you did with the resistor.

To check modulation with the antenna, run a foot of wire (connected to one of pickup probe coil lugs) close to the case or to the antenna. The former method is preferred so that antenna tuning won't be disturbed too much. Adjust the core in the pickup probe coil for highest scope pattern.

The TRT-1A module's frequency is certified only when the voltage is 15 volts ± 10%. The 7½ volt batteries we specify are the handiest size to use. They should give about 5 hours service (when used an hour a day) before their output drops to 12 volts. For better service, make up a pack of ten size C alkaline-energizer cells.

A HAM STATION FOR

TURN PAGE



The easy way to select top equipment for your shack! You pick the price—we tell you what to buy.

By PAUL HERTZBERG
K2DUX

GUIDANCE is one thing many hobbyists need if they are to get over the hurdles and become licensed hams. Such advice may come from friends, relatives, clubs, books or magazines. But few are the radio amateurs who can say that they secured their tickets without hints from some source.

Broadly speaking, obtaining an amateur radio license and going on the air entails three big steps. First off, you must bone up on electronic theory, familiarize yourself with the regulations governing amateur radio and learn the code in preparation for the FCC exam. Next step is to take and pass the exam. This done, you must equip yourself with a receiver, a transmitter and the rest of the gear that goes to make up a ham shack.

Most would-be hams have guidance galore on steps one and two. Fact is, there are more good courses in electronic theory around than there are ham bands. As for the code, there are group-practice sessions and on-the-air code transmissions, not to mention a variety of recordings and how-to-learn-the-code books. In short, no one who really wants a ticket will find either the theory or the code all that difficult to master.

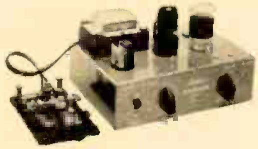
But what about the gear for that shack? There you have one hurdle almost no one bothers to guide you over. To be sure, you're well aware of what you need—in a general sense, at least. But when it comes to determining which transmitter and which receiver you should buy at a price you can afford—well, that's the place where hints are hard to find.

To help you over this hurdle, EI lists four complete ham stations in different price categories—$100, $250, $500 and $1,000. All you need do is determine how much you can afford to spend, then choose your station. Each of the four stations we show is complete and includes everything you need to set up a shack and go on the air. And the equipment in each station has been selected carefully to give you top value for your money.

An alternate unit is listed for each transmitter and receiver to allow you some options on the equipment you select. However, should you choose one of the alternates, some additional juggling may be required to keep the total price within the figure specified.

Ready to choose a ham station? Turn the page and take your pick.

$100



TRANSMITTER: Ameco AC-1T (kit)
- Covers 80- and 40-meter amateur bands
- Operates on CW only
- Crystal-controlled
- Pi-network output matches random-length antennas
- TVI suppressed
- Built-in AC power supply
- Two tubes; 6V6 in final
- Power input: 15 watts
- Price: $19.55

Alternate: Knight-Kit T-60

RECEIVER: Lafayette KT-320 (semi-kit)
- Tunes 550 kc to 30 mc
- Calibrated bandspread on 80-, 40-, 20-, 15- and 10-meter amateur bands
- S-meter
- Q-multiplier and BFO
- Automatic noise limiter
- Illuminated slide-rule dial
- Headphone jack
- Nine tubes
- Sensitivity: 1 μv for 10db S/N ratio
- Price: $74.50

Alternate: Lafayette HA-63

ACCESSORIES:
- Key (Lafayette 99G2554): 69¢
- Antenna (wire, insulators, etc.): about $2.50
- Switch (SPDT switch for transferring antenna between receiver and transmitter): about 25¢
- Speaker (Lafayette 99G2532): $7.95

$250

TRANSMITTER: Heathkit DX-60 (kit)
- Covers 80- through 10-meter amateur bands
- Operates on CW or AM phone
- Front-panel switch selects internal crystals or external VFO
- Pi-network output matches 50- to 75-ohm antennas
- Built-in low-pass filter
- Grid-block keying
- Front-panel meter
- Five tubes; 6146 in final
- Power input: 90 watts
- Price: $79.95

Alternate: Knight-Kit T-150A

RECEIVER: Heathkit HR-10 (kit)
- Tunes 80-, 40-, 20-, 15- and 10-meter amateur bands
- Preassembled, prealigned tuning unit
- Slide-rule dial
- S-meter
- Lattice-type crystal filter
- Self-contained BFO
- Jack for external 100-kc crystal calibrator
- RF stage
- Seven tubes
- 1 μv sensitivity for 10db S/N ratio
- Price: $79.95

Alternate: Knight-kit R-100A

ACCESSORIES:
- Key (Lafayette 99G2555): $1.95
- Microphone (Astatic JT-30): $10.82
- Antenna (Hy-Gain 4BDT): $24.50
- VFO (Lafayette 99G2501): $34.50
- Antenna Relay (Dow-Key DK60-G2C): $15.65
- Speaker (Heath AK-5): $10.95

$500

TRANSMITTER: Johnson Viking Ranger II (kit)
- Covers 160- through 6-meter amateur bands
- Operates on CW or AM phone
- Built-in VFO or crystal control
- Pi-network output matches 50- to 500-ohm antennas
- TVI suppressed
- Calibrated bandspread
- Grid-block keying
- Fourteen tubes; 6146 in final
- Power input: 65-75 watts
- Price: $249.50

Alternate: EICO 720K transmitter with 730K modulator and 722K VFO

RECEIVER: Lafayette HA-350
- Tunes 80- through 10-meter amateur bands, plus WWV (15 mc)
- Single-knob tuning
- S-meter
- Automatic noise limiter
- Double conversion
- Tunable preselector
- Crystal-controlled BFO
- Voltage-regulated power supply
- Twelve tubes
- Provision for 100-kc crystal calibrator
- Sensitivity: less than 1 μv for 10db S/N ratio
- Price: $189.50

Alternate: Hammarlund HQ-110A

ACCESSORIES:
- Key (Lafayette 99G2555): $1.95
- Microphone (Shure 520SL): $24.46
- Antenna Changeover Relay (Dow-Key DK60-G2C): $15.65
- Speaker (Lafayette 99G2532): $7.95

$1,000

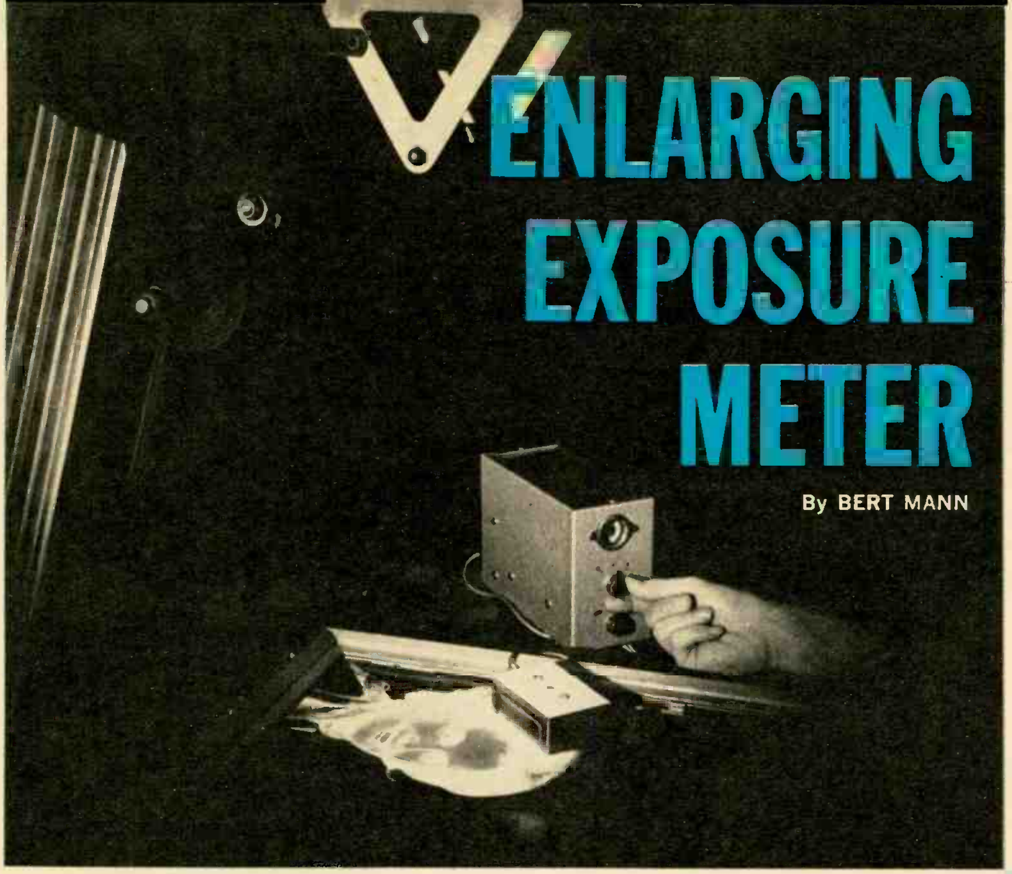
TRANSMITTER: Hallicrafters HT-37
- Covers 80- through 10-meter amateur bands
- Operates on CW, AM or SSB phone
- High-stability VFO
- Pi-network output matches 52-ohm antenna
- Built-in VOX
- Front-panel meter
- Eighteen tubes; 6146's in final
- Power output: 70-100 watts PEP on CW or SSB, 17-25 watts carrier on AM phone
- Price: $495

Alternate: Hammarlund HX-50

RECEIVER: Drake R-4
- Tunes 80- through 15-meter amateur bands, plus portion of 10-meter amateur band; accessory crystals available for other bands and frequencies
- Gear-driven circular dial
- S-meter
- Passband tuning
- Four selectivity bandwidths
- Notch filter
- Crystal lattice filter
- Built-in 100-kc crystal calibrator
- Sensitivity: less than 0.5 μv for 10db S/N ratio
- Price: $379.95

Alternate: Hammarlund HQ-180A

ACCESSORIES:
- Microphone (Astatic UG8-D104): $33.05
- Antenna (Mosley TA-33JR): $71.52
- Antenna Relay (Dow-Key DK60-G2C): $15.65
- Speaker (Drake MS-4): $19.95



ENLARGING EXPOSURE METER

By BERT MANN

WHEN you stop to think about it, a lot of time spent making enlargements is non-productive. No one will argue that it is worth a great deal of effort to turn out a good print. But it is not worth the time and extra paper to run several tests to determine the correct exposure for, say, *each* wallet-size print of Uncle Herman's Atlantic City vacation. Since Uncle Herman shoots 36-exposure, 35-mm film—and no two exposures are alike—a lot of time and money could go down the drain.

With EI's Enlarging Exposure Meter you get the correct exposure the first time without making unnecessary tests. And best of all the exposure meter is fast. Once calibrated for each of your enlarging papers, calibration never has to be touched again.

Look how easy it is to make a perfect print the first time from any negative. After the negative and easel are in place you open the enlarger's diaphragm all the way. Then you put the photocell in the brightest area on the easel as we show above. The next operation is to stop down the enlarger's diaphragm until the meter's eye pops open, give a ten-second exposure and the job is done.

If you're wondering where the paper-grade control is (since so-called pro meters have one), forget it. You can learn quickly to determine whether to use a low, normal or high-contrast paper. The time needed to make a grade test for each print isn't worth the effort and cannot replace your own artistic skill. The only frill on our exposure meter is an adjustment which compensates for the different sensitivity of each enlarging paper you use. Since this adjustment also happens to be the calibrate control, another extra step is eliminated. The calibrate control lets you instantly pre-set the meter for whichever paper you use. If you prefer exposures other than 10 seconds you can pre-set the meter for any time between 5 and 20 seconds.

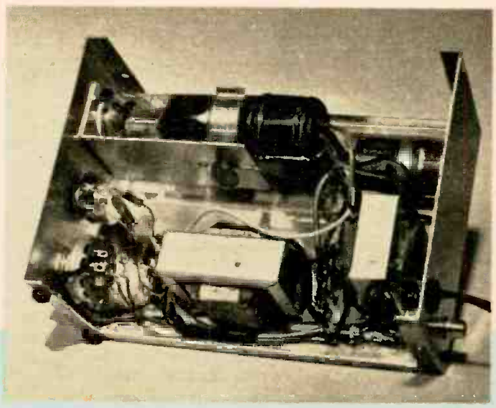
Construction

Our meter is built in the main section of a 3x5x7-inch Minibox. The wiring is not critical and the parts may be rearranged to fit into a cabinet of a different size.

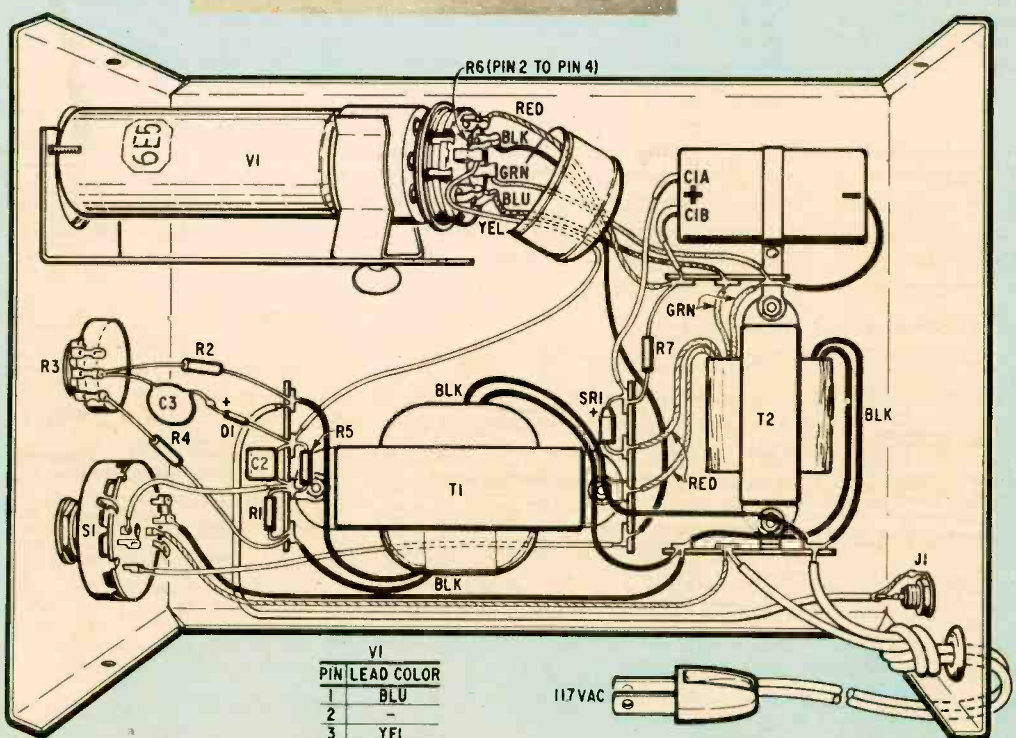
Take care when connecting T1. T1 is a special isolation transformer and is provided with a rubber-covered black line cord. These are the primary leads. The secondary leads are also black but they are *fabric* covered and are connected to the junction of J1 and R2, and to R1 and R4. Since T1's primary leads are long and come with a standard AC plug, the excess wire can be used for the meter's power cord.

Make certain that R3 has a logarithmic taper or the calibration will bunch up making adjustment difficult. Use a heat sink, such as an alligator clip, on the leads of D1 when soldering them in place.

To insure accurate operation construct the pick-up probe *exactly* as follows: In the center of a 3¼x2⅛x1⅛-inch Minibox, carefully drill a ¼-inch diameter hole. Then spray the top of the box with white enamel paint. After the paint dries center PC1 under the hole and secure it in place with a 3/16-inch wide bracket cut from scrap aluminum. Tape the bracket so it doesn't short PC1's leads. *Warning*. If you use some other size cabinet, or drill a hole larger or smaller than ¼ inch, it may be impossible to calibrate the meter. While V1 can be mounted with a



Mount the magic-eye tube as high as possible in the main section of the cabinet to allow room for potentiometer R3 and switch S1. Socket supplied with magic-eye tube mounting assembly comes with color-coded leads and R6. If you do not use assembly, connect R6 from pin 2 to pin 4. Watch the heat when soldering D1 or you'll damage it. To be safe, hold each lead with pliers when soldering. Black band on D1 is positive end.

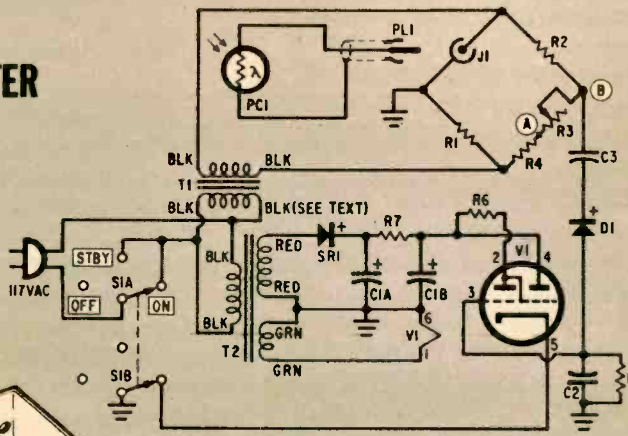


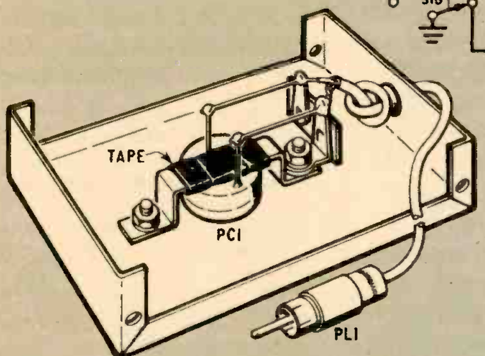
V1

PIN	LEAD COLOR
1	BLU
2	-
3	YEL
4	RED
5	BLK
6	GRN

ENLARGING EXPOSURE METER

Brightest light on PC1 from test negative lowers PC1's resistance. When R3 is adjusted so its resistance equals PC1's, bridge output at B is zero, eye opens. With other negatives, when you adjust diaphragm so eye opens it means light is same as it was with test negative and print will be perfect.





Exposure meter was designed around photocell specified in Parts List therefore do not use another type. The hole in cabinet above photocell must be ¼-inch diameter and all edges of cabinet must be sealed against light with tape.

PARTS LIST

C1A, C1B—20/20 mf, 250 V electrolytic
C2—.1 mf, 75 V or higher capacitor
C3—.02 mf, 500 V ceramic disc capacitor
D1—1N34A diode J1—Phono jack
PC1—Cadmium sulphide photocell (Polaris MAJ.I type LDR-C1. Allied Radio 7 E 565)
PL1—Phono plug
Resistors: ½ watt, 10%
R1—560,000 ohms R2—62,000 ohms, 5%
R3—250,000 ohm, log-taper potentiometer
R4—2,700 ohms R5—2.2 megohms
R6—1 megohm (see text) R7—470 ohms
S1A, S1B—2-pole, 3-position non-shorting rotary switch (Mallory 3223J or equiv.)
SR1—Silicon rectifier: minimum ratings, 100 ma: 400 PIV
T1—Line isolation transformer (Lafayette 33 G 7502)
T2—Power transformer: 125 V @ 15 ma, 6.3 V @ 0.6 A (Lafayette 33 G 3405 or equiv.)
V1—6E5 tube (Socket, Amphenol CM-49)

home-brew bracket, a complete mounting assembly, including a pre-wired socket containing R6, is available from many electronic parts distributors. For convenience, use a thin microphone cable to connect PC1 to PL1.

Calibration and Operation

Connect an ohmmeter across points A and B and rotate R3 until the meter indicates approximately 60,000 ohms. Connect the photocell plug to J1 and the meter is ready for calibration. First, turn on power by setting S1 to standby. The meter will be ready for operation but the magic-eye tube will not light.

Select a good, normal-density negative and make a perfect print with a *10-second* exposure at an appropriate diaphragm setting. If you are satisfied with the print quality, place the pickup probe *on the easel* so that its hole in the center of an area of *maximum* light (this is the spot which will come out dense black on the print). Turn off all safelights, set S1 to *on* (turning on V1's green target) and slowly adjust R3 in *both* directions until the shadow in V1 opens up fully. Put a mark on the panel opposite R3's knob pointer. This is the 10-second calibration for the particular paper you selected. If you use other papers, repeat this procedure for each of them.

For run of the mill enlargements the calibration will give you a good print almost every time following the procedure we explained at the beginning of this story. For high-quality enlargements where just a second or two change in exposure is needed for that extra effect, the meter will put you so close that the second print will be right-on-the-nose. The money you save on test enlargements will pay for the meter quickly.

The LISTENER

C. M. STANBURY II

BACK SCRATCH . . . Something for nothing doesn't come anyone's way very often. And though membership in the R. Portugal DX Club supposedly is free, there is a string or two attached. Matter of fact, R. Portugal's DX Club perhaps is more of a you-scratch-my-back-and-I'll-scratch-yours arrangement than anything else, as we soon will see.

Way EI understands it, R. Portugal already will have mailed out first copies of its free (?) monthly bulletin by the time this issue of EI reaches you. To join, a U.S. or Canadian SWL has to send five reception reports on The Voice of the West, a R. Portugal transmission beamed our way weekly on 6025 and 6185 kc. Other appropriate reports mailed off to Lisbon every succeeding two weeks will keep you in good standing.

In addition to its monthly bulletin, V. West will offer a (free) DX program on those Sundays following the second and fourth Fridays of each month. Times will be 2115 and 2315 EST, with the broadcasts featuring tape recordings from DX clubs round the world.

Explanation behind this interesting bit of mutual back-scratching is anybody's guess. But there's good reason to believe that R. Portugal is attempting to organize DXers primarily to sell the Lisbon line. Give a listen, and you'll find R. Portugal describing the U.N. as a "hybrid body supported at the expense of civilized nations." You'll also hear some anti-U.S. diatribes, though these have been toned down noticeably since President Kennedy's assassination.

Listen to R. Portugal enough, however, and you likely will conclude that its primary assignment is an all-out anti-African crusade. Fact is, they've blasted every independent African nation *except* South Africa, a nation whose racial policies are notably rigidly colonial. Interesting, too, is the fact that R. Portugal has smeared all of Africa's Negro leaders except Moise Tshombe (of Katanga province fame).

Few SWL's would consider R. Portugal's views unbiased. For they only too obviously are designed to win support for Lisbon's own colonial policies in Angola and Mozambique. African independence, to R. Portugal, becomes Black Fascism, Communist conspiracy or most any other damaging epitaph it can come up with.

But whether R. Portugal's African views are right or wrong is of secondary importance to SWL's. The real issue is whether any SWBC station can gain a measure of control over SWLing by offering club membership, a DX bulletin or other special services free. At this point, we only can wait and see.

Harmonic Hunting . . . Though the Federal Communications Commission sets rigorous technical standards for stations under its jurisdiction, many BCB stations sneak through on frequencies the FCC clearly didn't assign. These frequencies are harmonics of the ones the FCC intended, and on

[*Continued on page* 110]

Unusual QSL card from R. Portugal is larger than most and mailed in a separate envelope. Printed in five colors, it highlights the role that nation played in discovering and exploring the once unknown portions of the globe. Reports should be sent to R. Portugal at Rua do Quelhas 2, Lisbon.

ELECTRONICS ILLUSTRATED

DX CLUB OFFICIAL

ALL awards from EI's DX Club, with the exception of a broadcast-band certificate, are issued on the basis of the number of different countries from which a DXer holds QSL cards or letters. Since the important thing is the countries represented and not the sheer number of QSL's, the question of what is and is not a country becomes important.

To give DXers and short-wave listeners a definitive guide, we now present the EI DX Club's Official Countries List.

Because the Club gives credit for log entries back to January 1, 1950, our Official Countries List includes all nations which have existed between that date and the present. Dates following certain countries indicate the period to, from or during which they may be counted.

The Club defines a country in DX rather than political terms because the list is meant as a guide for radio hobbyists, not a key to world politics.

The criteria used:

1) Any self-governing nation shall count as a country.

—A—

Aden, Hadhramaut and Socotra Is.
Afghanistan
Aland (Ahvenanmaa) Is.
Alaska (including Aleutian Is.)
Albania
Aldabra (Seychelles) Is.
Algeria
American Phoenix Islands (including Canton and Enderbury Is.)
American Samoa Is.
Amsterdam and St. Paul Is.
Andaman and Nicobar Is.
Andorra
Angola
Annobon Is.
Antarctica
Antipodes and Bounty Is.
Argentina
Armenian S.S.R.
Ascension Is.
Asiatic R.S.F.S.R.
Asiatic Turkey
Auckland and Campbell Is.
Australia
Austria
Aves Is.
Azerbaidzhan S.S.R.
Azores Is.

—B—

Bahama Is.
Bahrein Is.
Bajo Nuevo Is.
Baker and Howland Is.
Balearic Is.
Barbados Is.
Basutoland
Bechuanaland
Belgian Congo (until 6/30/60)
Belgium
Bermuda Is.
Bhutan
Bolivia
Bonin and Volcano Is.
Bouvet Is.
Brazil
British Gilbert and Ellice Is.
British Guiana
British Honduras
British North Borneo (before 9/16/63)
British Phoenix Is.
British Solomon Is.
British Somaliland before 6/30/60)
British Togoland (before 3/6/57)
Brunei
Bulgaria
Burma
Burundi (after 7/1/62)
Byelorussian S.S.R.

—C—

Cambodia (after 11/9/53)
Cameroon
Canada
Canal Zone
Canary Is.
Cape Verde Is.
Cargados Carajos Is.
Caroline Is.
Cayman Is.
Cay Sal Is.
Celebes and Molucca Is.
Central African Rep. (after 8/13/60)
Ceuta and Melilla (Spanish Morocco)
Ceylon
Chad (after 8/11/60)
Chagos Is.
Channel Islands (Guernsey, etc.)
Chatham Is.
Chile
China
Christmas Is. (Indian Ocean)
Christmas, Fanning and Washington Is.
Clipperton Is.
Cocos (Keeling) Is.
Colombia
Comoro Is.
Congo Rep. (Brazzaville) (after 8/15/60)
Congo, Rep. of (Leopoldville) (after 6/30/60)
Cook Is.
Corn Is.
Corsica
Costa Rica
Crozet Is.
Cuba
Cyprus
Czechoslovakia

—D—

Dahomey (after 8/1/60)
Denmark
Dodecanese Is. (Rhodes)
Dominican Rep.

—E—

East Germany
East Pakistan
Easter and Salay Gomez Is.
Ecuador
Egypt (6/18/53 to 2/1/58)
El Salvador
England
Eritrea (before 10/30/62)
Estonian S.S.R.
Ethiopia
European R.S.F.S.R.
European Turkey

—F—

Faeroes Is.
Falkland Is.
Fernando de Noronha Is.
Fiji Is.
Finland
Formosa (Taiwan)
France
Franz Josef Land
French Equatorial Africa (before 8/15/60)
French Guiana
French India (before 10/31/54)
French Indo-China (before 7/20/54)
French Polynesia (Tahiti, etc.)
French Somaliland
French St. Martin and St. Barthelemy
French West Africa (before 8/6/60)

—G—

Gabon (after 8/17/60)
Galapagos Is.
Gambia
Georgian S.S.R.
Ghana
Gibraltar
Gilbert, Ellice and Ocean Is.
Glorieuse Is.
Goa, Damao and Diu (until 3/14/62)
Greece
Greenland
Guadeloupe Is. (Fr.)
Guadelupe Is. (Mex.)
Guam Is.
Guantanamo Bay
Guatemala
Guinea (after 10/2/58)

—H—

Haiti
Hawaiian Is.
Heard Is.
Honduras
Hong Kong
Hungary

—I—

Iceland
Ifni
India
Indonesia
International Waters
Iran
Iraq
Ireland (Eire)
Isle of Man
Israel
Italian Somaliland (before 7/1/60)
Italy (including Sicily)
Ivory Coast (after 8/7/60)

—J—

Jamaica
Jan Mayen Is.
Japan
Jarvis Is.
Johnston Is.
Jordan
Juan de Nova and Europa Is.
Juan Fernandez Is.

—K—

Kaliningradsk
Kamaran Is.

COUNTRIES LIST

2) Colonized territory (possessions) shall count separately from the mother country.

3) Any colony administered separately from all other colonies of similar nationality shall be considered a separate country. For the purposes of this rule, the central colonial administration (the British Colonial Secretary, for example) shall not be considered as governing.

4) Any area under joint control of two or more self-governing nations, under UN control or under UN trusteeship shall count as a separate country.

5) Any territory separated from all other territory of like nationality by 100 miles of foreign territory or international waters shall count as a separate country.

6) Where a territory extends across continental boundaries, it shall count as two separate countries.

7) The integral parts of Great Britain—England, Northern Ireland, Scotland, Wales—each shall count as a separate country.

8) Each Soviet Socialist Republic of the U.S.S.R. shall count as a separate country. Further, the Russian S.F.S.R. shall count as two countries. All other parts of the U.S.S.R. shall be considered as part of the Russian S.F.S.R. except where No. 5 applies.

9) Until territorial claims become clearer, Antarctica shall count as one country. In addition, the categories of International Waters and Outer Space each shall count as the equivalent of one country.

Karelo-Finnish S.S.R. (before 7/15/56)
Katanga (7/1/60 to 1/15/63)
Kazakh S.S.R.
Kenya
Kerguelen Is.
Kermadec and Sunday Is.
Kirghiz S.S.R.
Kuwait
Kuwait (Saudi Arabia Neutral Zone)

—L—

Laccadive and Amindivi Is.
Laos (after 7/21/54)
Latvian S.S.R.
Lebanon
Leeward Is.
Liberia
Libya
Liechtenstein
Line Is. (except Christmas, Fanning and Washington Is.)
Lithuanian S.S.R.
Lord Howe Is.
Luxembourg

—M—

Macao Is.
Macquarie Is.
Madeira Is.
Malagasy Rep. (Madagascar)
Malawi (after 7/6/64)
Malaya (7/11/57 to 9/16/63)
Malaysia (after 9/16/63)
Maldive Is.
Mali (after 6/20/60)
Malpelo Is.
Malta Is.
Manihiki (Danger) Is.
Marcus Is.
Mariana Is. (Rota, Saipan, etc.)
Marion and Prince Edward Is.
Marquesas Is.
Marshall Is.
Martinique Is.
Masqat and Oman
Mauritania (after 11/28/60)
Mauritius Is.
Mexico
Midway Is.
Moldavian S.S.R.
Monaco
Mongolia
Morocco
Mozambique

—N—

Naura Is.
Navassa Is.
Nepal
Netherlands (Holland)
Netherlands Antilles (Aruba, Bonaire, Curacao)
New Caledonia Is.
New Hebrides Is.
New Zealand
Nicaragua
Niger (after 8/3/60)
Nigeria
Niue Is.
Norfolk Is.
North Korea
North Vietnam (after 7/21/54)
North-East New Guinea Territory
Northern Ireland
Northern Rhodesia
Norway
Nyasaland (until 7/6/64)

—OP—

Outer Space
Panama
Papua Territory
Paracel Is.
Paraguay
Pelagie and Pantelleria Is.
Peru
Philippines
Pitcairn Is.
Poland
Portugal
Portuguese Guinea
Portuguese Timor Is.
Puerto Rico

—QR—

Qatar
Reunion Is.
Revillagigedo Is.
Rodriguez Is.
Romania
Roncador Cay and Seranna Bank
Ruanda-Urundi (until 7/1/62)
Russian S.F.S.R.
Rwanda (after 7/1/62)
Ryukyu Is. (Okinawa)

—S—

Saarland (before 1/1/57)
St. Helena Is.
St. Pierre and Miquelon Is.
San Andres and Providencia Is.
San Marino
Sao Tome and Principe Is.
Sarawak (before 9/16/63)
Sardinia Is.
Saudi Arabia
Scotland
Senegal (after 6/20/60)
Sierra Leone
Sikkim
Singapore (before 9/16/63)
Sint Maarten (Dutch St. Martin), Saba and St. Eustatius Is.
Socotra Is.
Somalia (after 7/1/60)
South Africa
South Korea
South Orkney Is.
South Shetland Is.
South Vietnam (after 7/21/54)
Southern Rhodesia
South-West Africa
Spain
Spanish Guinea (Rio Muni)
Spanish Sahara (Rio de Oro)
Spitsbergen (Svalbard) Is.
Sudan
Surinam (Dutch Guiana)
Swan Is.
Swaziland
Sweden
Switzerland
Syria (before 2/1/58)
Syrian Arab Republic (after 9/30/61)

—T—

Tadzhik S.S.R.
Tanganyika (12/9/61 to 7/1/64)
Tangier (before 10/28/56)
Thailand
Tibet
Tinian Is.
Togo (after 4/27/60)
Tokelau (Union) Is.
Tonga (Friendly) Is.
Trieste (before 10/5/54)
Trindade and Martim Vaz Is.
Trinidad and Tobago Is.
Tristan da Cunha and Gough Is.
Tromelin Is.
Trucial Oman and Das Is.
Tunisia (after 7/25/57)
Turkey
Turkmen S.S.R.
Turks and Caicos Is.

—U—

Uganda
Ukrainian S.S.R.
United Arab Rep. (2/1/58 to 9/30/61)
United Nations
United Republic of Tanganyika and Zanzibar (after 7/1/64)
Upper Volta (Voltaic Republic) (after 8/5/60)
Uruguay
Uzbek S.S.R.

—V—

Vatican State (City)
Venezuela
Vietnam (7/20/54 to 8/31/54)
Virgin Is.
United States of America
Volcano and Bonin Is.

—W—

Wake Is.
Wales
Wallis and Futuna Is.
West Berlin
West Germany
West Pakistan
Western Samoa Is.
Willis and Coringa Is.
Windward Is.
Wrangell Is.

—YZ—

Yemen (before 2/1/58, after 12/26/61)
Yugoslavia
Zanzibar (10/7/63 to 7/1/64)

HI-FI TODAY

By John Milder

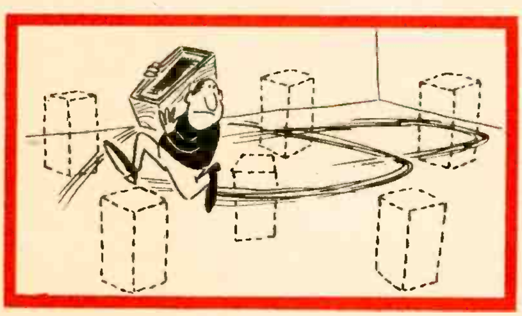
- *Ready rule for proper speaker placement*
- *Best bets for best stereo discs*
- *The case against those made-over mono's*

PRACTICALLY every loudspeaker instruction sheet I've ever seen has stressed the importance of proper speaker placement. But that's about as far as the instructions seem to go.

"Experiment," the manufacturer says. But how? And where?

"Ah," says Mr. Manufacturer, "that's *your* worry."

And so it is. But, for all the dearth of solid information, there's no real mystery about the subject. True, it *does* take a little experimenting to determine where to put your speaker for best sound. The right spot, of course, is where its bass is full and rich without also sounding boomy, where all its highs blossom forth without sounding shrill. And, happily, there is a fairly easy rule to follow.



To put it as baldly as possible, the closer a speaker is moved toward intersecting room surfaces, the more bass there will be in the overall sound. Why? Reason is that bass frequencies are non-directional and tend to be dissipated easily. Hang a speaker dead center in a room and it just may seem to have no bass at all. But move it toward floor, wall or ceiling, and that non-directional bass will become focused somewhat, making it much more audible.

You'll get the greatest amount of bass when you put a speaker at the junction of three surfaces—in a corner at the floor or ceiling. Next best place for bass is at the intersection of two surfaces—wall and wall, wall and ceiling or wall and floor. And so it goes until you move away from the various room surfaces to the dead-center position where bass seems weakest of all.

But why is bass the thing to talk about? Answer: it's the vital factor in the all-important *balance* of a speaker's sound. When a speaker seems thin and strident it's usually because of missing bass. And when it sounds boomy, too much bottom ordinarily is the cause.

Use the intersecting surfaces-rule as a guide, though, and it's fairly easy to find the place where any speaker yields just the right proportion of bass for smooth sound. If the speaker's high end needs some touching up, you can fiddle either with the speaker's high-frequency level control or the treble control on your amplifier.

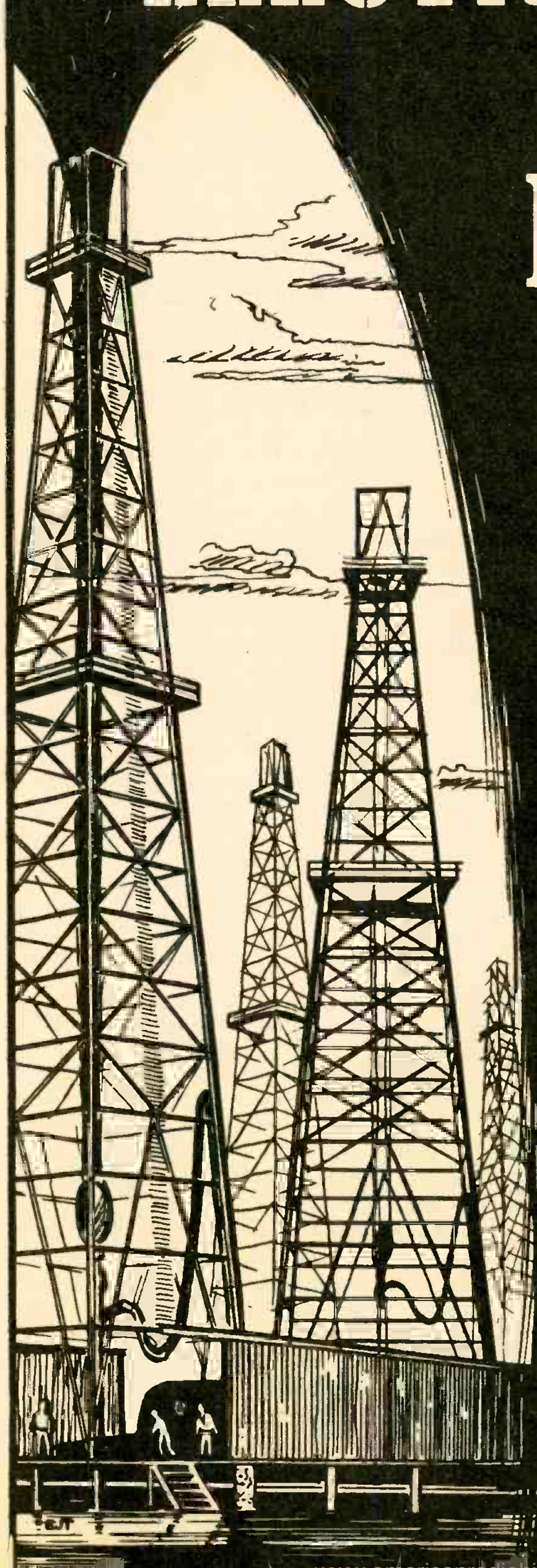
Occasionally, of course, tricky room acoustics can result in standing waves. And these potent phenomena may cause a speaker's bass to overwhelm you at one listening position and yet be almost non-existent at another.

Tearing your listening room apart and building a new one is one way out of this dilemma, but there are easier solutions. I've found the most practical tack is to move a speaker around over a limited area (a foot or two often is enough) until the worst effects of standing waves occur at non-critical points in the room—the places where no one usually settles down to listen, anyway. You'll find it next-to-impossible to rid a room of standing waves, but tricks such as these can keep them under control.

What about placement for effective stereo? Well, this stacks up as a much overrated problem. To my mind, it's best to start with the minimum speaker separation that seems to give good stereo spread, then work outward from there to get the overall sonic bal-

[*Continued on page* 115]

ELECTRONICS AND BLACK GOLD



By A. D. JACKSON

"ELECTRONICS in the petroleum industry? It would be hard to find a place where electronics isn't used in the oil business today."

So says Dr. Gerald A. Harlow, supervisor of the Shell Development Co.'s analytical chemistry laboratory in Emeryville, Calif. And a tour through these modern laboratories, just off the eastern end of San Francisco's famed Bay bridge, quickly confirms the fact that electronics *is* immersed in oil. Matter of fact, electronics is all but instrumental to black gold—from finding the crude in the ground, to refining the finished products for the consumer.

One reason electronics has entered the oil business so substantially stems from the elusive nature of oil itself. As it happens, geologists feel there still may be twice as much oil in the U.S. as the 100 billion or so barrels discovered in the last century. Problems are to find it, then refine it. Electronics measures up to both tasks nicely.

"To help make up for the lower level of exploration activity and to find new ways to find oil more economically, the industry is making

ELECTRONICS AND BLACK GOLD

increasing use of research and technology," observes Harold Gershinowitz, chairman of the Royal Dutch Shell Group Research Council in the Hague, Netherlands. And much of the research and technology he mentions are of an electronics nature.

Precisely what new tricks *has* electronics brought to the oil industry? Actually, there are so many it's difficult even to list them all. For one thing, more and more companies are using electronic devices—ultrasonic transducers—to pump vibrations into the earth—and thus learn more about the lay of the land (and oil) down there. This particularly is true when a firm is searching for a possible well off-shore.

In another instance, a company is feeding data gathered in actual drilling into computers for accurate recording and analysis. Other oil companies, using new data processing equipment, currently are reclassifying the reams of information they have gathered over the years.

Socony Mobil, for example, has poured seisomographic data going back as far as 1938 into a new $500,000 electronic monster. The machine spins its electronic gears, eventually converts the information into cross-sectional maps of rock layers. And just to prove you can't beat a robot, this computer actually projects the maps it has made onto a TV screen.

Other instances of electronics and black gold are legion. Texaco, for example, has opened the nation's first electronically controlled blending plant which automatically mixes over 40 different lubricants in half the time it took manual workers to do the job. A single control console directs the entire operation.

In another new development, an electronic data transmission system enables oil companies to control petroleum fields or pipelines remotely. Made by RCA, the system is designed to keep constant watch over widely-separated oil or gas wells or cross-country pipelines. It logs production data and reports breakdowns, relaying instructions from a central control point.

One of the more interesting applications of electronics in the oil industry is in the solution of a decades-old problem—the loss of crude oil through cracks and holes in the casing. Though they may be thousands of feet in the ground, these leaks can be repaired readily simply by forcing cement into them under pressure. But until very recently, problem has been to locate the leaks and determine their nature.

The old way of finding defects and corrosion involved pulling the casing—perhaps a mile or more in length—back out of the ground. This obviously was expensive and time-consuming. Further, it meant the loss of the well's production during shutdown for inspection and repairs.

But today an electronic device conceived by Shell Development can sniff out defects in the pipe while it is in the ground, reporting findings to a recorder on the surface. Ferret-fast, the instrument inspects all sides of the pipe at a uniform rate of 1,800 feet per hour. And in an emergency it can move at twice that speed.

The probe tool is a pipe about eight feet long, looking something like a flagpole. A knob at the bottom acts as a weighted bumper, bringing the total weight of the tool to upwards of 500 lbs., so it readily will drop to the bottom of the well.

A second knob at the top houses an exciter coil which induces an electrical signal into the well casing. And in the middle is still a third knob, housing a pickup coil which receives the signals after they have passed through the length of casing between the coils.

In the narrow cylinder separating the coils is the down-hole electronic circuitry, all of which is transistorized. Working with this down-hole probe are the surface instruments, installed on a truck in standard 19-inch relay racks.

In operation, the electromagnetic probe is dropped to the bottom of the well. Next, with the instruments turned on, it is pulled back out of the pipe at the uniform rate of 6 inches per second. Simultaneously, a 60-cycle signal is fed down the cable from a generator on the surface. This is radiated by the exciter coil out to the casing walls, where it sets up eddy currents.

Because of these currents, the signal which reaches the pickup coil not only is much weakened but also shifted in phase. This phase-shifted signal is greatly amplified and used to modulate a 3-kc carrier, which then travels back up the cable to the surface.

Since this same cable also carries the 60-cycle signal which goes down the hole, a high-pass filter and amplifier reject it, passing only the FM-modulated carrier. The signal then is demodulated and further stepped up by a tuned amplifier. Its time phase lag is determined by a phase meter, and the resulting signal fed to a pen recorder.

A typical pen recording of a length of pipe reveals every change in thickness. If, for example, a pipe had thinned for some reason at 4,000 feet, the recorder would indicate this, Or, if there were pitting at about 5,050 feet and again at 5,075 feet, the recorder would show this as well.

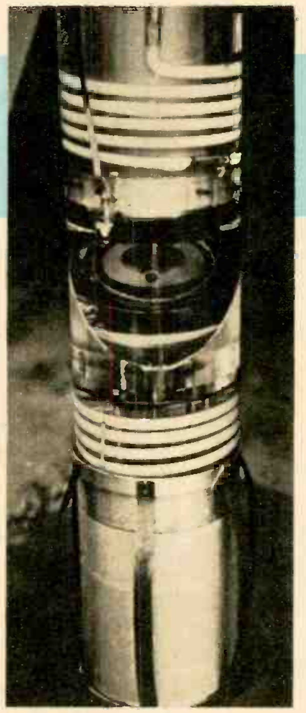
Though the device operates on a relatively simple principle, its importance shouldn't be underestimated. For the long and the short of the matter is that oil companies now may obtain information on corrosion and other deterioration of well casings which previously was unavailable. And electronics has made it possible.

Another important objective of oil companies is to make oil wells as automatic as chemical plants and refineries already are. Here, too, electronics is in the picture. Fact is, new electronic devices automatically make well tests, transfer custody of crude oil and even pay the oil-field lessor.

First thing to understand in considering oil-field automation is the fact that most land from which crude oil is extracted is not owned by the oil company. The company merely leases rights to seek oil, and if successful, to remove it. This arrangement has an important bearing on how automation is achieved, as we shall see shortly.

[*Continued on page* 118]

Specially designed TV camera enables engineers to inspect oil-well casings visually at depths up to one mile.



Electron accelerator is big boon in chemical analyses. Machine stands two stories high.

RACK YOUR HAM STATION

PICTURE a ham in action and what do you see? Someone pounding brass, barking into a mike, maybe hunched over a bandspread dial? Could be, but that's movie stuff. Walk into a real shack and the ham probably is rassling with tangled wires in back of his rig. Or maybe he's pushing a new VFO onto a jammed-up table while a receiver slides off the other end.

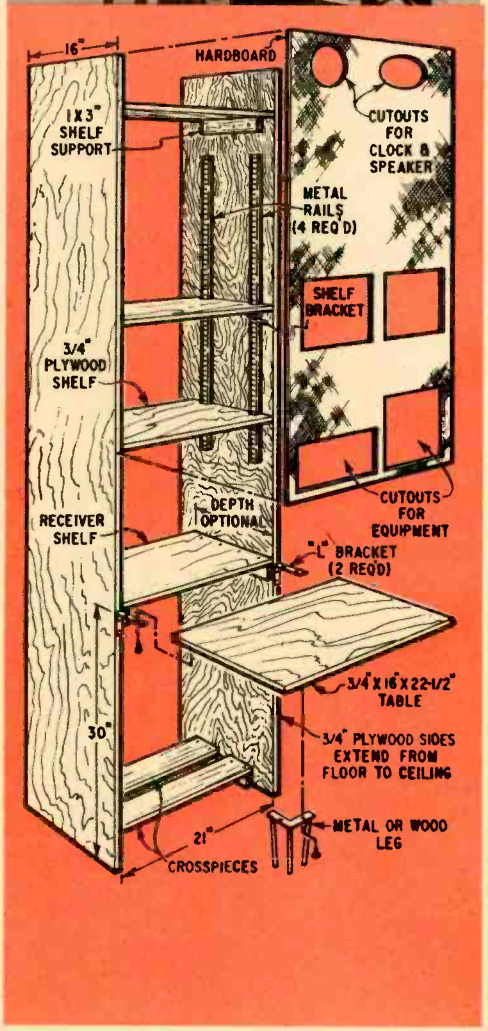
The answer? Don't wreck it, rack it! And one way to rack it is with EI's 15-buck home-brew week-end special.

Our drawing and photos give the details, so we'll concern ourselves here with the basics. Start with a standard, 4x8-ft. sheet of ¾-in. plywood. Cut it into three long strips, each 16-in. wide and your rack is underway. Two strips become the uprights, the other is sawed up for shelves.

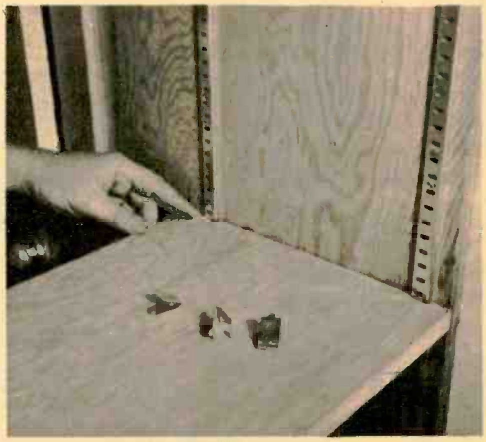
Next step is to fasten one upright against a convenient wall. (If the ceiling is less than 8 ft. high, trim the upright at the top. And if there's a baseboard along the wall bottom, use a wood shim at the top so the upright stands true and vertical.)

Note that three shelves, or crosspieces, are fastened permanently to give the rack rigidity. Two are near top and bottom, the other is the middle shelf which supports the receiver at about table height. The adjustable shelves use the metal rails and matching clips which are stocked in hardware stores. Each movable shelf is notched into its rail to prevent any front-to-back sliding.

A finished appearance can be achieved by using a large piece of hardboard as a front panel, marked and cut according to the equipment on the shelves.



Easily modified or moved, EI's wooden rack costs much less than commercial metal variety. Basic structure consists of two uprights made of ¾-in. plywood, cut to extend from floor to ceiling. Convenient depth is 16 in., but figure can be altered to meet your requirements.



Metal rails installed above receiver shelf accept clips which support additional shelves. Note that shelf ends have been notched for snug fit.

Two crosspieces at bottom add rigidity. Top shelf and receiver shelf also are attached permanently.

Rear of rack is open, leaving equipment and interconnecting cables within easy reach. AC outlets can be installed along rear of either upright.

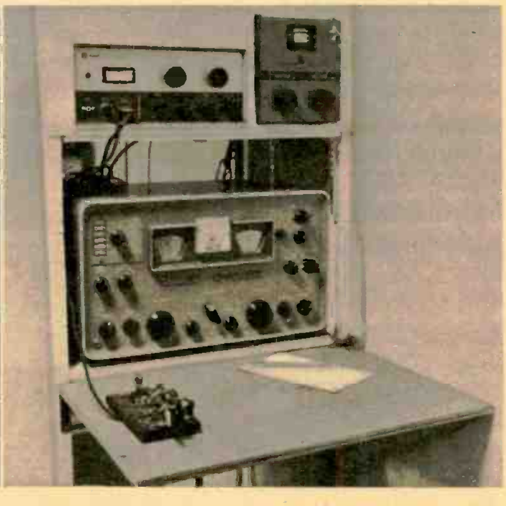
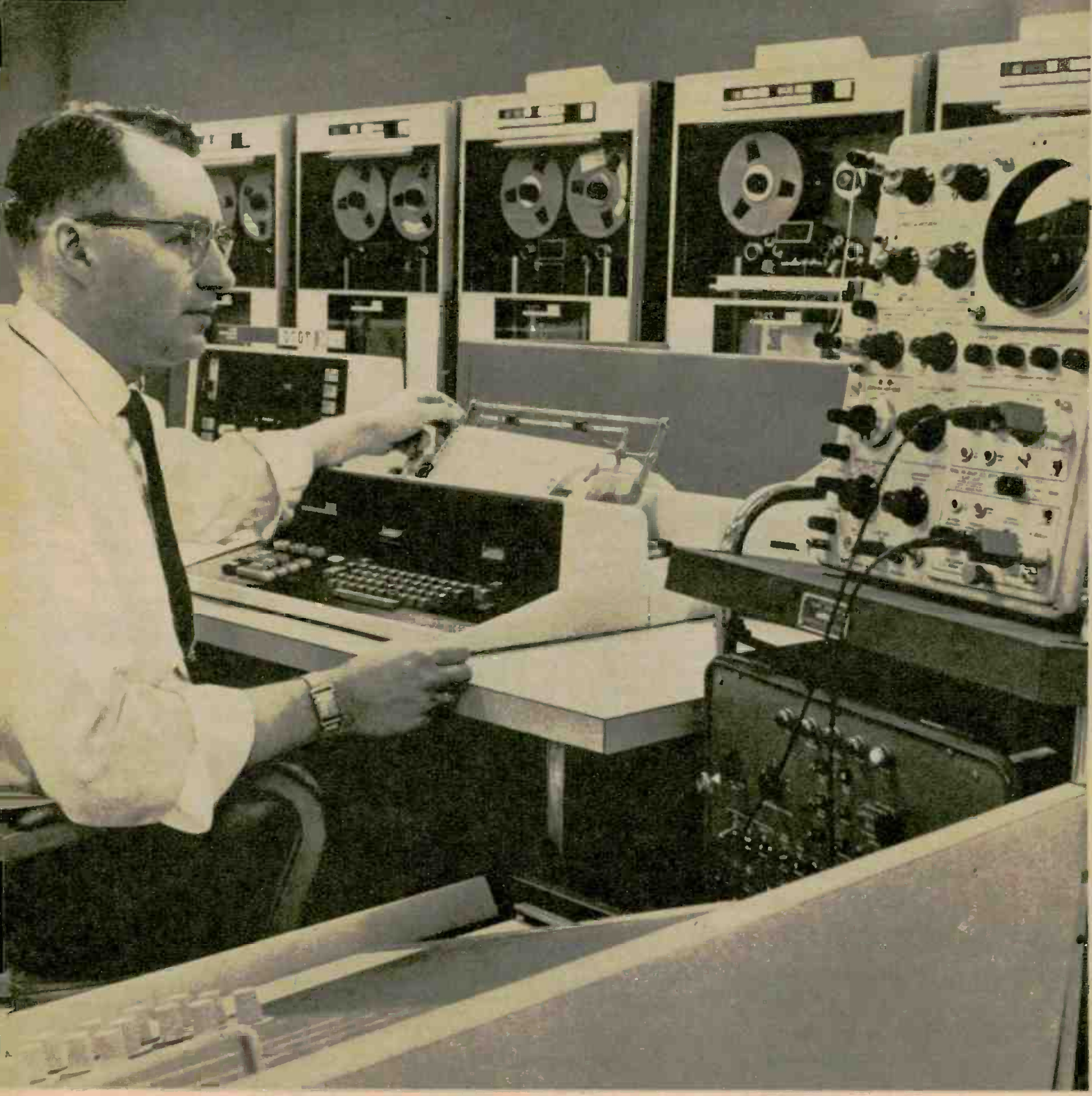


Table directly in front of receiver is perfect for key or logbook. For two-tone rack, paint edges of table and crosspieces contrasting color.



TALK ON A

Someday you'll be able to afford laser

BY EDWARD LININGER

COMMUNICATIONS is a word you hear a lot these days. Instant, world-wide, broadcast, TV, amateur and Citizens Band are but a few of the terms that get linked to this word. And one of the newest methods of communication—though still in the laboratory stage of development — involves the laser.

Our novel method of communications permits you to talk on a beam of light. You might liken our talking flashlights to a poor-man's laser. Using ordinary flashlights, modular amplifiers and a few other standard electronic parts, this project enables you to talk over a distance of a couple of hundred feet. The beam of light is an electro-optical representation of your voice.

To appreciate how far man has come in his effort to communicate over distances, let's go back a few hundred years to see how things developed. Just plain shouting, drum beats and smoke signals were the early techniques. As time passed, Morse code and wires were used. It wasn't long thereafter that the telephone came along, only to be followed by radio.

But radio had a difference. It used what is known as a carrier, on which intelligence was superimposed. At first this carrier was amplitude-modulated. This is still the basis of most AM broadcasting. At the receiving end, the modulation on the RF carrier is converted back to audio.

Then came frequency modulation. With this system, the RF carrier's amplitude remains constant but its frequency is varied. In either case there is always a carrier that has something done to it to get the message across.

It's the carrier concept that is important in our talking flashlights. In this case the carrier is a beam of light whose brilliance is varied. Just think of an ordinary flashlight beam as equivalent to the RF signal a transmitter puts out when intelligence is not being transmitted. Speak into a microphone and the RF carrier's amplitude will be varied. Speak into the talking-flashlight mike and you will see the intensity of the light beam vary.

Short-range, line-of-sight voice communication can now be yours for a lot less than those high-priced lasers you've heard about. A pair of our units can be assembled with standard parts for about $30. You can use them to carry on conversations via a light beam in either daylight or darkness.

The voice-modulated light beam is virtually eavesdrop-proof (though it's unlikely a hobbyist would want a secret means of communication). The beam is directed to the other unit only and cannot be converted easily into audio by someone else.

In addition to being useful for experimental work and Science Fair projects, the talking flashlights can be used for house-to-house, construction-site and camping communications.

How They Work

Take a look at the schematic and pictorial. The heart of the unit is a modular five-tran-

LIGHT BEAM

communications, but in the meantime try flashlights.

sistor amplifier and a doctored-up transistor. The amplifier is used for both transmitting and receiving.

When you want to transmit, the signal from your microphone is fed to the amplifier, where it is boosted in strength to modulate, or vary, the intensity of the flashlight bulb. Input and output connections to the amplifier are switched by S1.

When receiving, modulated light from the transmitting unit is focused by an ordinary magnifying glass on photo transistor Q1. Q1 also provides the first stage of amplification. The amplifier boosts the signal from the transistor so it is large enough to drive a small speaker.

Transistor Q1 is a standard audio type that is modified so it will work as a photo transistor. It is made into a photo transistor simply by removing the paint from its glass case to expose the internal junctions.

To get a better idea of how the transistor can be used in this way, let's have a brief refresher on semiconductor theory.

Current carriers in a transistor can be caused to move by three types of energy—heat, electrical potential or light. Overheat an operating transistor and you see circuit operation go haywire mighty quickly. Apply an electrical signal to a transistor and current through it and the circuit will increase. (This, by the way, is the way in which most transistors are used.)

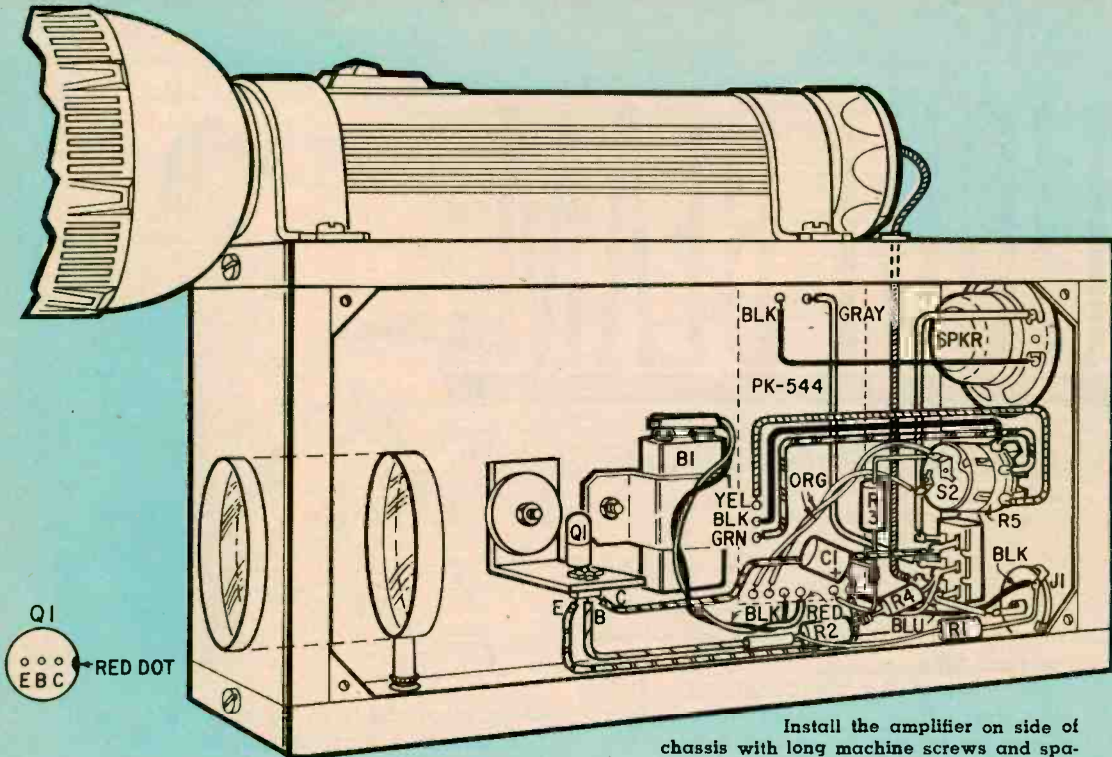
When a beam of light is focused on one of the PN junctions in a transistor, current will flow in about the same way it would if you applied a signal to the transistor's base.

An increase in light intensity causes an increase in current from the transistor's emitter to collector. A decrease in light intensity on the internal elements of the transistor reduces the current flow from emitter to collector. When the intensity of the light beam on the transistor changes, the signal to the amplifier will change.

Construction

The most important part of construction is optical. By this we mean that transistor Q1 must be mounted at a point where all light aimed at the lens will be concentrated on a single point—the transistor. This point is called the focal point of the lens. The diameter of our lens was 2 inches and its focal length was 4 inches. Therefore, we mounted Q1 exactly 4 inches behind the lens. A larger-diameter lens would gather more light and could be used; however, its greater focal length would require a longer box.

To find the focal length of your lens, aim the lens at a distant light bulb. Then focus the image of the bulb on a piece of paper until you have a minimum-size spot, then measure the distance from the lens to the paper. This distance is called the focal length and is the distance your transistor must be mounted behind the lens. Mount the transistors' socket on a bracket made from scrap aluminum. It's important to mount the transistor correctly. The red dot on the transistor's case must be turned *away* from the lens. By mounting the transistor this way, the



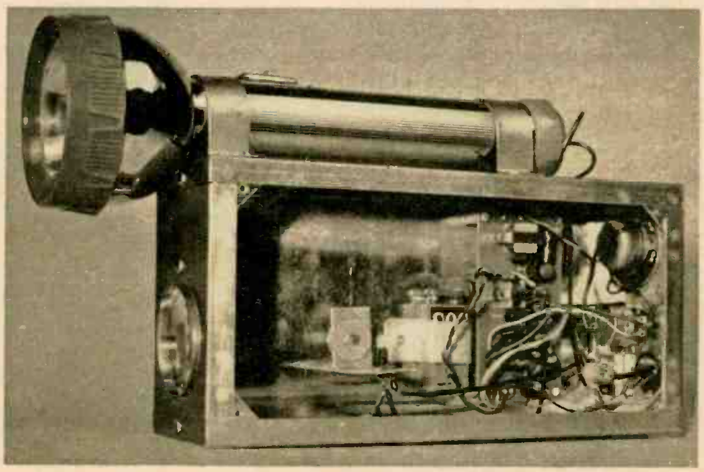
Install the amplifier on side of chassis with long machine screws and spacers. Q1's position depends on focal length of lens.

TALK ON A LIGHT BEAM

more sensitive transistor junction will be facing the lens.

Once the transistor is mounted, mount all other parts in the rear of the cabinet as shown in the pictorial. Be sure to install the amplifier with spacers so its back does not touch the cabinet.

Before mounting the flashlight install the PR-7 bulb (this type can be modulated more easily than other types). Drill a hole in the cap at the back of the flashlight and insulate the spring in the cap with tape or spaghetti so that it *does not* make contact with the battery. Place the batteries in the flashlight and solder a piece of wire to the back of the



Do not mount the amplifier until you have determined where Q1 will be located. Because our lens had a 4-inch focal length, Q1 was mounted in such a position that there was plenty of space for amplifier and other parts. If your lens has longer focal length it may be necessary to install amplifier in upper part of cabinet.

last battery. Pull the wire through the cap and connect it to S1. Mount the flashlight on the cabinet so that its metal case makes good electrical contact with the cabinet.

Then mount the volume control, microphone jack, switch S1, the lens and the speaker. Connect the wires and components going to these parts, then install the bias resistors following the layout in the pictorial. Use stranded wire to Q1's socket.

You can use almost any low-impedance carbon microphone. Lots of them are available on the surplus market and they don't cost much. If their resistance is in the vicinity of 30 to 100 ohms they'll work. One possible source is mentioned in the Parts List. If you have a pair of old telephones lying around, the carbon mike in the mouthpiece will be fine.

Test and Adjustment

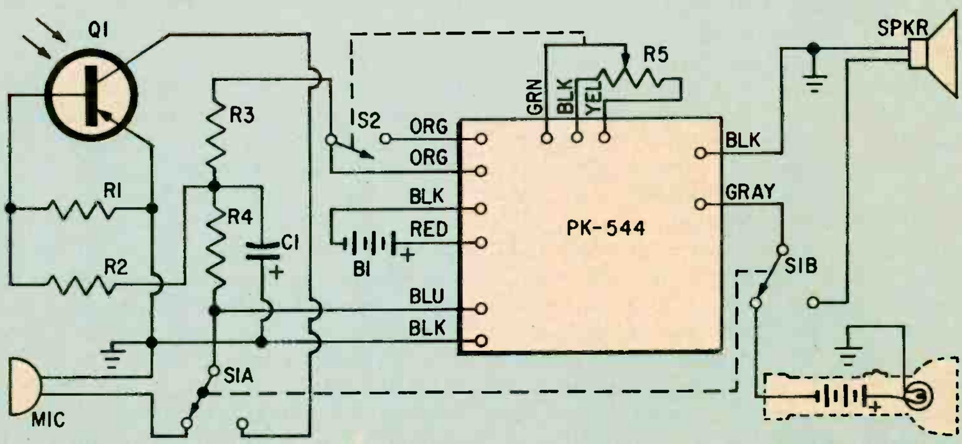
Focus the image of a light bulb about 15 feet away on Q1. Adjust the position of Q1 so the image of the bulb is sharp. With S1 in the receive position, turn the volume control up. There should be a loud hum, indicating that the receive function is working. Then push S1 to the transmit position and speak into the mike. The flashlight bulb intensity should change and the volume control should be able to affect the change.

Operation

Make your first test with the units separated about 20 feet. When operation is satisfactory, increase your distance. As you increase separation the position of both units will become more critical. You may find it necessary to mount both units on inexpensive camera tripods so perfect aim can be maintained.

When you use the flashlights outdoors, it will be helpful to shield the lenses from bright light. A simple way to do this is with hoods made from tin cans painted dull black.

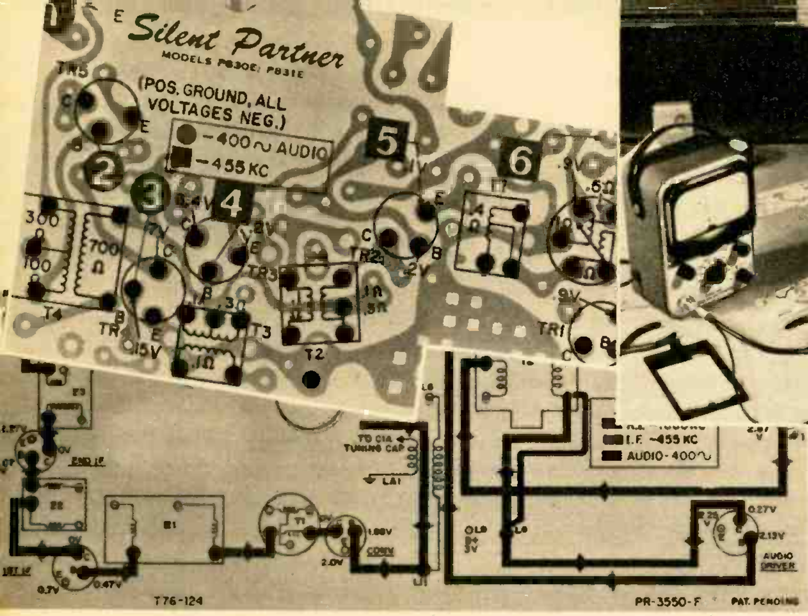
And if you plan to carry on long conversations use alkaline energizer batteries in the flashlights.



When S1 is in transmit (as shown), mike is connected to amplifier input and amplifier output is connected in series with flashlight to ground. Light beam brilliance is modulated by amplified mike signal. Since black battery lead is connected internally to top orange lead, DC is applied to carbon mike through R3, R4.

PARTS LIST

B1—9-volt battery
C1—20 mf, 15 V electrolytic capacitor
J1—Phono connector
MIC—Carbon microphone: 30-100-ohms impedance (McGee Radio Co., 1901 McGee St., Kansas City 8, Mo. Stock No. MCS-2841. 79¢ plus postage.)
PK-544—Modular amplifier (Lafayette 99 G 9037)
Q1—2N279 transistor (Amperex)
R1,R4—10,000 ohm, ½ watt, 10% resistor
R2—270,000 ohm, ½ watt, 10% resistor
R3—68,000 ohm, ½ watt, 10% resistor
R5 — 10,000-ohm, audio-taper potentiometer with SPST switch
S1—DPDT slide or toggle switch
S2—SPST switch on R5
SPKR—2-inch, 8-10-ohm speaker
Misc. — 10x5x3-inch aluminum chassis (Premier ACH-401), 10x5-inch aluminum chassis bottom plate (Premier ABP-401), flashlight bulb: 3.7 V, 300 ma, (GE PR-7 or equiv.), 3-cell flashlight



NEW

YEARS AGO—in the days before science fiction became science non-fiction—some prophets were predicting that radios would become so simple and inexpensive that servicing would be no more. If a set stopped working for some reason or other, its owner would just throw it away and get another. At most, he might pull out the "works" module and plug in a low-cost replacement.

But predicting is an inexact science, and in this case it was way off the mark. Radios have become dirt-cheap, all right (we put a $2.98 transistor portable through its paces just the other day). But servicing is still very much with us.

What people think of a product often depends on how easily and cheaply it can be repaired. This means that it's good business for a manufacturer to devise a shortcut or two for servicing his radios or TV sets. And that's exactly what some have done.

These shortcuts understandably are of big interest to servicemen. But they're a boon to hobbyists, as well. For they make it downright easy for most any electronics-minded person to service his own sets—not to mention those of his friends and neighbors.

As you're probably aware, most transistor radios include a printed-circuit board, and it's no picnic to try to trace a signal through one. Yet this must be done when the cause of the trouble can't be uncovered immediately. One easy answer to this problem is a card of the same shape and size as the printed circuit board itself (see photos above).

The card fits over the back of the radio neatly (after the rear cover has been removed, of course). What's more, the various test point holes on the card fall over specific terminals, solder joints and conductors on the printed circuit board. Marked right on the card in three colors (blue for RF, red for IF and green for AF) is the path that the signal takes from the antenna to the speaker.

But that's only the beginning. The card gives the correct voltage that should appear at each test point, shows the proper lead orientation for each transistor and is, in effect, a simplified schematic diagram of the receiver. Special color coding even tells you what kind of signal to feed in at any point on the board (1600 kc for RF, 455 kc for IF and 400 cycles for audio) when you want to do some signal tracing.

How does all this work to help fix a radio? Say we have a transistor portable for which a card is available, and that the radio suffers from low volume. We've checked the batteries and battery contacts, the antenna and various other components for loose connections. We next slip the card over the back of the radio and check the voltages at the various transistor leads through the holes in the card.

If we get an incorrect reading at one

Typical of the many new aides for speedy transistor servicing is General Electric's Silent Partner (at right). It features color-coded cards which can be dropped right over the printed-circuit board in a transistor portable. Once a card has been put in place, finding the defective stage or component in a faulty circuit usually is as quick as 1, 2, 3.

LOOK IN SERVICING

lead, reference to the Voltage Reading Interpretation Chart furnished with the card will tell us what's probably the cause. It could be a bad transistor or maybe a resistor; replace the part and the radio works again.

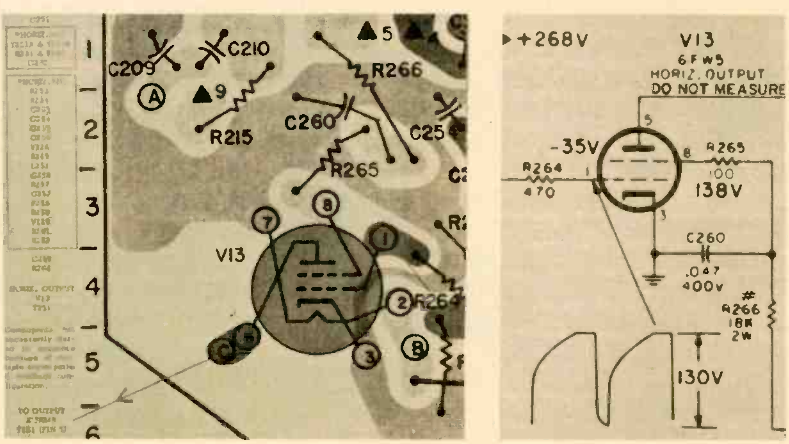
Things also are looking up for TV repairs in much the same way. The printed circuits in TV sets are no simpler than those in transistor portables (that's the understatement of the year). But hold on—there's a whole series of colored diagrams for various models of TV chassis (see photos at lower right). They show signal flow in the same fashion that the cards depict signal flow for the little portables.

What you get is a master schematic diagram, color-coded so you know precisely where you are at any given spot. It also shows proper waveforms and correct voltages and resistances for critical points all through the circuit. Along with this diagram comes other valuable servicing information—including a number of colored charts, outlining the audio and video circuits, the vertical and horizontal sync circuits and so on.

Armed with this battery of data, even a neophyte ought to be able to make a sizable stab at fixing a TV set. But personal portable or TV, it all boils down to the same thing. And that's what we call a new look in servicing.

—Paul Daniels

Figuring out what's where on a TV set's printed-circuit board is a tough, time-consuming chore if the only thing you have to go by is the schematic itself. But schematics and pictorials are keyed on TVD's Colorgrams to make a serviceman's task that much easier. You mightn't guess it, but both diagrams shown here represent the same portion of the circuit.



MOST anyone who's tried living in an anarchy probably would agree that laws are nice to have around. Radio broadcasters more or less unanimously are sold on laws, too, for the simple reason that the spectrum would be chaos without them. Matter of fact, most broadcasters toe the legal line so closely that logging anything illegal is almost as rare as an unsolicited QSL. But some broadcasters *do* go a little farther afield.

The law—international law, that is, stemming from an organization called the International Telecommunications Union—says that all international SW broadcasting is supposed to take place within the limits of 12 specific bands (our chart lists these bands and shows the frequencies concerned). Yet certain SWBC stations continue to broadcast outside frequency allocations. Doing so just plain ain't cricket, of course. It's also a menace to international communications and in some instances dangerous to public safety. But those offband SW stations sure make for some prize DX.

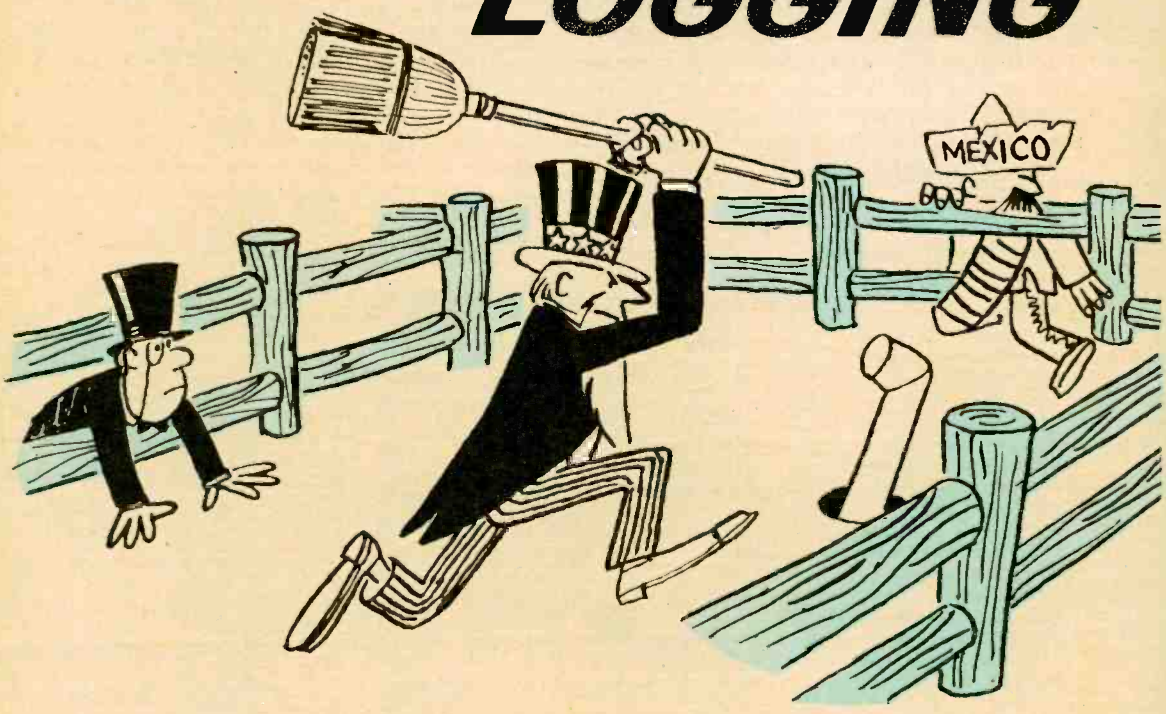
First for a look at the dangerous side. Two prime examples of offband SWBC outlets are R. Chiclayo and R. Huaraz, both in Peru. Drifting back and forth from 5500 to 5700 kc, the two at various times have lighted on 5559.5, a North Atlantic aeronautical channel. With communications on this route often a ticklish matter and with the present low sunspot count producing world-wide reception on these frequencies, such interference conceivably could cause a disaster at any time.

In a similar vein, utility services often are plagued by offband broadcasters. The Ontario Department of Lands & Forests, for example, legally transmits in the 4500-4600 kc range. But drifting Ecuadorian SWBC outlets quite *il*legally give the Lands & Forests people plenty to worry about. It doesn't happen often but once is enough to spell serious trouble.

Now none of the broadcast stations we've mentioned so far has the slightest interest in long-range coverage. Their unconventional activities are due largely to lax government administration (both Peru and Ecuador belong to that International Telecommunications Union we brought up earlier, but you'd never know it).

Also part of the picture are the stations'

LOGGING



own sloppy technical standards. Transmitter frequencies obviously are not crystal-controlled. And in many instances stations are allowed to use any channel they choose, since getting their own message across seems far more important than adhering to any mere international agreement.

In another category, we have small nations or small broadcasters which must obtain international coverage with a minimum number of transmitters. And, for this set, it clearly is tempting to move off the QRM-ridden SWBC bands.

As a case in point, consider R. Caribe (now R. Santo Domingo). When this station first came on the air, it used 9485 kc which, believe it or not, happens to be a telephone channel for the neighboring Radio Corporation of Puerto Rico. Another offbander is Kol Israel on 9009 kc, a Royal Canadian Air Force frequency. Others in this same pasture are R. South Africa and R. Nacional Espana, both of which can be found on unorthodox frequencies.

Reason such examples abound is because little pressure is brought against them. Fact is, some major broadcasting organizations have been known to pull similar tricks. The Communists, for example, frequently use offband channels, and it seemingly makes no difference whether the broadcaster is Moscow, Peking, Budapest or Prague.

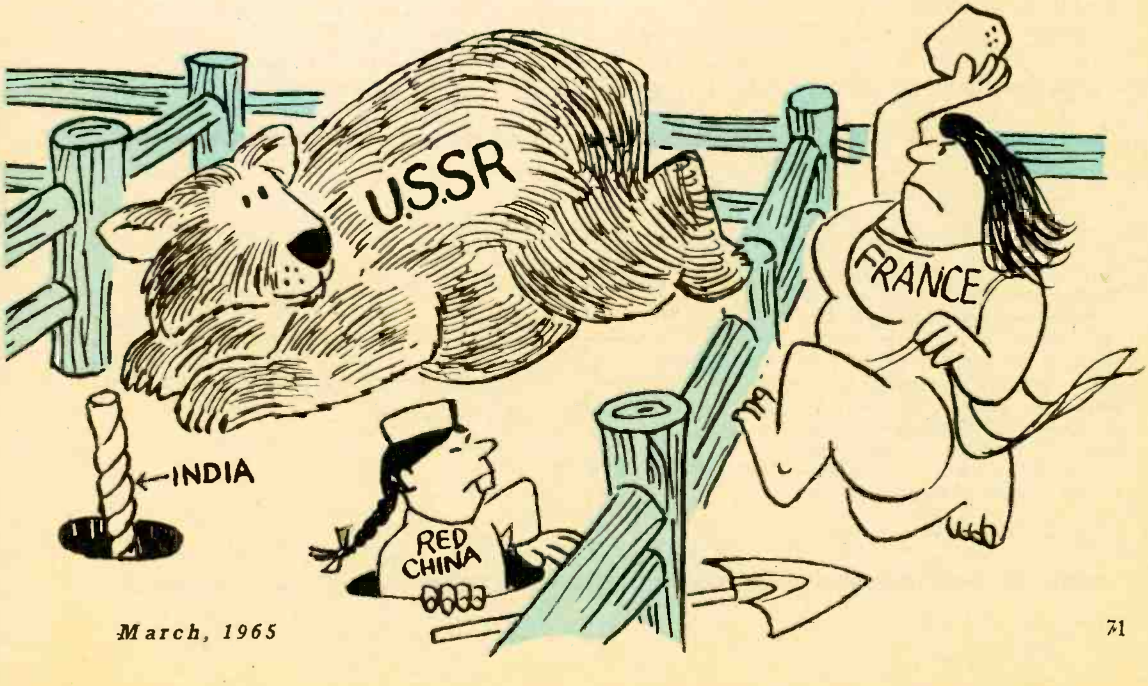
Even that much-respected giant among broadcasters, the British Broadcasting Corporation, has been known to revert to offband tactics. One of the BBC's favorite frequencies is 9410, which happens to fall within a few kilocycles of the AT&T station at White Plains, N.Y. True, the British beam this particular transmitter to Africa, but it nonetheless puts a strong signal into North America.

Another BBC channel is 12040 kc, beamed to South America and smack in the middle of what is supposed to be busy radioteletype territory. Still another offbander is All India R. on 9870 kc—a U.S. military channel. Question is, so long as the BBC and AIR do it, how can we expect small fry like R. Huaraz to stop?

Getting down to the meat of the matter, this whole business of offband SWBC stations really shows several sides. Fixed circuits of international telephone variety are

[*Continued on page* 119]

ILLEGAL DX



GOOD READING

By Tim Cartwright

THE ENCYCLOPEDIA OF HIGH FIDELITY. Six volumes. Edited by John Borwick. Focal Press, New York and London. $9.50 per volume, $49 the set

One *could* talk about this unique British encyclopedia in a general sort of way, of course, but we've chosen another approach. Most readers probably will be more interested in one or two volumes rather than the whole premium-priced set, so it makes more sense to cover each of the six entries individually. Here we go, then, on the chance that you may find one or more of them up your particular alley.

ACOUSTICS. By G.W. Mackenzie

The subject being what it is, you might expect this volume to be the most textbookish and technical of the lot. But it isn't. Instead, it poses a readable and thoroughly practical explanation of the nature of sound and its reproduction. Theoretical principles are there all right, as are such important matters as recording-studio practices and miking techniques. In short, this definitely is a volume worth dipping into.

DISC RECORDING AND REPRODUCTION. By P.J. Guy

There's a good deal of solid and interesting information in this volume but a lot of frustrating omissions as well. The slighting of stereo is one real shortcoming. So, too, is a lack of recognition of what's been happening on this side of the Atlantic for the past few years.

Both flaws join, for instance, in providing not even a few-word description of the moving-magnet stereo pickup, the overwhelming favorite on these shores. Similarly, nothing is said about rumble and acoustic feedback in stereo record-playing, nothing about such lately-interesting subjects as vertical cutting and playback angles.

Give this volume an A for effort and an F for frustration.

TAPE RECORDING AND REPRODUCTION. By A.A. McWilliams

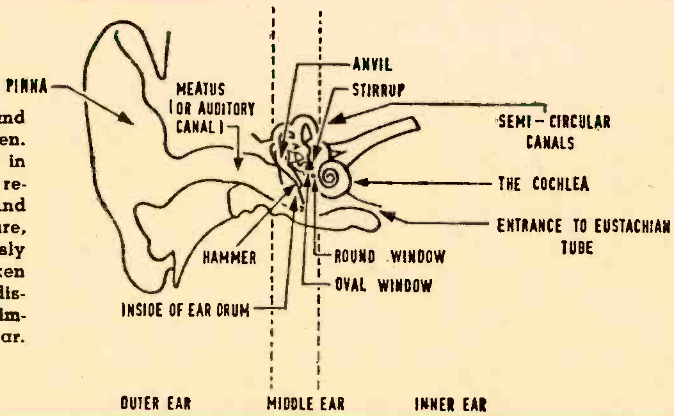
There's no complaint about the lack of specific stereo coverage here. And the fact that there is little material aimed at the home recordist doesn't detract much, either. Matter of fact, the amount of information here that you almost can't find elsewhere makes the few omissions seem trivial in comparison. This one certainly is worth looking over.

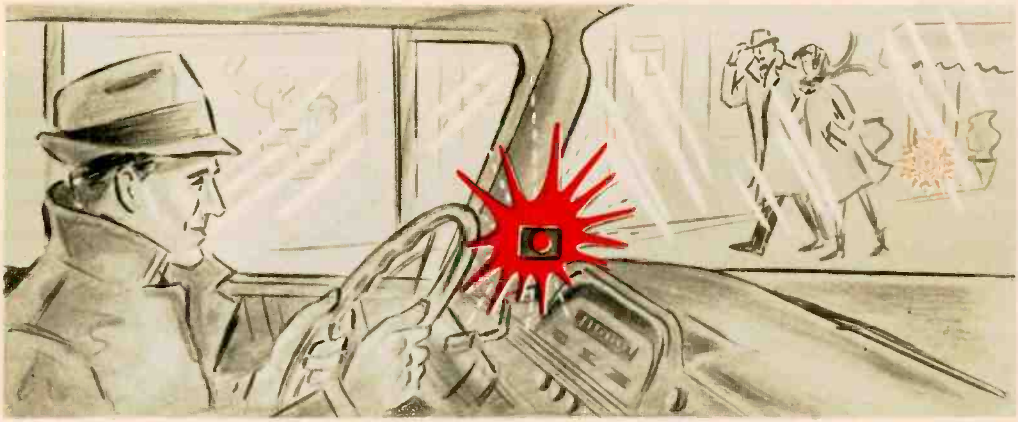
RADIO RECEPTION. By H. Henderson

Here, again, we have the problem of slighted stereo (a final chapter on multiplexing is all we get). And here, too, is obvious confusion about who the potential reader

[*Continued on page* 109]

Ears are the thing in hi-fi, and they range from tin to golden. But precisely what takes place in the human hearing system remains a subject for experts. And even they don't know for sure, since the process is curiously complex. Our illustration, taken from the book on acoustics discussed above, shows a much simplified diagram of the human ear.





DRIVER'S ICE ALARM

This low-cost ounce of prevention tells you when the road is dangerous.

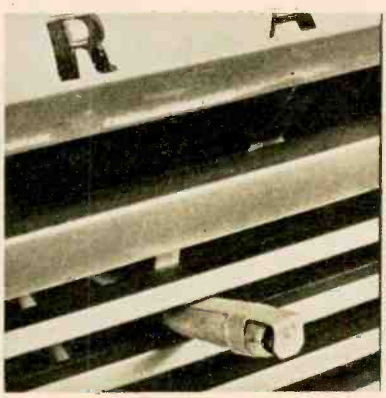
By STEVEN E. SUMMER

THE late-afternoon winter sun is bright, the road is clean and inside the car you are warm and comfortable. You can see there's no snow on the road but what you don't realize is that some snow has been melting, and the water flowing onto the road is starting to freeze. Run into one of these patches of ice and you may be in for a bad skidding accident—or worse.

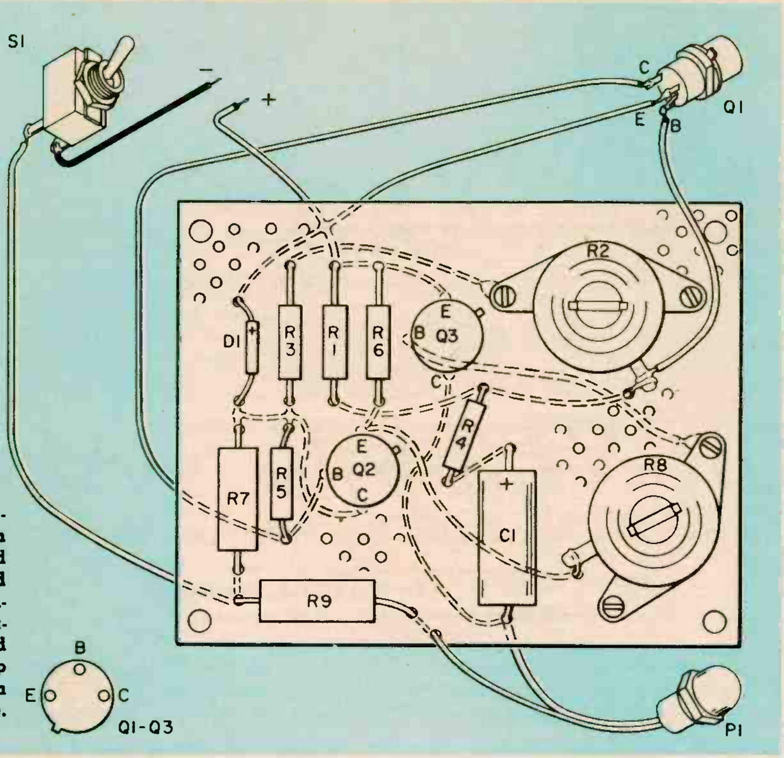
But with our Ice Alarm in your car you'll be forewarned of dangerous road conditions. When the air temperature falls to 36° F., the Alarm's warning light starts flashing. At 32° the light stays on.

Because it is difficult to measure the temperature of the road directly, the Alarm measures the temperature of the air just above the surface. And approximately 2 feet above the road the temperature could be as much as 4° higher when the air is windy and humid. On a wet road, on which ice won't form until the temperature drops below 32° (with the air dry and calm, ice may form when air temperature is as high as 36°), the Alarm will start flashing. When the alarm light is on constantly, road conditions are becoming pretty bad, though you ordinarily might not realize it from inside the car. This inability to judge road conditions from several feet away causes hundreds of accidents each year. The Ice Alarm solves the problem by doing the judging for you.

Basically an electronic thermostat, the Alarm uses a transistor (mounted on the



The near photo shows how Alarm's probe is installed in car's grille. Be sure wire going back to unit in car doesn't come in contact with hot parts of engine. Photo far right shows installation of warning lamp under dash. Alarm box should not be mounted on firewall as heat may affect performance.



All parts will fit easily on a 3x4-inch piece of perforated board. Mount board on side plate of utility box, using machine screws and spacers to keep back of board from touching the plate.

DRIVER'S ICE ALARM

grille in the front of the car) as a temperature sensor. Response is fast and the Alarm can be calibrated easily and accurately.

Construction. Mount all parts except D1 on a 3x4-inch piece of perforated board as shown in the pictorial. (Wiring on the back of the board is shown with dotted lines.) Mount the two transistor sockets on the board by pushing their pins through the holes and bending them flat on the back of the board. Connect all other parts, using spaghetti on bare leads. Now install D1, using a heat sink on its leads and a low-temperature iron. Be sure D1's polarity is correct.

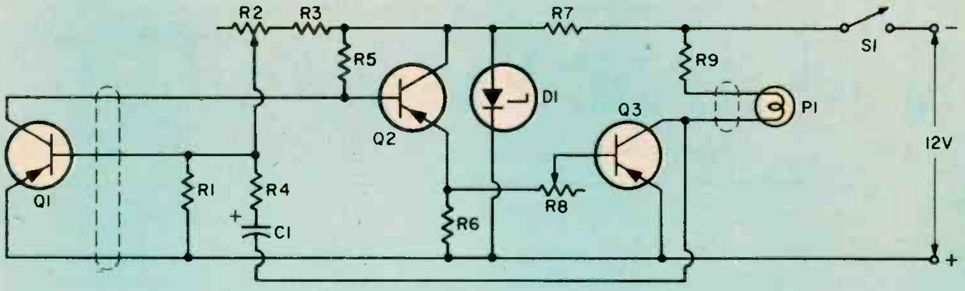
The perforated board will fit in a 4x4x2-inch aluminum utility box. After the case has been drilled, insert grommets in the cable holes, mount switch S1 and a six-lug terminal strip. Mount the board on one of the case's side plates with machine screws and spacers.

Make a bracket for pilot lamp P1 from a piece of 1x3-inch scrap aluminum. Drill mounting holes in the bracket so it can be mounted under the dash or near the windshield. Solder a transistor socket on the end of the three-conductor probe cable, making sure the emitter, base and collector connections are correct.

Don't try parts substitutions. However, if your car has a 6-volt electrical system, use the alternates specified in the Parts List for D1, R7 and R9.

Calibration. Fill two glasses with water

Completed Ice Alarm ready for installation. Note how the probe is constructed and that only its tip is exposed. Shield should be 1/8-in. away from tip.

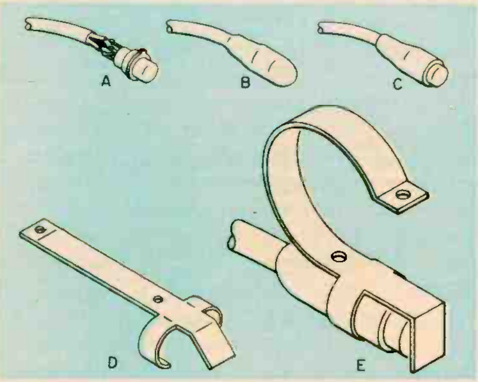


Q1's collector current changes with temperature. Current change is coupled by Q2 to Q3 to change its bias. At 36°, Q3 is forward-biased so it conducts. P1 flashes because positive feedback (R4, C1) causes oscillation. At 32° oscillation stops and P1 stays on. Zener diode D1 provides voltage regulation. R2 and R8 compensate for transistor differences and are used to calibrate the unit.

PARTS LIST

C1—20 mf, 12 V electrolytic capacitor
D1—1N753 zener diode (12 V) or 1N1520A (6 V)
P1—Pilot lamp; 6 V, 40 ma (GE No. 345)
Q1-Q3—2N508 transistor
R1—10 ohm, ½ watt resistor
R2—250 ohm, 2 watt, wire-wound flange mount rheostat (Mallory FL-250)
R3—220 ohm, ½ watt resistor
R4—6,800 ohm, ½ watt resistor
R5—15,000 ohm, ½ watt resistor
R6—1,000 ohm, ½ watt resistor
R7—200 ohm, 1 watt, 5% resistor (12 V); 15 ohm, 1 watt 5% (6 V)
R8—1,500 ohm, 2 watt, wire-wound flange mount potentiometer (Clarostat U39)
R9—150 ohm, 1 watt, 10% resistor (12 V); 27 ohm, ½ watt 10% (6 V)
S1—SPST switch
Misc.—4x4x2-inch aluminum utility box (Premier AC-442), Insul-X rubber tool dip, 3-conductor cable, pilot lamp holder (Dialco 101-5030-971), perforated phenolic board, terminal strips

and ice cubes. Put one glass of water in the refrigerator and let the ice in the other glass melt. Wait another minute or two and the water temperature should be approximately 36°. (A thermometer can be used to check temperature but high accuracy is not required here.) Now dip the top of Q1's case into the glass of ice water that has been kept in the refrigerator (32°) and wait a second. Adjust R2 until P1 lights constantly but is just on the verge of flashing. Next, put the top of Q1 into the other glass of water (36°) in which the ice has melted. Wait a few moments and adjust R8 so P1 goes out but still is on the verge of flashing.



Coat all of bare probe (A) with the insulating compound, as in B, then remove compound from tip (C). Construction of probe shield is shown in D and E.

Repeat this process two or three times until the settings remain the same. Better results may be obtained by switching the transistors around. Determine (with a transistor tester that measures DC beta) which transistor has the highest beta and use it for Q2. Use the other transistor for Q3. Don't switch transistors again or calibration will change.

After calibration, put several coats of a rubber tool-insulation compound, such as Insul-X, on Q1 and its socket to waterproof and shockproof the probe. When the compound has dried, cut away some rubber from the tip to expose just the top of Q1. If you don't do this, the Alarm will not respond to temperature changes quickly. The metal shield in front of the probe protects Q1 from the direct force of the wind, which could affect accuracy. Mount the alarm's case under the dash and connect the power cable.

Notes from EI's DX CLUB

WE suspect our ham readers are cursing the BBC these days. True, the Commies have been beaming SWBC transmissions (and we mean *beaming*) into NA on 40 meters for years. And, ITU treaty or no, there doesn't seem much anyone can do about it.

But now the British Broadcasting Corporation not only is pulling the same trick on 40 meters (7130 kc at 1800-2230 EST), but on 75 as well (3952.5 kc at 1900-2145). They would appear to be doing so without violating that treaty since they list their target as the "Atlantic Islands." Nuts.

Jim Howard has moved from Kansas City to Cleveland for the season, bringing reports of his (and our) favorite mystery station right along with him. This one sends the letter L almost continuously in Morse, occasionally tossing in short cryptographic messages. First heard on 6047, the weirdie now appears on 9520 kc from time to time. We once queried the FCC on the station. They know it exists, all right, but that's all the Commission would tell us.

La Voix de Laos has appeared suddenly with a potent signal on 7340 kc, where it first was noted by California EIDXCer H. L. Chadbourne at 0715 EST sign-off. Just one catch—we don't know yet whether this is the real Laotian-government station or a Chinese Communist ringer.

Our ace Maryland member, Hank Holbrook, is back in the news again and he gets better all the time. In his latest venture he got Peking to verify reception of its regional broadcast station at Chekiang, China, on 2475 kc. That's 120 meters.

Dave Bennett (British Columbia) has bagged the U.S. Navy's station NME on Eniwetok atoll (Marshall Islands). West Coast DXers should watch for this one around 4930 kc.

One call which made our ham members flip is YF1HUKE, heard around the upper edge of 20 meters. This sounds like an Indonesian (or Martian) but probably is a pirate.

R. Hong Kong has been getting into the West Coast around 0545 PST on 3940 kc when the ham QRM seems to drop off. Remember that this country and Brunei are the only two British territories in SE Asia that *didn't* join the Malaysian Federation.

Trans World R., Bonaire, Netherlands Antilles, must have set some sort of record in the number of reports it received during its initial tests on the SW bands. Frequencies now include 5955, 6170, 9600, 9705, 9755, 11855, 15240 and 15295 kc. Even BCB DXers weren't forgotten, since there's also a powerful (500 kw) transmitter on 800 kc.

The New Guinea territorial government is planning two new broadcast stations for 120 meters. They'll be VL9BR (2340 kc) at Rabaul and VL9CG (2410) at Gereka, so keep both ears open.

R. Ecuatorial (4926 kc), Bata, Spanish Guinea, is being received as far west as the Mississippi River. Sign-off weekdays is between 1700 and 1715, but this piece of true DX is around til 1800 on Saturdays.

Propagation: The record-breaking BCB DX of the past several months should begin to taper off with the arrival of spring. However, just as the number of medium-wave stations that can be logged will drop off noticeably, FM- and TV-DX will pick up toward the end of the period because of a seasonal increase in sporadic-E activity.

Of the various SWBC bands, 15, 17 and 21 mc all will be usable throughout the daylight hours. Both 9 and 11 mc should start coming through in the late afternoon. And, in the evening and nighttime, 6, 7 and 9 mc will be best for DX.

CQ de Tape

An endless loop of taped CQ's is an easy way to keep a fresh fist.

By HERB FRIEDMAN, W2ZLF

LISTENING to a pile-up of stations answering a *short* CQ is one of the greatest satisfactions a ham can get. On the other hand, the surest way to have the wind taken out of your sails is to pound out CQ's for hours before even one reply comes back. Unfortunately, there are too many of those days when your wrist gets so tired from CQing that it hardly lasts through one contact.

All this will be a thing of the past when you use our CQ Sender to do the CQing. You just sit back and relax while your tape recorder sends an automatic CQ—time after time if necessary.

The Sender is a device which enables a pre-recorded tape to key the transmitter. You record a CQ on a tape loop once. Then, when the tape is played, it keys the transmitter automatically.

The Sender consists of two units: a code-practice oscillator, which is used to record the tape, and a keyer. The CPO is like most any other unit of its type, except it has an audio-output jack. This is used to feed the mike input of a tape recorder. (If you have a CPO, just connect a jack to its speaker leads and you can dispense with our CPO.)

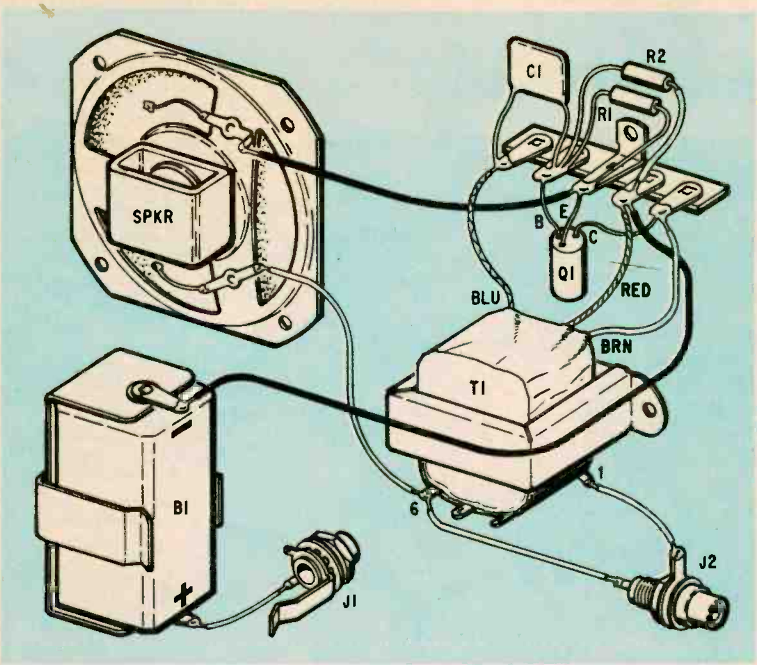
The keyer, which is connected to the recorder's speaker-output jack, contains a relay (and a few other parts) that is controlled by the recorder's output signal. A transformer in the keyer steps up the recorder's output voltage to operate relay RY1. Every time the recorder plays a tone burst, RY1 closes and the transmitter is keyed, just as if you'd pressed a conventional telegraph key. Insensitive to RF pickup, the keyer can be placed behind the transmitter and located several feet from the tape recorder.

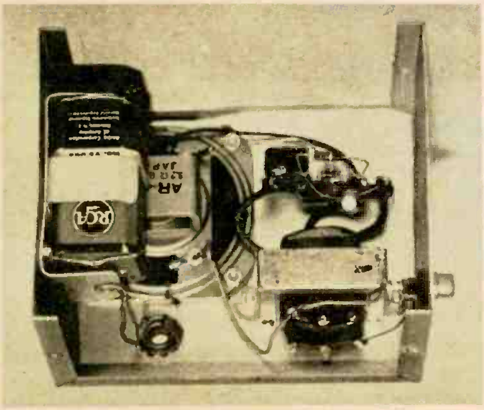
Construction

The CPO can be built in the main section of a 3x4x5-inch Minibox. Parts layout isn't critical but component values are—particularly Q1 and T1. The CPO may not work if a substitution is made for Q1 and T1. Jack J1 should mate with your present key plug and J2 should match the tape recorder's patch-cord plug.

The CPO's frequency is about 400 cps. By changing the value of C1 (and only C1) the pitch can be raised or lowered.

Don't worry about layout. It isn't critical and any you choose will work. Do not try substitutions for T1 or Q1 since CPO was designed around these parts. It will be a lot easier if you mount C1, R1, R2 and Q1 on the terminal strip before putting the terminal strip in the cabinet. And go easy on the heat when soldering Q1. Though it is not apparent in the pictorial, the cabinet serves as the ground return for J1, J2 and the center (ground) lug on the terminal strip.

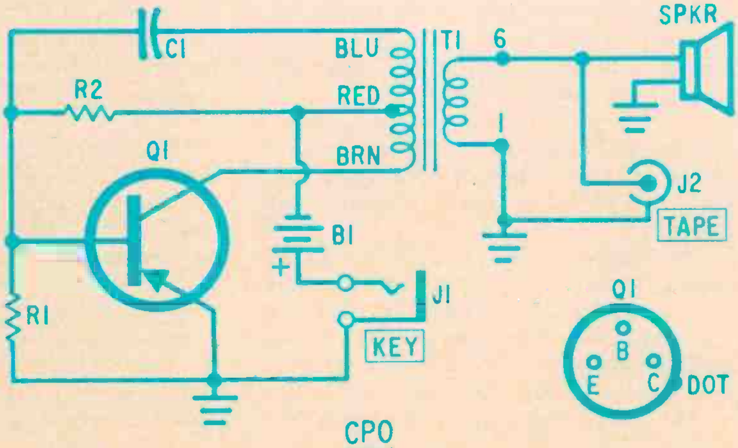


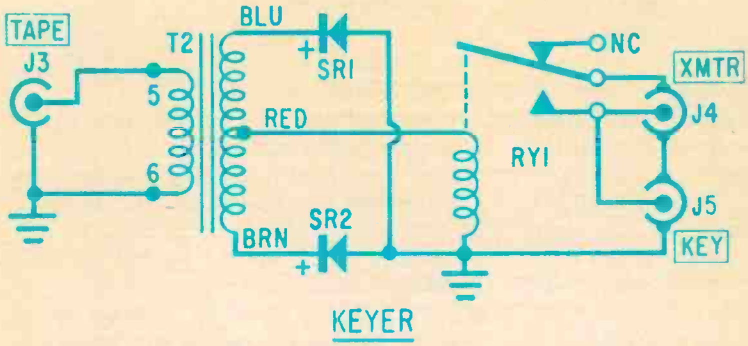


PARTS LIST

B1—6-volt battery (Burgess Z4 or equiv.)
C1—.2 mf, 75 V (or higher) capacitor
J1—Phone jack
J2-J5—Phono jack (see text)
Q1—2N217 transistor
R1—4,700 ohm, ½ watt resistor
R2—27,000 ohm, ½ watt resistor
RY1—SPDT relay, 2,500-ohm coil. (Potter and Brumfield GB5D or equiv.)
SPKR—2¼ inch, 3.2-ohm speaker
SR1,SR2—Silicon diode: minimum ratings; 100 PIV, 50 ma
T1,T2—Universal output transformer (Lafayette 33 G 7505)
Misc.—2¼x2¼x5-inch and 3x4x5-inch Miniboxes, terminal strips, battery holder

Schematic of the CPO. Oscillator's frequency is approximately 400 cps, but it can be lowered or raised by changing the value of C1. Increasing the capacitance of C1 lowers the pitch. Use a smaller-value capacitor for C1 and the pitch will rise.





Schematic of keyer. Signal from recorder is stepped up by T2 and rectified by SR1, SR2. DC energizes relay RY1, causing its contacts to close and key transmitter. Your key, plugged into J5, will key the transmitter instantly.

CQ de Tape

Do not try to increase the speaker's output level. Component values have been selected so the output level at J2 is approximately that of a microphone. The speaker level is about equal to normal receiver output level.

The keyer is built in the main section of a 2¼x2¼x5-inch Minibox. Do not substitute for T2 and RY1. Diodes SR1 and SR2 can be any silicon diode rated at 100 PIV or higher. Jack J4 connects RY1's contacts to your transmitter's key jack. Jack J5, which is connected in parallel with RY1's contacts, becomes your new key jack.

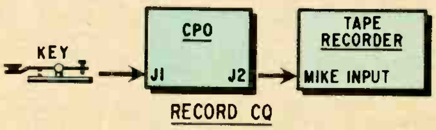
Using the Sender

First thing to do is make a tape loop of CQ's. To determine how much tape is required you'll need to know the time it takes to send a complete CQ. (CQ CQ CQ de—then your call three times). For example, if it takes 20 seconds and you can record at a speed of 1⅞ inches per second, you'll need 37½ inches of tape (20 seconds multiplied by 1.875). A tape speed of 3¾ ips will require 75 inches of tape. To be on the safe side, add another inch or two. Splice the ends of the tape together and you're ready to record.

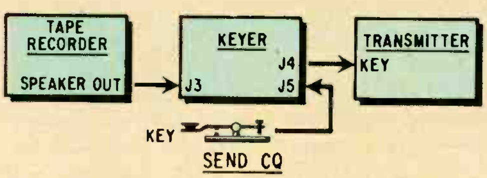
Connect your key to J1 and connect the CPO's output at J2 to the recorder's mike input. Hold the key down and adjust the recorder's level control until the recording level indicator shows normal. Start the recorder and send a complete CQ in the same time (or less) you first clocked yourself at. When the master tape is completed, disconnect the CPO.

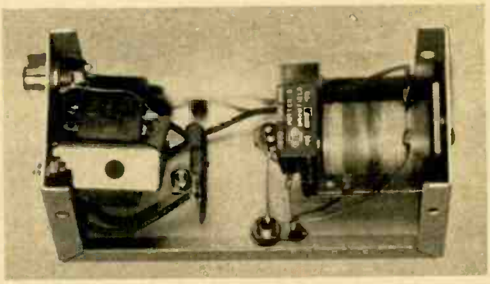
Connect the keyer input jack (J3) to the recorder's speaker output and connect J4 temporarily to the CPO key jack (J1). Play the tape and adjust the recorder's playback level control so RY1 follows the code accurately. You will hear the keying from the CPO and will know when the level is correct. Note the correct output level setting and disconnect the CPO.

Connect J4 to the transmitter's key jack and plug your key into J5. When the tape is played the transmitter will be keyed. Whenever you feel enough CQ's have been sent, just stop the tape and hit the already-connected key to add the K (go ahead). It isn't necessary to disconnect the recorder—it's always ready for instant use



To record CQ on a tape, use the setup above. To use tape to send CQ, use the setup shown below.





All of the components in the keyer will fit easily in the main section of a 2¼x2¼x5-inch Minibox.

By KEN GILMORE. One day a few years ago a young rock-'n'-roll recording star named Johnny Sardo made a guest appearance on TV. Idiot-box watchers across the nation saw Johnny step into the limelight and, for all they knew, start to sing. Only something went wrong. The words coming out didn't match the movement of Johnny's lips.

Such goofs are rare on TV. But lip sync —make-believe singing while a record produces the actual sound—isn't. Fact is, many rock-'n'-roll record idols never sing on television, radio or in person. When called on to perform, they play their records and do a lip-sync act for cameras or audience, just as Johnny hoped to do in this instance.

know him. And they throw in enough gurgles, chuckles and oinks to delight the ears of any scream-ager.

Does our would-be vocalist have an unpleasant nasal twang? Filter it out. Weak on the low end? Beef it up. Thin and flat? Add echo. Switch in a gadget called a Pultec to accentuate or diminish bass, treble or midrange. Call on a Graphic—another control—to exaggerate or attenuate a specific frequency and thus clear up mistakes nature may have made in creating the voice. Disguise the voice completely. Create a new sound, a selling sound that didn't exist before.

Record the song over and over again. If he can't sing it all the way through, record

GURGLE CHUCKLE OINK

The reason is simply that many voices on records nowadays don't exist in real life. They are manufactured products, skillfully fabricated in a recording studio. The basic ingredients are a little singing and a lot of electronic manipulation.

Sitting before an array of dials, knobs, controls and meters as complex as those in a DC-8 cockpit, the recording industry's professional voicemakers go to work. They shape and alter the basic sounds squeezed from a singer until even his own mother wouldn't

it in bits and pieces—a bar here, a phrase there. Is his pitch shaky? His rhythm weak? Somewhere on the tape he got this note right, that rhythm on the beat. Find the good pieces, snip them out, splice them together. The result may not be music, but it sends adrenalin pulsing through the teen-age bloodstream. And it sells records.

Even the orchestra on modern-day records isn't what it seems. Listen to a stereo disc and you'll hear strings on the left, brasses on the right, singer out front. But look in on

YEAH! YEAH! YEAH!

the creation of a new record and you're in for a surprise.

Typical session might take place in a gymnasium-size recording studio in mid-Manhattan. Sitting around the room are a half dozen small groups of musicians—a couple of trumpets in the far corner, a drummer in another corner partially hidden by a screen, a guitar in the near center of the room and small clumps of saxophones, strings and trombones scattered here and there.

Bundles of cables snake across the floor to the microphones placed in front of each group. On one side of the studio sits a closet-size box with a glass window. Inside the box is the vocalist with his own microphone. Sure, he may bleat like a lamb in real life. But the voicemakers with their million-dollar manipulation machinery can make him roar like a lion on the disc.

As large reels turn silently on three-track tape recorders, the singer's voice is recorded on the center track. The signal from the strings is piped to the left track, the brasses to the right. Other instruments are distributed according to plans made before the session began. Their actual position in the studio has nothing to do with where they appear on the record.

When the session is over each track is changed, manipulated, altered. A big echo on the right track makes three trumpets sound like ten. And jacked-up bass gives a beat solid enough to wobble a brick wall.

Though the gimmicked disc reached its present high state of development only a few years ago, the foundations were laid back in the 1930's. When London's famed Ambrose Orchestra rented a huge, empty ballroom for a recording session, it got more than it had bargained for. But the boomy sound on the discs it made wowed the customers. (Any bathroom baritone knows the principle.)

A short time later, Columbia Records discovered Liederkranz Hall, a cavernous studio in New York. Benny Goodman loved the big sound his band made there and Andre Kostelanetz gleefully noted that ten fiddles sounded like 20.

In 1937 it suddenly dawned on recording engineers that you don't have to have a studio as echoey as a locker room to get an echo on the disc. Horace Heidt, recording a snappy number called Little Sir Echo, put a singer in a men's room and gave him a pair of head-phones and a mike. When he sang, his voice had the same kind of sound that makes any man into a Caruso in the shower.

This gave recording experts an idea. They put a loudspeaker on one side of the men's room, a microphone on the other. As a record was being made, they piped the sound into the men's room. The booming echo that resulted was picked up by the microphone, then piped back to the recording machine, where it was mixed with the regular signal.

From that time on, most popular records have been made with generous doses of echo. Fortunately, most companies have regular echo chambers now and no longer use the men's room. But it remained for a guitarist named Les Paul to teach the world a few more recording tricks.

When the first tape recorders appeared in the 1940's, Paul was fascinated. He bought one and started experimenting. One of his early innovations was an extra playback head attached to the machine an inch or so behind the recording head. During the recording he piped some of the signal being picked up by the extra playback head into the recording channel. The result was a sort of shimmering sound—as though the music were coming from underwater. But tape reverb, as it came to be known, was just the beginning.

Paul also began overdubbing. He'd record one guitar part, then play it back and simultaneously use it to record a second part on another tape machine. Back and forth the recording would go from one machine to another, with Paul adding a new guitar part each time. A few passes and he sounded like a

GURGLE CHUCKLE OINK YEAH! YEAH! YEAH!

roomful of guitars. Then he did the same thing with his wife's voice and parlayed one voice and one guitar into a hall full of instruments and a female chorus.

Elvis Presley gave the manipulated sound its next big boost. Though the voice was Presley's all right, his use of tape reverb gave his discs a vibrant, frantic effect. By this time all stops were out. Record buyers were glomming frantically onto new sounds. And the record companies were scratching just as frantically to supply them. Voices created in the studio leaped into the top ten. New sounds, no matter how unmusical, soared into stardom.

The Chipmunk records, made by overdubbing the words of a songwriter named Ross Bagdasarian at twice the normal speed, sold by the tens of millions. A disc called Beep, Beep, a purported race between a Cadillac and a Rambler, poured forth horn sounds that sent many a younger music lover (?) into ecstasy. One of the biggest hits was an Australian classic called *Tie Me Kangaroo Down, Sport*. Its popularity, explained disc jockey Scott Muni of New York's WABC, was due to "something on the record that sounds like a bathroom plunger."

Today, record companies have become expert alchemists, adroit at turning tin-throated sparrows into golden-tongued nightingales. With millions of dollars worth of complex electronic equipment and legions of engineers who can play the knobs and dials as they would an organ, they create sounds at will.

Since the sound that eventually appears on the disc frequently resembles nothing in real life, the vocal equipment which nature gave the prospective star couldn't be less important. If the voice makers think they've got someone with star quality (translation: he'll look sexy to teen-age girls), they couldn't care less if his music-making ability is roughly comparable to that of a rusty hinge.

Go back to a fall evening a few years ago. George Avakian, who produces pop records for Warner Brothers, was watching 77 Sunset Strip. Kookie Byrnes, one of the program's regulars, came on.

"I was struck by a sudden inspiration," recalls Avakian. "He should make rock-'n'-roll records. I was sure that kids would like [*Continued on page* 109]

THE HAM SHACK

BY ROBERT HERTZBERG W2DJJ

TECH TICKETS . . . Seems we stirred up a hornet's nest with a recent comment in this column about the uselessness of the Technician license — uselessness in our opinion, that is. Many Techs took our views as a personal insult. Others admitted that for a mere 8 more words per minute they could be Generals—with the same call letters and with unlimited instead of severely restricted operating rights.

A few even went so far as to say that they know of Techs who actually use some of the General bands. To do so is illegal, of course, but it isn't much of a trick. After all, distinguishing Tech calls from General calls is plain impossible under the present setup.

"I suppose you'll be attacking Novices next," postcards one Tech. Not at all. The Novice ticket serves a very useful purpose and its holders have distinctive calls. What many hams seem to overlook is that the Novice license runs only one year, cannot be renewed and cannot be obtained for a second time at some later date.

Tempus Fugits . . . From the looks of the Quarter Century Wireless Association's roster, you might argue that hams are getting older and remaining in the game longer. Open only to hams who have held tickets without a break for 25 years or more, the QCWA now has a membership of more than 4,000. And that's not all: 76 of these OM's (literally) have been licensed for a full 50 years!

On second thought, maybe that *old* terminology isn't as literal as it seems. Most of the fellows remain almost as young and full of pep as they were back in 1912. One, incidentally, even sports a call that's mighty close to home—W2DJ. Not W2DJJ . . . W2DJ. Don't know the gentleman concerned, but it's a safe bet that there's a difference of a few years between us!

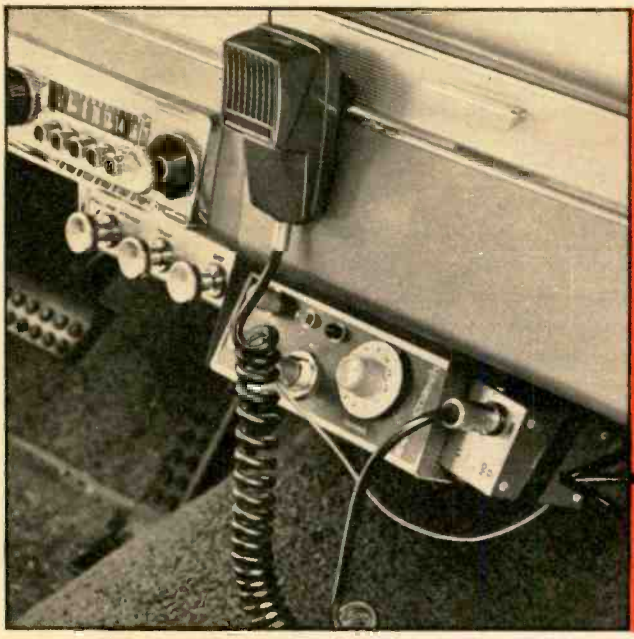
Ham Stamp . . . Exchanging QSL's with stations round the world has given many hams the secondary hobby of philately. And anyone with an eye for stamps will be glad to learn of a new one soon to roll from the presses. A commemorative stamp honoring the first half-century of ham licensing, it should be available by the time this issue of EI appears.

Commerce Crazy . . . Sometimes a ham here and there slips up and plain forgets our reason for being. Fact is, our hobby is *amateur* radio and we're dedicated to public service—like saving lives during emergencies and phone-patching an overseas GI to his wife back home.

But one thing we're *not* in is the commercial communications business. Just the same, 20 meters saw two flagrant abuses of our operating privileges just the other day.

[*Continued on page* 114]

A shack's a shack in anyone's language, but here's a custom console that's sleek enough to be at home most anywhere in the house. Our guess is that the op at the controls wishes this setup belonged to him, though we'd also wager that George Baily, W2KH, and former president of the ARRL, has a pretty good rig of his own. Called the Nova-K, the console is distributed by Harrison Radio of New York City.



CB MINI CLIPPER

By HERB FRIEDMAN, KBI9457

It's small in size and small in cost but it does big things for your range.

NOT much larger than a pack of cigarettes, easy to install as a new crystal, almost certain to save you up to $200, yet the gadget costs only about $10. What is it? EI's CB Mini-Clipper, an all-transistor miniature clipper.

How can the Mini-C put all this dough in your wallet? Simple. Big thing in *expensive* CB transceivers these days is some sort of modulation booster which extends transmitting range. But plug the Mini-C into your budget transceiver, plug your mike in the Mini-C and your signal will be right up there with those from $200-to-$300 rigs. You can forget about spending all that money for a new transceiver and you'll never be drowned out by a channel hog again.

The Mini-C is connected between your mike and transceiver, as we indicated. It contains its own battery; therefore, power connections or modifications to the transceiver are not required. Since the current drain is low, the battery will last about six months in normal service. The unit is palm-size and can be tucked conveniently behind the transceiver. Or you can attach a small magnet to the Mini-C's case and hang it on the side of the transceiver.

The Mini-C's clipping level is automatic. That is, it's always able to produce maximum clipping. There is no possibility of too little or too much clipping.

How it Works

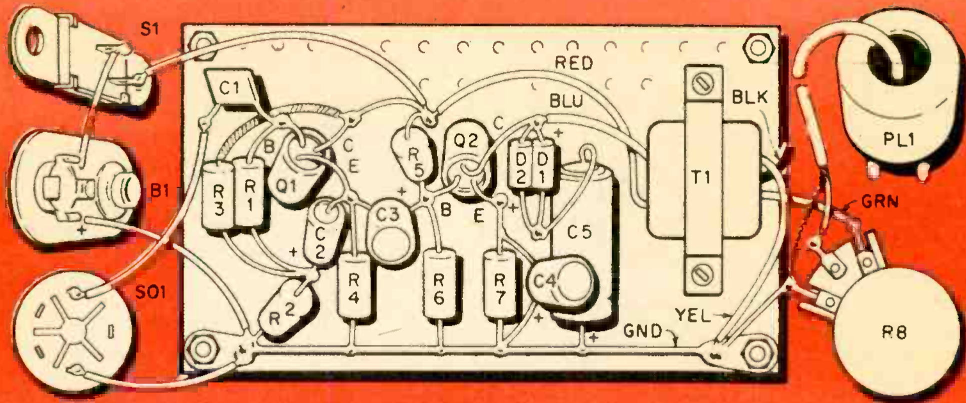
The mike gain of CB rigs is preset for a normal or average voice level. This means that only a *loud*, or above average, voice level (peak) will produce 100 per cent modulation. If your voice has only an occasional peak, the *average* modulation level could be down around 10 per cent—and that doesn't give you much of a signal.

With this sort of down-in-the-basement modulation you'll end up getting mighty sad reports from contacts since their ears respond to average modulation and not the peaks.

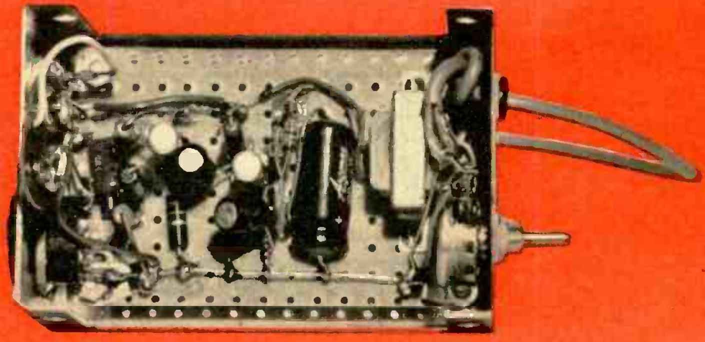
For a modulating signal to be called excellent, its amplitude must remain constant, no matter what the level of your voice. How is a signal like this produced? By clipping the peaks, both high and low speech levels will effectively end up being almost equal in amplitude. Add a little gain to this evened-off modulating signal and you'll be able to produce uniformly high modulation whether you shout or whisper.

The effect at the receiving end is a solid wall of sound that seems to be coming from a transmitter of much higher power.

Though the Mini-C is transistorized it has



Follow this pictorial carefully and you won't have trouble in squeezing all the parts on the board. Transistors are shown upside down so you can identify leads. Ground buss at bottom must make contact with cabinet through mounting screw.



Mount level control R8 (right), input socket SO1 and switch S1 (left) in cabinet before installing parts on board. Then determine where to mount the transformer and all other parts so that the completely wired board can be installed easily in the cabinet.

an input impedance of nearly 2 megohms, which means any crystal or ceramic mike can be plugged in. It won't change the mike's frequency characteristics.

To avoid the problem of a high noise level caused by the added preamplification, the Mini-C uses low-noise transistors. You won't hear a roaring background hiss.

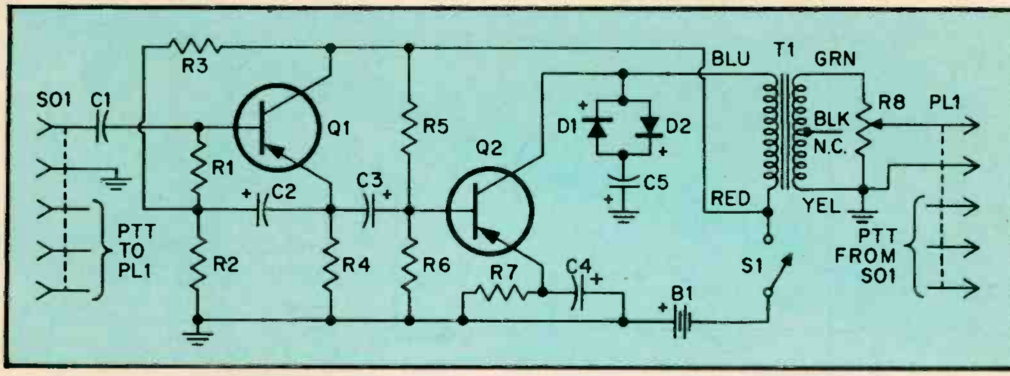
Construction

Our Mini-C is built on a 2x3-inch piece of perforated board which is mounted in the main section of a 3¼x2⅛x1⅝-inch minibox. Space is at a premium so we suggest you use a slightly larger cabinet if you don't have experience at construction in cramped quarters. Since space is limited, lay out the cabinet-mounted components with the board mounted temporarily in position. Use as much of the board as possible, taking care that components don't prevent the cabinet cover from being slipped into place.

Special precautions are not required when wiring the board. Follow our pictorial and, as we indicate, mount the components shown standing on end in just that way or you'll run out of space before the board is wired. Flea clips are used for tie points.

T1's mounting holes are small and the transformer frame will be damaged easily if you attempt to enlarge them. Mount T1 with #2 or #3 machine screws.

The leads on Q1, Q2, C1, D1 and D2 must be short so make certain you use a heat sink, such as an alligator clip, on each lead when soldering it. Transistors Q1 and Q2 are spe-



Because transistor Q1 is a bootstrapped emitter-follower, Mini-Clipper's input impedance is on the order of 2 megohms. Signal is amplified by Q2 and coupled to transceiver input by T1. Output level is adjusted by R8. Diode D2 clips positive-going peaks at Q2's collector. Diode D1 clips the negative-going peaks.

cial low-noise transistors. Do not substitute general-purpose transistors for them or you will have a noisy signal.

To prevent the back of the flea clips (they extend through the perforated board) from touching the cabinet, place a quarter-inch stack of washers or a spacer under each of the board's corner mounting screws.

Mike socket SO1 must mate with your existing mike plug. And output lug PL1 must be the same type as your mike plug. Since push-to-talk (PTT) circuitry varies from transceiver to transceiver we don't show PTT lead connections. Simply connect the PTT leads from SO1 to PL1 as required. Power switch S1 must be the miniature type specified. There isn't room for a standard slide or toggle switch.

Battery B1 should be mounted in the U-section of the Minibox directly over the components on the board. If an insulated battery connector isn't used, or if you solder directly to the battery terminals, cover the end of the battery with electrical tape.

Using the Mini-Clipper

The Mini-C's output level is adjustable and slightly higher than the normal mike output level. This is necessary to boost the average level of the clipped modulating signal. It also is useful for giving an extra boost to those rigs normally a little shy on modulation. Since there is extra gain, it could be possible to overmodulate the transmitter. We suggest the Mini-C be adjusted by using a modulation indicator. Any of the CB modulation indicators in past issues of EI will do the job (BIG-I CB MODULATION MONITOR, July '64; IN-LINE MODULATION MONITOR, Nov. '64).

PARTS LIST

B1—9 V battery
Capacitors: 6 VDC or higher unless otherwise indicated
C1—.01 mf
C2—4 mf electrolytic
C3, C4—10 mf electrolytic
C5—100 mf, 15 V electrolytic
D1, D2—1N34A diode
PL1—Plug to match mike socket on CB transceiver
Q1, Q2—2N220 transistor (RCA)
Resistors: ½ watt, 10% unless otherwise indicated
R1, R4—47,000 ohms
R2, R3—100,000 ohms
R5—150,000 ohms
R6—10,000 ohms
R7—220 ohms
R8—5,000-ohm miniature potentiometer (Lafayette 32 G 7355 or equiv.)
S1—Miniature slide switch (Lafayette 99 G 6189 or equiv.)
SO1—Socket to match mike plug
T1—Transistor driver transformer; primary impedance: 10,000 ohms, secondary impedance: 2,000 ohms center tapped (Lafayette 33 G 8505)

Connect your mike to SO1 and plug PL1 into the transceiver. Turn level control R8 fully counterclockwise and set S1 to *on*. While holding the mike in normal position and speaking in your normal voice, adjust R8 until the transmitter modulation is 85 per cent on *average* voice peaks. One hundred per cent modulation will now be produced on intermittent peaks.

Once the correct setting for R8 is determined we suggest you tape the knob in position to prevent changing its setting.

Once R8 is adjusted, raising your voice will not increase the modulation above 100 per cent; should your voice level fall off, the modulation level will hold at about 85 per cent.

BEGINNERS PAGE

The Power Transformer

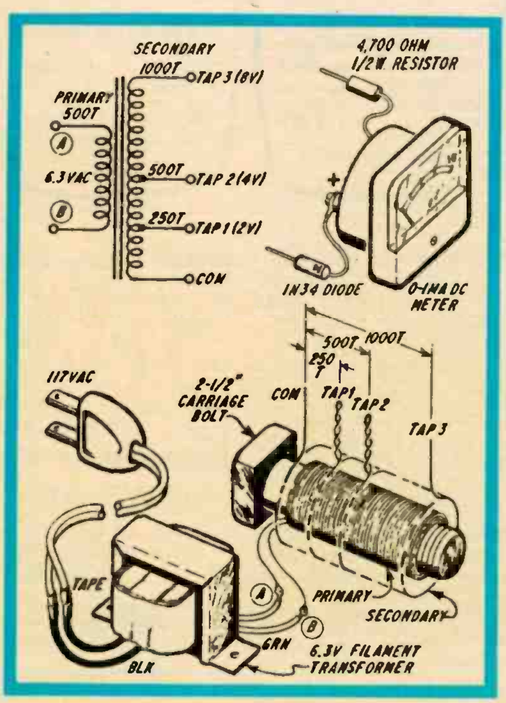
JUST about everywhere there's AC you'll find a power transformer stepping the voltage up or down. It's a simple job to wind your own transformer on a large carriage bolt to see and get the feel of transformer action. To keep our experiment shock-free, we use a 6.3 volt filament transformer as a source of operating voltage.

For the primary, wind 500 turns of No. 28 enameled wire in even layers as shown. The beginning lead of the secondary, which is wound on top of the primary, is called the *com* or common lead. Wind 250 turns, bring out a 6-inch loop for *tap 1*, wind 250 more turns, bring out a loop for *tap 2*, then wind 500 more turns for *tap 3*. Connect the primary leads to the secondary of the filament transformer and you're ready to go.

You can make measurements with a 0-10 V AC voltmeter (or a 0-1 ma DC milliammeter by adding the diode and resistor as shown). Plug in the filament transformer and measure the primary voltage at A and B. It should be about 6 volts. Now read the secondary voltage across the *com* and *tap 1* leads. It should be about 2 to 3 volts. This shows that voltage has been stepped down. And the amount of step-down is equal to the ratio of primary and secondary turns. Since the secondary we used has half the number of primary turns, the voltage is half.

Move the meter to *tap 2* and the voltage will be about the same as the primary voltage because the turns ratio is one to one. Connect the meter to *tap 3* and the voltage will be twice the primary voltage because the secondary has twice the number of primary turns. Secondary voltages are not always in proportion to the ratio of turns because of poor magnetic coupling between the primary and secondary.

Transformer action takes place because current changes in the primary create an expanding and collapsing magnetic field. As lines of this field cut across the secondary windings, they induce a current in them. The carriage bolt, however, is not efficient enough to transfer all the energy. To improve the coupling, lay a screwdriver flat against the secondary. Now angle the screwdriver so its tip touches one end of the bolt. The voltage should increase because of the improved coupling. Another transformer loss occurs because the magnetic field induces current in the bolt and this just produces heat. Commercial transformer cores are made of iron laminations which provide a good path for the magnetic lines of force but resist current flow.



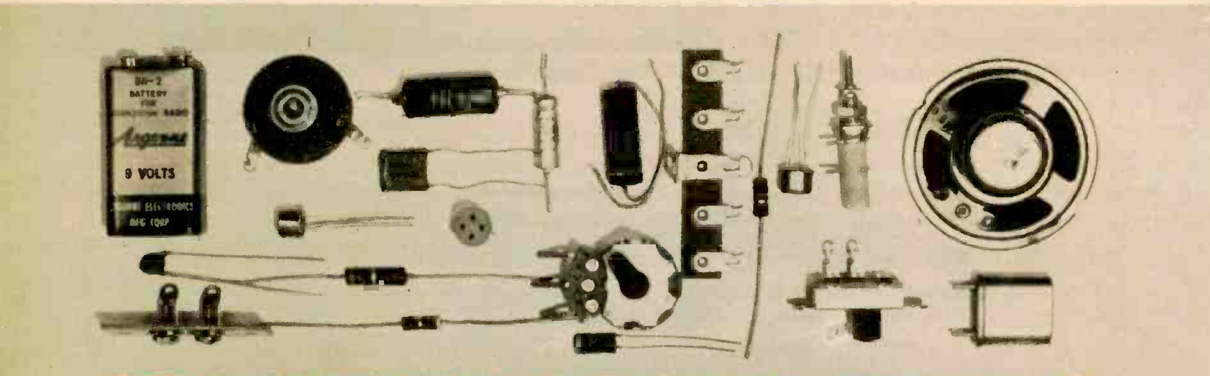
The transformer's turns ratio also changes current but in the opposite way. If a 6-volt primary is rated at 1 amp, the available current in a secondary with twice the number of turns will be .5 A. Stepping down the voltage will increase the current and vice versa.

—*H. B. Morris*

ROBOT Rembrandt

IF NEW YORK INVENTOR Raymond N. Auger has his say, automation may one day mark the end for abstract artists. Enterprising as a gang of kids on an Easter-egg hunt, Mr. Auger's Robot Rembrandt has painted hundreds of abstracts, some gratifyingly good, all with ample color and no two alike. It all began when Mr. Auger developed an intricate gadget he couldn't sell—an arm that was supposed to stuff toothpaste into tubes. Undaunted, the inventor set about to bring automation to abstract art. A little something called creativity soon produced a Robot Rembrandt that's as esthetic as environmental variables and controlled probability can make it. No, the Robot hasn't had an exhibition just yet. But when it does, there's good chance it will ask some computer-composer friend if it doesn't want to schedule a premiere of electronic music for the same occasion.

Toothpaste-tube stuffer turned painter, the Robot Rembrandt produced the novel abstract painting shown below. Plastic tapes resembling arty IBM cards serve as its brain food.



OPTIMUM OSCILLATORS

You name the frequency and these simple design tips tell you how to get it.

By AL TOLER

THINK back a few years. How many times would you have given your grandma's toothbrush to have a source of AF or RF that's as handy as AC at a wall outlet? You know the situation. You get an idea for a project or have to do some troubleshooting and need an RF or AF signal. You don't own a signal generator, therefore the only alternative is to try to make one with a quick lash-up of parts.

But what kind of a circuit are you going to use? Looking through back issues of EI for a suitable oscillator would take a lot of time. Most likely its frequency won't be just what you need anyway.

The answer—knowing how to design your own oscillator. Forget about slide rules, high-power mathematics or advanced engineering. We have an easy way of designing simple AF and RF oscillators.

We know these circuits work because they have been used successfully in the following EI projects: AN EASY-TO-BUILD SIDE-BAND ADAPTOR FOR YOUR CB RECEIVER, May, '63; A MODULATED CRYSTAL CALIBRATOR, Sept., '63; 6-IN-1 CB SERVICE SET and WANT TO BE A JUNIOR HAM?, March, '64.

There's nothing really unique about these circuits. The AF oscillator is right out of a Government electronics handbook and the RF oscillator is used by several manufacturers of ham and CB equipment. Both circuits can be built with junk-box parts.

The Audio Oscillator. The AF oscillator (Figs. 2 and 3) has a frequency range of about 100 to 15,000 cps. Additional specifications are shown in the table in Fig. 1. While the circuit works best with a 2N586 transistor, any general-purpose transistor, such as a 2N217 will do the job, though the distortion may be slightly higher. Because the distortion is high compared to the specs of a stereo amplifier, you shouldn't use this oscillator for making amplifier-performance measurements anyway. A more practical application of the AF oscillator is the STEREO BALANCER (Nov. '63 EI) which just provides a steady 1,000-cps signal of reasonably low distortion.

What determines the frequency of the oscillator in Fig. 3? The parallel-resonant circuit consisting of L1/C2,C3. Since C3 must be one tenth the capacitance of C2 in this circuit, C3's reactance is ten times C2's. Therefore C2 is essentially out of the circuit

AUDIO OSCILLATOR			
Supply Voltage	Supply Current (ma)	E-out (rms)	Total Harmonic Distortion
6	1.1	0.13	1.8%
9-13.5	6.5	0.3	2.8%
22	11.0	0.54	2.6%

Fig. 1—Specifications of the AF oscillator.

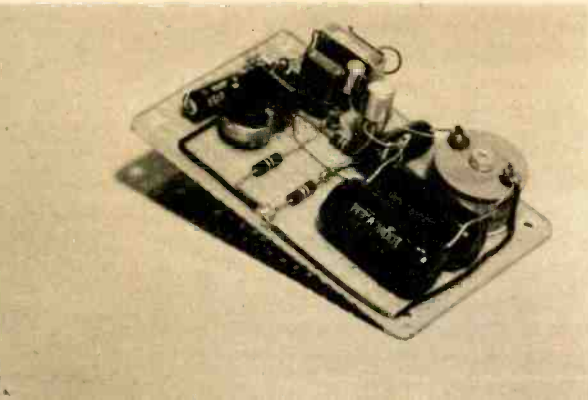


Fig. 2—1,000 cps audio oscillator (lower right). Output is fed to one-transistor power amplifier (upper left) which can drive speaker. Schematic of oscillator is shown at the right.

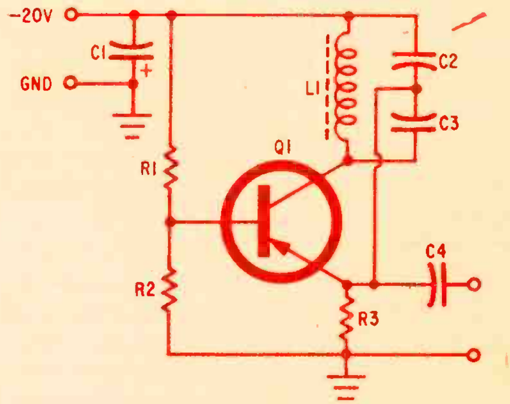


Fig. 3—Audio oscillator is Colpitts type. Feedback is from collector to emitter through the capacitor voltage divider (C2, C3). Frequency is reasonably independent of the supply voltage.

in terms of determining frequency. The frequency, therefore, is determined by L1 and C3.

Let's now take a look at the formula for the resonant frequency of a tuned circuit which is: $f_r = 1/(2\pi\sqrt{LC})$. f_r is the resonant frequency in cycles per second, L is inductance in henries and C is capacitance in farads. Since L and C are multiplied, you can see there will be infinite number of values for them that will produce the same answer. That is, L can be large and C can be small, or vice versa, and you'll come up with the same answer.

So where do you start? To tie things down we prepared the table in Fig. 4 which shows values for L and C for some commonly-needed frequencies.

A very useful tool to have handy for determining values of L and C for these and other frequencies is a Shure reactance slide rule. With this rule you merely set the frequency opposite an arrow, then read off combinations of L and C. The rule is available from Allied Radio and other distributors for $1.00 plus postage. Allied's stock No. is 37 K 950.

Let's take a practical example by building a 2,000-cps oscillator. From the table in Fig. 4 you can see that a choke whose inductance is between 47 and 125 millihenries can be used. A 56-mh choke would be a good choice because it costs less than a dollar. Next thing to do is use the resonant-frequency formula to determine the value of C3. By rearranging the terms of the formula we find that $C3 = 1/(6.28f_r)^2 L1$. When we put 2,000 cps and 0.056 henries in the formula we come up with .114 mf. Since this isn't a standard value, use two .05 mf capacitors in parallel or a .15 mf capacitor. A .15 mf capacitor is close enough if the frequency doesn't have to be right on the nose. C2 must be ten times C3's value or 1.15 mf. (Use a 1.5 mf capacitor.)

On the other hand if you prefer to use standard-size capacitors use the following formula to calculate the value of L:

$$L1 = 1/(6.28f_r)^2 C3$$

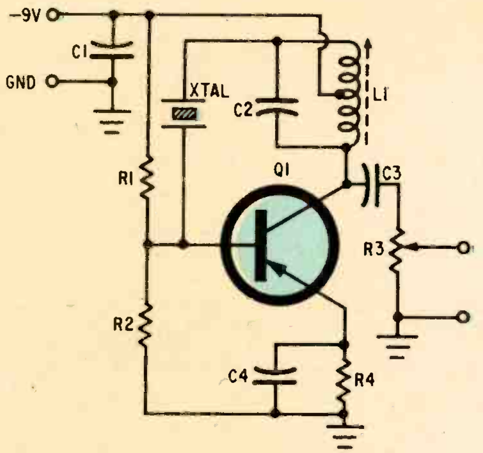
For a 2,000 cps oscillator using .2 mf and 2 mf capacitors, for C3 and C2 respectively, the formula tells us to use about a 30-mh choke. Or, you could use an adjustable inductor, such as a Miller No. 9007 which has a range of 25 to 150 mh.

Note that the output signal is taken across R3, a 4,700-ohm resistor. While the signal amplitude at the collector is substantially higher, it also is much more distorted (30

AUDIO OSCILLATOR			
F (cps)	C3 (mf)	C2 (mf)	L1
100	.5	5.0	5 hy
500	.02	.2	5 hy
1,000	.2	2.0	125 mh
5,000	.02	.2	47 mh
10,000	.01	.1	27 mh
15,000	.005	.05	22 mh

Fig. 4—L/C values vs frequency—AF oscillator.

OPTIMUM OSCILLATORS



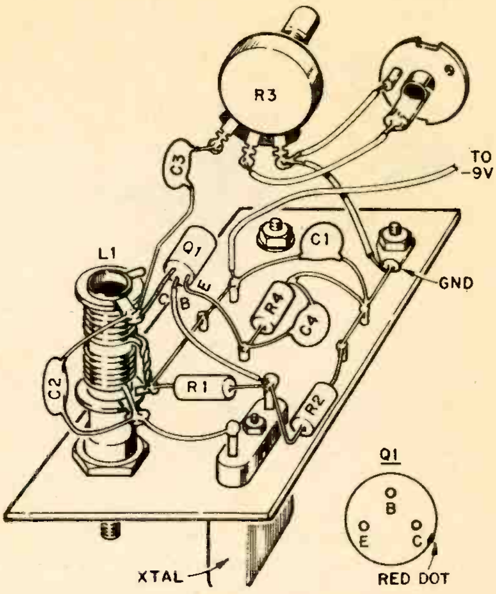


Fig. 5—RF oscillator is modified Hartley. Crystal in feedback path increases frequency stability. Crystal impedance rises at frequencies above and below its series-resonant frequency.

Fig. 6—Suggested layout for RF oscillator on perforated phenolic board. Start winding L1 at collar end, pull out wire midway to form loop (tap), twist it and continue to wind in same direction.

per cent or more).

Any device connected to the oscillator must not upset the emitter-circuit impedance. Therefore the load must be at least ten times larger than R3, or 47,000 ohms. If you are going to feed the oscillator's output into a 25,000-ohm potentiometer, you'll have to connect a 22,000-ohm resistor in series with the output and the pot. Other parts values are as follows: C1—50 mf, C4—1 mf, R1,R2—10,000 ohms.

The RF Oscillator shown in Figs. 5 and 6 will work with either fundamental or overtone crystals to 54 mc. The part values (R1—270,000 ohms, R2—33,000 ohms, C1, C4—.01 mf, C3—1-3 mmf) have been selected so that the circuit will work with an RCA 2N274 transistor. For 27 mc operation, C2 should be a 47 mmf silver-mica capacitor.

Emitter resistor R4 is 680 ohms to limit the collector current to about 1 ma. If R4 is reduced to 47 ohms, the input power (collector current times collector voltage) can be raised to almost 100 milliwatts. But even with a 680-ohm resistor, the oscillator (with a 5- to 12-inch length of wire connected to Q1's collector) will radiate an S9 signal into a receiver two feet away. If you need a strong signal to troubleshoot a receiver that has lost all its sensitivity, connect the oscillator's output through a 50,000-ohm potentiometer (R3) directly to the receiver's antenna terminals.

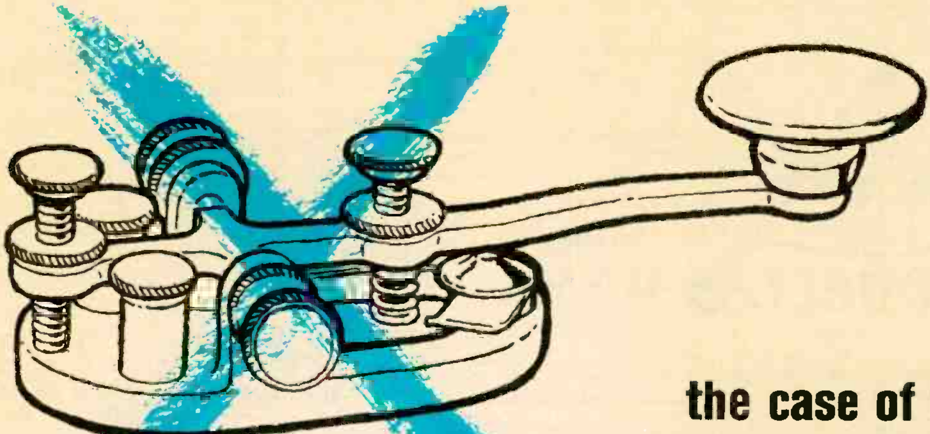
Overtone crystals may not produce the frequency stamped on their cases. For example, a 27-mc third-overtone crystal will produce an output frequency slightly higher than 27 mc. However, by adjusting L1's slug, you can change the frequency somewhat. Resonance is not limited to only one very precise slug setting. Adjusting the slug will "rubber" (change slightly) the output fre-

[*Continued on page* 111]

RF OSCILLATOR

F (mc)	C2 (mmf)	L1 (µh)
3.5	47	36.0
7.0	47	9.0
14.0	47	2.3
21.0	47	1.0
27.0	47	0.6
28.0	47	0.55
50.0	25	0.36

Fig. 7—L/C values vs frequency—RF oscillator.



the case of the

CODELESS HAMS

By ALEX KARLIN

THE BIGGEST battle in many a decade quietly is shaping up on the ham/CB scene these days. We say quietly, because a good many hams and CBers scarcely are aware it exists. But exist it does. And it concerns what might be called codeless hams.

One view common among radio enthusiasts holds that a large proportion of Citizens Band licensees (and many ordinary citizens as well) would like to become amateur radio operators. And hams they would be, were it not for that little stickler called the code. As things now stand, every ham in the United States must satisfy the Federal Communications Commission that he can send and receive the International Morse Code.

For years there have been grumblings (mostly from non-hams) about these code requirements. Argument is that they are outmoded, oppressive, unrealistic and constitute an unfair barrier to the many thousands of potential ham operators. Through it all the FCC steadfastly has held its ground, requiring a 13-word-per-minute code proficiency of all General Class operators, a 5-wpm proficiency of all Novices and Technicians.

The situation has intensified in the past few years, however. Even a passing acquaintance with the goings-on in most areas of the Citizens Band bears out the they-want-to-be-hams contention. And no one doubts the existence of a vital interest in ham radio by non-hams.

For these reasons, a new radio band and a new type of radio amateur would seem entirely within the scheme of things. The band would be open to all varieties of ham-type, non-substantive communications. There would be no code requirement for obtaining a license. So far as an examination is concerned, would-be licensees might be required to answer only a few technical questions (or none) and a few questions about operating procedures. Or there might be no exam at all. Almost the only requirement would be the filing of an application.

In some ways, of course, the Citizens Band already has become a codeless ham band. Trouble is, those who make like codeless hams are violating the rules. What is needed, say some, is a real codeless band to legalize these activities somewhere else in the spectrum.

As the foregoing indicates, no single and unified concept of the proposed new band exists. There are many proponents but each seems to have slightly different ideas about what the new breed of radio hobbyist should have or should want. This divergence of opinions is by no means the main barrier between wish and fulfillment, however. Matter of fact, it is one of the lesser problems.

Foremost among the hurdles to be cleared is the lack of any known interest on the part of the Federal Communications Commission to create such a band. Second is the problem of where to find room in an extremely

the case of the CODELESS HAMS

crowded spectrum to put a codeless ham band. There simply are no open spaces at any reasonable frequency to slip a new group of hobbyists into.

Farther down the list of troubles is the Geneva Radio Regulations of 1959 (to which the United States is a party). These regulations forbid the operation of amateur stations below 144 mc unless the operator is able to send and receive code.

Add to these problems the fact that, virtually to a man, currently licensed hams and their main organization, the American Radio Relay League, now are opposed to the general concept. And they are certain to fire broadsides at any concrete proposal that is made to the FCC.

The battle, however, already has started. Fact is, many of the 700,000 users of the giant CB service already are attempting to obtain at least a portion of what is now the 10-meter ham band. Simultaneously, of course, the amateurs of the nation are counterattacking. Recalling how CBers were awarded the old 11-meter ham band after the hams supposedly had abandoned it, they have begun an intensive campaign to pep up activity on 10 meters. And they have good reason, since there's no denying that tired old 10 has fallen into relative disuse during the past few years and the current low-sunspot cycle.

Though there have been complaints and more complaints about that code requirement, first formal petition to the FCC seems to have been presented by the International Crystal Mfg. Co. of Oklahoma City, Okla., back in February 1963.

A leading manufacturer of CB and ham radio equipment, International Crystal asked that the FCC create a hobby-class ham license which would permit crystal-controlled 10-watt transmitters to be operated with amplitude modulation on 17 channels within the confines of the 10-meter amateur band. There also was a request for six frequencies upon which unmodulated code could be transmitted.

No exam was to be given by the FCC to allow operation in this service. The operators would be allowed to contact any ham station (even Generals), and the only equipment allowed would be of commercial manufacture and type-approved by the FCC. International Crystal, while presumably considering the obvious commercial potential of such a new service, also stated that this class of ham license would "start a large group pursuing electronics as a possible livelihood and create a technical pool of interest to the nation."

The FCC didn't agree. It not only rejected International's proposal, but also turned down several other proposals which would have allowed Technician Class hams (who *do* have code abilities) to operate on 10 meters. Further, the FCC continued to tighten the vise on CBers who pursued ham-type operations on the existing CB channels.

Two CB clubs next entered the picture. One, the National Association for Citizen Band Radio (NACBR) had, at least at the time its petition was filed, only one member—the president of the group. The NACBR chieftain, who is owner of a commercial radio station in Rochester, N.Y., said in effect that code was an outmoded form of radio communication that should have been buried with the steam automobile. NACBR asked that the FCC do away with code tests and turn the 10-meter band over to the CB service.

The American Citizens Band Association, the second group, has had a short but stormy history, already having irritated many FCC officials through virulent attacks in its publications. In this instance, ACBA also asked for the 10-meter ham band, but on slightly different grounds.

The CBers of America had a *right* to hobby-type communications, ACBA argued. And, in view of the fact that the FCC seemingly had played into the hands of CB's so-called commercial users in its handling of the existing 11-meter band, the non-commercial ops had been left without a band. Therefore, the hobbyists deserved the 10-meter band so they could grow and multiply in their own right.

Amateurs, meanwhile, getting wind of such proposals, silently have gone to bat to save 10. Evidence is a Save-10 program, a concentrated attempt to repopulate the dormant 10-meter band with hams. And to top it all off, the ARRL, oldest of the existing ham organizations, put its own Save-10 petition into the FCC. In doing so, it brought up a little-publicized point which could prove to be the cat some canaries hadn't bargained for.

The thing which most everyone seems to have overlooked is international laws and agreements. As it happens, most of the nations of the world sit down round a table every now and again to slice up the radio spectrum like a pie. Certain frequency bands are given to broadcast services, some to aeronautical services, still others to police, maritime, international telephone and telegraph services and so on. Hams also get their slices, though some feel they receive little more than the crumbs at the end of the meal.

But more than just serving pieces of pie, the nations also agree on just how each slice of pie is to be eaten. In other words, they agree on certain operating and licensing rules so that the various stations in each category reasonably will be standardized regardless of their nationality.

Most recent of these international radio conferences took place in Geneva, Switzerland, during 1959. At that time, the nations agreed on a restriction regarding the operation of ham stations on frequencies below 144 megacycles. It states that the operators must exhibit to their respective governments that they can send code by hand key and receive same by ear—i.e., without the aid of automatic decoding equipment. (No speed requirements are mentioned in the Geneva rules, by the way. This little matter is left strictly up to the individual governments involved.)

Since the U.S. is a party to the Geneva regulations, it accordingly must honor them. Therefore, regardless of the wishes, desires or opinions of FCC officials, CBers, hams, manufacturers or Mr. John Q. Citizen himself, the U.S. cannot permit ham stations to operate within the confines of the internationally agreed-upon 10-meter band unless the operators have demonstrated that they can send and receive code.

Next time the nations will sit down to recarve the pie will be late in 1967 or, possibly, 1968. And the question is whether the American delegation will go to bat for codeless hams. Answer is anybody's guess, though it seems possible that the U.S. representatives could be talked into getting a change in the no-code-below-144-mc rule. At best, this would put a codeless band several years away, but tomorrow is better than never.

For in spite of the heavy enemy lineup staring it in the face, a codeless ham band seems likely to materialize. To be sure, many radio hobbyists, hams and otherwise, believe it will not. But we don't agree. We feel that there *will* be such a band at some time in the future, though not necessarily soon.

At the bottom of our reasoning lie two factors. The Citizens Band has demonstrated graphically that hundreds of thousands of Americans want the right to carry on the type of communications envisioned in the codeless ham band concept. Secondly, CB showed equipment manufacturers that a new and popular radio service can mean a new market for their products—in terms of millions of dollars of new income. Another new market that could equal CB in potential is an alluring prospect to any company in the field.

The FCC and the rest of the government—in theory, at least—are in Washington to administer the people's money and the people's laws and the people's airwaves according to the desires of the citizens. This being the case, it seems unlikely that the FCC would ignore several hundred thousand voters and an industry representing billions of dollars. Instead, the agency can be counted on to give the now-formless group a fair hearing and, if possible, accomodate its desires.

To our way of thinking, 10 meters might

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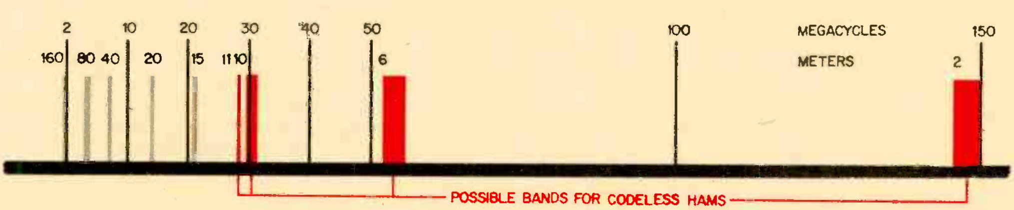


Our chart shows major amateur bands and also indicates the four that conceivably could go codeless. Placing codeless hams on any of these bands (save two meters) would necessitate a treaty revision.

KIT EI REPORT

KNIGHT-KIT KG-275

build-it-yourself
EXPOSURE METER

ALLIED RADIO'S Knight Electronics division has stolen a march on both electronic and photographic competitors by bringing out the first exposure meter in kit form.

The KG-275 is the new cadmium-sulphide type of meter in which a photosensitive CDS cell controls the flow of current from a mercury battery through a meter movement according to the amount of light falling on the cell. The more light, the more current and the higher the meter reading.

Knight's kit meter contains exactly 49 parts, including a dozen electronic components. Electrical and mechanical assembly are easy and straightforward. Our builder took 80 minutes to complete construction and encountered no problems.

List price of the KG-275 is $15.88. In features and accuracy, the unit equals or surpasses factory-assembled models costing $50 or more. Some half-dozen low-cost CDS meters presently are on the market, ranging in price from $10.95 to $22.95, but none offers all the features of the KG-275.

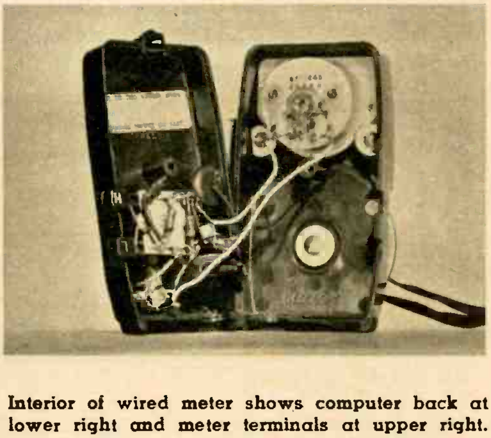
We tested the Knight product for accuracy on a photometric bench, using a master light source calibrated by the U.S. Bureau of Standards, and found its readings fell within prescribed limits in all ranges. This was particularly noteworthy in view of the fact that the CDS cell and meter movement must necessarily be economy models to make possible the $15.88 price tag.

The meter has light-measuring abilities to burn, giving accurate readings at light levels well below those any camera bug can use. The argument in favor of such unused abilities is that the meter is not likely to become obsolescent in the foreseeable future, even with phenomenal increases in film speeds.

Besides giving normal reflected-light readings, the KG-275 has a diffuser permitting measurement of incident light. There are two light-level ranges, the lower one reading from .014 to 28 foot-candles, the higher range running from 28 to 28,000 f-c. The color-coded computer's scales are large and easy to read. Shutter-speeds range from 1/4,000 sec. to 30 min. The f-stop range is from .5 to 64. For cameras with the EV-LVS exposure system, the range is from —12 to +22. Movie readings range from 4 to 128 frames per second. The meter is calibrated for films with an ASA rating of 6 to 12,000 (or degrees ASA from 1° to 12°). Its light-acceptance angle is a normal 50°.

The battery-test button requires care or it hangs up. The meter pivot base is merely cemented to the coil assembly. However, vibration tests indicated the joint can stand up under hard usage.

Considering its price, features and accuracy, the KG-275 for the time being enjoys the distinction of being in a class by itself.



Interior of wired meter shows computer back at lower right and meter terminals at upper right.

how to wire COAX CONNECTORS

By FRED J. WHITEMAN

PUTTING a new plug on a lamp is duck soup. But installing connectors on shielded audio or coax cable is an entirely different story. Do a quick and sloppy job and you'll regret it. One tiny piece of shielding in the wrong place or a broken conductor, and everything will be dead as a doornail. It doesn't take much time to do the job correctly the first time. But it could take hours to track down a short or intermittent later on.

Despite coax's wide use, many hams, CBers and audiophiles haven't acquired the touch for installing connectors on coax easily and correctly. These tips should keep you from losing your temper in the future.

First, let's get our terminology straight. (The diagram at the upper left of the next page shows the construction of typical coax such as RG8/U or RG58/U.) A solid or stranded inner *conductor* is surrounded by an insulating *dielectric*. This in turn is covered with a woven outer *braid* (often referred to as the shield) which is enclosed by a *jacket*.

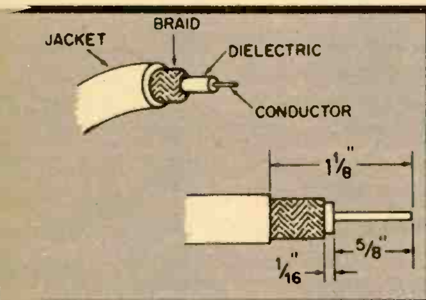
Audio and microphone cables sometimes use spirally wound rather than woven shield. Some shielded cable may not have an outer jacket.

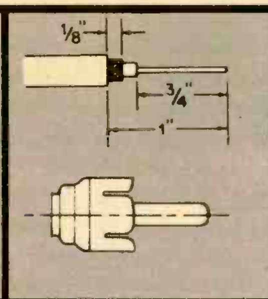
Phono plugs (top, center diagram, next page) are probably the most popular connectors for hi-fi equipment. And they are being used more and more with low-power communications equipment. First thing to do is *dress* the cable as shown in the diagram on the next page and the photo below.

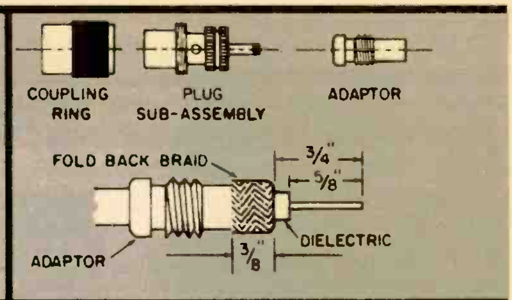
Measure one inch back from the end of the cable, then cut through the jacket all the way around the wire. Be very careful not to cut into the shield. Then make a lengthwise cut to remove the plastic jacket. Again, be careful you don't cut into the shield.

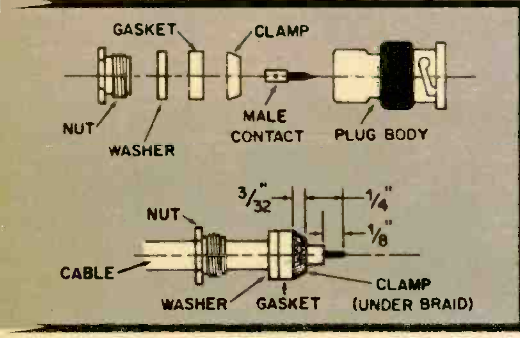
Sometimes the shield is woven loosely so that it can be pushed back. Or, it may be possible to open a hole in the weave of the shield and pull out the conductor and the

Phono plug cable preparation. One inch from end of cable, cut through the jacket around the circumference being careful not to cut the shield. Then make a second lengthwise slit to remove the jacket.









When using UG175/U or UG176/U adaptors (top, right diagram) for smaller-diameter coax such as RG58/U and RG59/U, remove ¾ inch of jacket. Slide coupling ring and adaptor on cable. Position adaptor at end of jacket, spread shield over body of the adaptor and trim it to ⅛ in. back on adaptor. Strip ⅝ in. of conductor and tin it. Screw plug sub-assembly on adaptor and solder shield to shell through solder holes. Solder the conductor to the center contact of the plug and scrape off any residue on the outside of the contact. Then screw coupling ring on the plug sub-assembly to finish the job.

COAX CONNECTORS

dielectric. In either case, cut the shield so it extends only about ⅛ inch beyond the jacket, being careful not to cut into the dielectric. Now, cut through the dielectric ¾ inch back from the end and pull off the dielectric.

Tin the conductor and insert it in the prong of the phono plug, wedging the plug shoulder between the dielectric and the shield. Solder the conductor in the center prong and solder the shield all around the shoulder. Trim the conductor flush with the end of the center prong and scrape off the flux.

The PL-259 UHF plug is the most commonly used connector for ham and CB equipment; it mates with the SO-239 chassis receptacle. When installing it on heavier coax, such as RG8/U, only the coupling ring and the plug sub-assembly are required (top, right diagram above). Remove 1⅛ inch of the jacket, strip ⅝ inch of conductor and trim the braid back 1/16 inch from the remaining dielectric. Slide the coupling ring on the cable and tin the exposed conductor and shield. Screw the plug sub-assembly on the cable and solder it to the shield through the solder holes. Solder the conductor to the center contact and screw the coupling ring on the plug sub-assembly as shown above.

When smaller-diameter coax is used, you must use an adaptor (top, right diagram). Use the UG175/U adaptor for RG58/U cable and the UG176/U adaptor for RG59/U cable. The caption under the diagrams explains how the adaptors are installed.

BNC Connectors. The quick-release BNC-type RF connector is often found on commercial and military equipment. It is used with RG58/U and RG59/U coax and is sometimes the most difficult to install since it comes in six parts (lower left diagram).

Remove ¼ inch of the coax's jacket. Position the clamp at the edge of the jacket and fan, or spread, the shield back over it. Trim off the shield so it just covers the clamp. Remove ⅛ inch dielectric and tin the conductor. Slip the contact in place, butting it against the dielectric and solder it to the conductor. Now, push this assembly into the plug body as far as it will go.

Next, slide the nut into the plug body and screw it tight, holding the cable and shell rigid and rotating the nut. And after the job is done always check the coax for continuity and shorts before you use it. This takes only a few minutes time with an ohmmeter, but can save you a lot of head scratching later on. All it takes is a single strand of stray shield to ruin the whole job.

THE ALHAMBRA AFFAIR

By DON CARTER

A FEW YEARS back when a man named Newton Minow was chairman of the Federal Communications Commission, you heard a lot about public interest, convenience, necessity and that sort of thing. Mr. Minow doesn't happen to be with the FCC anymore, but he certainly let you know the way the FCC saw things in the short time he was around.

"Vast wasteland" was the stamp he put on the American TV industry in that famous speech of his back in 1961, and the industry has yet to forget it.

"I do not accept the idea that the present overall programming is aimed accurately at the public taste," Mr. Minow said at one point. There also was much talk at the time about how the airwaves belonged to the people and how stations held their licenses only by *proving* they served the public. And it was said that license renewals for broadcasters would not be an automatic, rubber-stamp affair. Instead, stations would have to demonstrate that they deserved to hang onto their tickets.

In these recent times no one has heard of much difficulty for commercial licensees seeking renewals. But that was not always the case. Mr. Minow didn't originate the serve-the-public-or-shut-down idea. Almost 30 years ago, when the FCC was brand new, the Commissioners seemed to have the same concept.

In those days they even tried to do something about the way they felt the public should be served and the result was the little-celebrated Alhambra Affair. The case didn't cause much of a stir at the time and now is almost forgotten, but it doesn't deserve extinction because the Alhambra Affair was a noteworthy chapter in America's radio annals.

The year was 1935. Only a few months before, Congress had created the FCC in its Communications Act of 1934 to regulate radio in the "public interest, convenience and necessity." In California in that Depression year a group bearing the name of the Alhambra Electronic Institute went into the business of practicing medicine without, as the authorities later said, proper licensing. In order to sell its services, Alhambra bought time on some local broadcast stations, chief of which was KMPC, the Station of the Stars, operating in Beverly Hills. Alhambra eventually came to its justified end but not before both it and KMPC had been the subjects of thousands of words of testimony and the objects of more investigations than they desired.

When the incident started, the FCC was still in creepers and had just reached the end of its initial clean-up campaign to rid the air of what it considered undersirable or unethical programs. Its crusade already had driven Norman Baker and John (Doc) Brinkley to regions south of the border. Once before in its clean-up the FCC had hit the Los Angeles area. The victim that time was Dr. Bob Shuler and his station which, in the words of a Shuler disciple named Dan Gilbert, had "dared denounce Al Smith, the 'rum and Romanism' candidate for President." But that's a tale for another time.

As it happened, the Alhambra Electronic

Institute was a group of chiropractors offering diagnosis of any ailment via that "new marvel instrument," the "Electron-O-Meter." Clearly a miracle machine (if we are to believe the advertiser's claims), the device was heralded as a godsend no listener well could afford to pass up. Hear the announcer now, as he proclaims the wonders of this 1935 panacea:

> **"Ladies and gentlemen—Here is good news for all people who are sick or in ill health. The Alhambra Electronic Institute has installed the latest Scientific Invention—the Electron-O-Meter—a machine that shows you definitely the cause of your illness, the condition of your internal organs, the severity of the ailment, and how to correct the faulty condition.**
>
> **". . . (This instrument) . . . is causing a sensation here before us in Southern California, for this reason, it shows you visually the underlying and basic cause of your ailment. Many of you have spent many dollars trying to regain your health and today you are at a loss to know what is causing your ailment. You say to yourself, 'If I knew what was causing my sickness, I certainly would regain health.'**
>
> **"All right, you would, and here is your opportunity, that is for ten people, we are authorized to make appointments for ten people at this time for this examination. Now this examination usually costs $10.00, but for these ten people it is going to be given to them for just $1.00 and that is the total cost without any obligation. The only thing we ask of you is that you make a definite appointment right now."**

So much for the Electron-O-Meter. Miracle machine or no, it really didn't carry much weight in the affair. For Alhambra's chief of staff soon found himself arrested, tried and convicted of violating the California State Medical Act. At about this same time, KMPC's license came up for renewal.

The thing the FCC had to decide was whether the station had been operating in the public interest, convenience and necessity. As we said earlier, licenses are granted on this basis and "past conduct of the applicant" must be considered at renewal time.

Since the whole Alhambra Affair would suggest that public interest might not have been served, the FCC seemingly found itself faced with the unique possibility of affixing the mark of extinction on two stations in the same area during a period of less than two years. Hearings were held but there was no ax. Instead, while condemning KMPC's promotion of the Alhambra scheme, the FCC renewed the Station of the Stars' license in light of its "general program service."

After renewal, the station was sold, its management changed and this could have been the end of the affair—but wasn't. Almost simultaneously, Alhambra reorganized and went back in business as the Basic Science Institute. Its operation was essentially unchanged. And once again it was allowed to purchase time on the same station. Worse still, Basic Science was only one of two such pseudo-institutes whose commercials KMPC carried. The Samaritan Institute, specializing in a 48-hour cure for alcoholism, also was touted. Later the courts held that its staff, too, was engaging in the practice of medicine without a license.

On September 28, 1937, against this backdrop, W.H. Kindig of Hollywood filed for a construction permit from the FCC which in effect would have given him all the facilities of the Beverly Hills broadcaster. An examiner's hearing was set for December 8 to coincide with still another renewal of the Station of the Stars' license.

But Kindig never showed up. His application was denied as in default and the examiner recommended that the existing license be renewed. But before this recommendation could be carried out, Washington got wind of the Basic Science (Alhambra) and Samaritan deals. Result was that a full FCC hearing was set for January.

Though substantially the same hoax had been perpetrated twice via the same station (with an intervening warning from the FCC), KMPC's officials said they had done nothing wrong. And the FCC eventually decided in the station's favor, noting that KMPC was under new management, that both Basic Science and Samaritan had been dropped as

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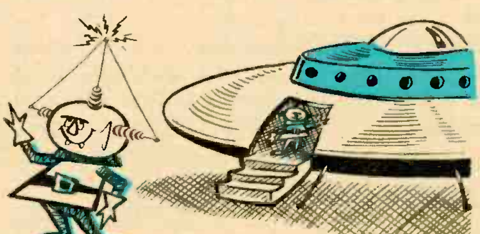


CB CORNER

BY LEN BUCKWALTER KBA4480

CB's SECRET WEAPON

RAGING like a Watusi warrior, one CBer we know of recently shook his fist and bellowed, "This gol-danged law is against free speech!" Which law? Specifically, that newly written regulation which, to the FCC's way of thinking, would clamp the lid on talk about technicalities over the Citizens Band.

Interestingly enough, the man's remark came on the heels of the FCC's own statements about what it can and cannot do (the FCC recently indicated that certain sections of the law "authorize the Commission . . . to classify radio stations and prescribe the nature of the service . . ."). This being the case, his ranting, we figured, held no more weight than the 2,500 cantankerous letters sent to the Commission when the rules changes were being considered.

So, unmoved we remained—that is, until this CBer whipped out his secret weapon. No pearl-handled six-shooter this. It was a small booklet about the size of EI. Its title: The Communications Act of 1934, the set of laws that created the FCC, doled out its powers and guides it to this day. (We show the opening section of the Act in our illustration.)

Our friend, it would seem, had culled through that book with the fervor of a convict trying to find a loophole. And between sections on distress signals and naval stations he discovered this choice paragraph:

> **Sec. 326. Nothing in this Act shall be understood or construed to give the Commission the power of censorship over the radio communications or signals transmitted by any radio station . . .**

But that's only the first part. You should have heard our friend warm up in the second half, which goes:

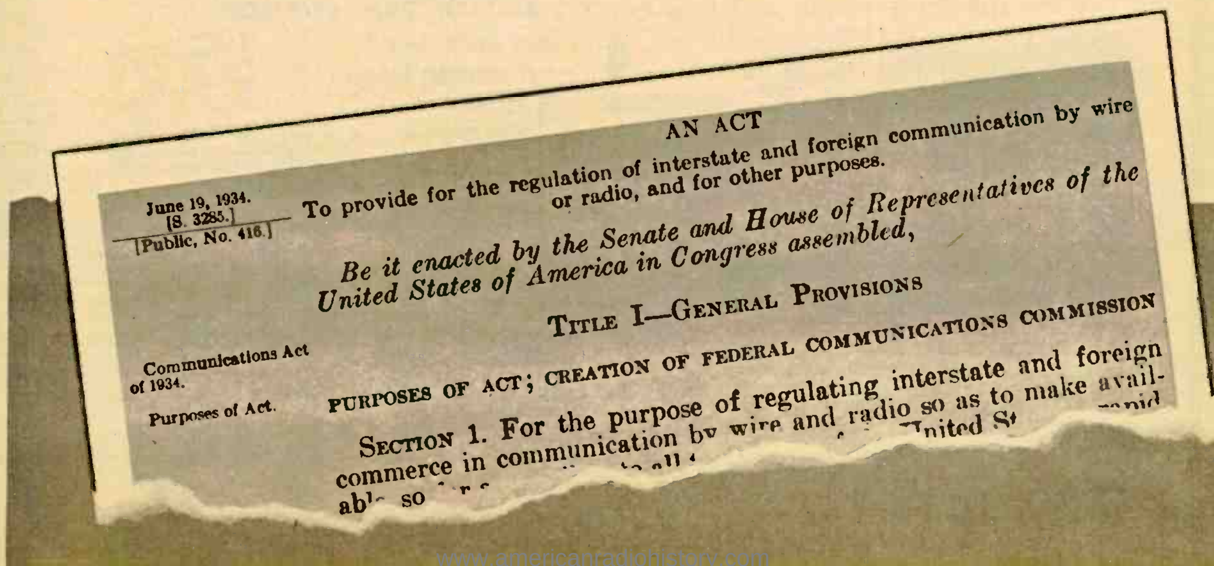
> **. . . and no regulation or condition shall be promulgated or fixed by the Commission which shall interfere with the right of free speech by means of radio communication.**

Caught red-handed? Our friend thinks so. After all, he believes he singled out a damaging contradiction in the law. And who knows? Maybe we will see CB batted around in the courts before this round is over.

Q and A. Do you get a better signal with a bent beam? Does the rig go *pffffft* when you throw the switch? Well, let's hear about it. This department welcomes your technical questions, so pick up a pen and send them in. Matter of fact, let's feed one through right now and see what comes out.

Reader from Johnstown, N.Y., asks if it's possible to attach connectors to a coax feedline so two CB sets can work off the same antenna. Answer is that having both sets op-

[*Continued on page* 111]



AN ACT

June 19, 1934.
[S. 3285.]
[Public, No. 416.]

To provide for the regulation of interstate and foreign communication by wire or radio, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—GENERAL PROVISIONS

Communications Act of 1934.

PURPOSES OF ACT; CREATION OF FEDERAL COMMUNICATIONS COMMISSION

Purposes of Act.

SECTION 1. For the purpose of regulating interstate and foreign commerce in communication by wire and radio so as to make available so

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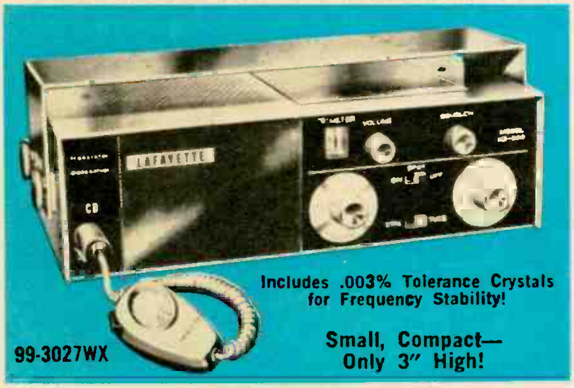

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Continued from page 72

might be. The volume begins with a treatment of basic AC and DC theory that an engineer won't need, then goes on to circuit descriptions that the interested layman won't find exciting. All in all, this entry is a real disappointment.

AMPLIFIERS. By H. Lewis York

The problem here is spelled t-r-a-n-s-i-s-t-o-r. All but ten pages in this 250-page volume deal with vacuum-tube theory (or valve theory, as the English author would have it). And most of the information—highly technical at that—is sadly dated for the people most likely to use it.

Still another problem is that stereo amplification is given short shrift. Matter of fact, most of the circuit descriptions are of the mono designs made possible in 1956-58 by tubes like the EL34 and EL84. Result is that there just isn't much here to be excited about.

LOUDSPEAKERS. By E.F. Jordan

This is the most thorough coverage of speaker theory and practice we've seen in really comprehensible form, and it deserves reference-shelf space alongside Edgar Villchur's Handbook of Sound Reproduction.

The language isn't the layman's by any stretch of the imagination but the information is almost endless. Subject matter runs all the way from an esoteric discussion of speaker Q to the relation of speaker efficiency and listening-room size to necessary amplifier power. Recommended for audiophiles and speaker designers alike.

103 SIMPLE TRANSISTOR PROJECTS. By Tom Kneitel. John F. Rider, New York. 120 pages. $2.75

To come back home, here's an electronic cookbook full of recipes for an evening's or week end's entertainment. The projects, ranging from what may be the world's smallest receiver to a reasonably good square-wave generator, are interesting and fairly simple to tackle.

Though you won't pick up much information on transistors as such, you will find more interesting things to do with them than most of us would be able to dream up in a month of Sundays. All illustrations, by the way, are schematics, and all seem quite clear and accurate.

Continued from page 82

his talk and his looks, especially the way he had of looking out of the corner of his eye."

It turned out that Kookie couldn't carry a tune, much less evidence rhythm, range or pitch. But no matter. A girl named Connie Stevens was written into the script of the TV show to build up her stock with teen-agers. And a song was written in which she could do most of the singing while Kookie injected comments once in a while. Then the voice-makers went to work on Kookie.

To keep things simple, his singing participation was limited to six bars. His part was recorded again and again. His voice was given the full treatment—echo, filters, boosts—to make it sound as pleasing as possible. The record, called Kookie, Kookie (Lend Me Your Comb), was the nation's top hit in the Variety poll in three weeks.

Kookie isn't the only voiceless wonder around. A couple of years ago a Philadelphia record executive named Bob Marcucci spotted a 14-year-old named Fabian Forte on the street. Marcucci decided then and there that Fabian would be a recording star.

Though the first two singing teachers gave up without trying after they heard Fabian groan a few bars, a third agreed to take the job. He helped some. But his pupil still couldn't sing on key or do much else quite so radical.

Then Fabian did a guest spot on the Dick Clark TV show. His appearance (as Marcucci had known it would) set teen-age passions afire. Fabian spent every holiday and week-end—he still was in high school at the time—making personal appearances. And, thanks to some hefty beefing, his recordings soon were hitting the top ten regularly.

Where does the rage for phony voices leave the singers who really sing—the Sinatras, the Tormes, the Staffords? Their records, of course, contain only music and no crazy sounds, so they can't hope to compete with singing chipmunks, bathroom plungers and the electronically manufactured voices of teen-age idols.

Nevertheless, it's a hopeful sign that they continue to sell at all. For despite the current state of popular music, they perhaps prove that an ability to sing isn't necessarily fatal in the record business.

Continued from page 51

occasions they can be logged at amazing distances. Given these circumstances, a station which normally is just a routine catch becomes a prize addition to your log.

Most BCB harmonics are heard between 1600 and 3200 kc, though such signals have been bagged as high as 49 meters. However, because low power (we trust) and low frequencies usually are involved, this is strictly a nighttime DX field.

To start, check the second multiples of the so-called graveyard channels. For the record, these multiples work out as 2460, 2480, 2680, 2800, 2900 and 2980 kc. Since myriads of U.S. stations operate on the fundamentals of these frequencies, evening BCB DX on these spots ordinarily is just plain impossible. But hunt for those second harmonics, and you just might find a few punching through around sunset or perhaps a little before.

With a little ingenuity, you should be able to verify about half your harmonic loggings. And about 50 per cent of those stations that do QSL not only will appreciate your report but will say so, too. When reporting, never state that you picked up a harmonic as such. But clearly indicate the frequency you heard by underlining it, putting it in red or some such thing. Needless to say, you never should pass off harmonic reception as an ordinary BCB logging—not unless you want to join the cheat club.

Those Rumor Mongers . . . Speaking of cheats, it seems that hoaxing is one of the more popular DX sports these days. Fraudulent reception reports are one thing, but making up fictitious news about non-existent stations is as bad if not worse. And this is especially true when such info gets passed throughout the DX world.

Way it happens, the original report usually is sent to a station with an SWDX program (R. Sweden is one) where reporters aren't known by reputation and where one man's word is as good as the next. Once broadcast, the story frequently is picked up on all five continents and reprinted in numerous DX publications—depending on just how sharp their editors are (or aren't).

Probably the most glaring recent example of what we're talking about was the Yemeni

[*Continued on page* 112]

Optimum Oscillators

Continued from page 94

quency—the maximum shift being a few kc.

We can't pin down L1's exact specifications because of the frequency and the parts layout (we suggest the layout in Fig. 6). The RF section of EI's 6-IN-1 CB SERVICE SET is a good example of where this 27 mc oscillator is used. Coil L1 is wound of No. 22 enameled wire on a Cambridge Thermionic slug-tuned coil form No. 1534-2-2. For the exact coil construction details, refer to the 6-IN-1 CB SERVICE SET and the Junior Ham Station stories.

For further information about designing and winding RF coils for other frequencies, refer to the Radio Amateur's Handbook (ARRL). A grid-dip oscillator also comes in handy—you just cut-and-try until the GDO dips at the frequency you want.

When the slug is completely out of the form, the circuit will not oscillate and Q1's collector current will be about 500 microamperes. As the slug is turned into the form, the collector current will rise to a maximum of about 2 ma, indicating oscillation.

Unlike the AF oscillator, the RF oscillator won't work above and below the design frequency if other components and voltage are off value. And be sure to mount the oscillator in a metal cabinet to avoid direct signal radiation.

While we don't claim these oscillators will work for everyone in every application, they do meet the need for something that can be thrown together quickly, even on a breadboard.

CB Corner

Continued from page 103

erate *simultaneously* from one antenna just isn't practical.

For one thing, mismatch would waste signals on receive. Worse yet, the transmitter of one rig would feed power into the other receiver, possibly burning out some delicate coils.

Even so, there is a way to work out a two-on-one-antenna setup. Wire up a coax switch and you can switch one antenna manually between two or more sets with practically no loss or danger at all. Look one up in the catalogs; they're made by B&W.

The Alhambra Affair

Continued from page 102

advertisers and that "a satisfactory public service is now being furnished."

The Station of the Stars again had managed to stay on the air. This "satisfactory public service" included, among other things, a lecture series on metaphysics, sponsored by the Royal Order of Tibet—George Adamski, lecturer.

For the record, Adamski's activities didn't stop with metaphysics. On November 20, 1952, somewhere near the height of America's flying-saucer bugbear, Professor Adamski claimed to have met and communicated with a Venutian in the California desert.

KMPC still is on the air today, a highly respected and successful broadcaster with some 37 years of continuous operation behind it. The station has many distinctions, among them a couple it no doubt would like to forget. Not only is it one of the few stations ever called on the FCC's carpet on the public-interest angle, but KMPC has the distinction of having been there twice

Codeless Hams

Continued from page 97

be the best place to put our codeless hams. We have heard of at least one proposal that would open 2 meters to codeless hams, but we do not believe this would be the most practical thing to do. Favoring this proposal, of course, is the fact that no treaty revisions would be required to make this band available to codeless hams.

Trouble is, the way things seem to be moving for CB, the current 11-meter band very well could be locked up tight as far as hobby-type operations are concerned. Should this happen, CBers would be left with millions of dollars worth of useless equipment. A better idea would be making part of 11 meters or part of 10 meters into a codeless ham band. Old CB equipment then would be usable as-is on 11 meters or it could be retuned easily for use on 10.

But regardless of where codeless hams eventually are put, the fact that they will exist seems reasonably certain. For now that the ball has started rolling, the big question is *when*—not *if*

The Listener

Continued from page 110

Cave bit. As originally carried by the Swiss Broadcasting Corporation, this tale went as follows:

"Yemeni Royalists are to begin transmissions shortly in French and English. At present the Royalists have available a 5-kw transmitter in a bullet-proof cave. The frequdncy is somewhere in the 41-meter band."

Now this sounds a trifle unbelievable even to a novice, assuming he gives it a little thought. After all, if that cave were bulletproof, it also might be short-wave proof, too.

Just the same, one prominent NA SW editor got hold of this story, deleted the cave angle and made the thing sound quite legitimate. Why? Well, we won't even guess. But we are certain that many North American DX clubs could do with sharper blue pencils. In fact, if they don't start making a real effort to weed out hoaxes and dubious news tidbits, things soon may be as bad as they currently are in European DX circles.

As things stand, the only SWBC station EI knows for sure to be in Yemen is operated by the government at Sanah. Frequency varies from 5950 to 5985 kc, and DXers should try for it before 1700 EST.

Difficult Reports . . . Preparing reception reports can be a problem, especially for many programs transmitted by stations in Asia and North Africa. These broadcasts simply don't fit into any of the normal categories—news, classical music and so on. A good example is Radio Baghdad's transmission on 6155 kc beginning about 2130 or 2200 EST. This program is a mixture of chanting, talking and singing.

You *could* use a tape recorder, of course, but some stations won't take the time to monitor tapes. A better solution simply is to send the station a blow-by-blow account of what you heard during the broadcast. If there was chanting at a certain time, say so. If there was talking by a man, put that down. This certainly doesn't make for a spectacular report, but it can get the job done.

The Ham Shack

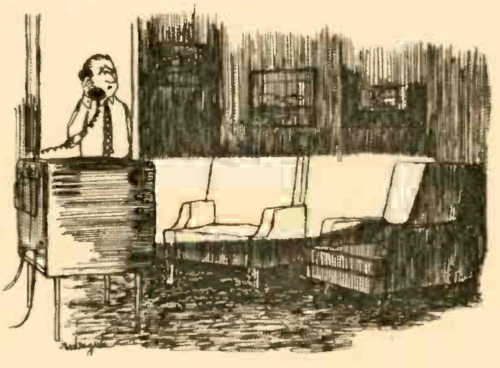
Continued from page 83

In one case, a chap in Italy had a long talk with a confrere in California about the resale and shipment of some animals to a zoo out there, with much detail about peanuts and other food for the beasts en route. And then there was the lad in Florida who spent ten minutes discussing a shipment of merchandise with a salesman in a New York store. Not good, fellers, not good.

Free Plug . . . Don't fret if you didn't get to the New York World's Fair this year. Come next year, and you still can see the sights and operate station K2US in the Coca Cola Building. Better yet, as a bonus, you can sit in at the ham station in the lobby of Manhattan's Hotel Rutledge, 30th Street and Lexington Avenue. Manager Stan Doben even is willing to give you a cut in the regular room rates—if you show your ticket when you register. Good deal, eh?

Boomerang . . . Funny how some complaints to the FCC about amateur interference bounce back to the complainant. Latest case we've heard about involved a beef to the Commission's San Francisco office. Seems radio and TV reception in an Oakland apartment house was being blanketed.

Interesting thing here is that "blanketed" proved the perfect word. The trouble eventually was traced to a defective thermostat in an electric blanket owned by . . . guess who? The complainant, natch!



"It's about that picture-brightener you put in. . . ."

Continued from page 54

ance you want. And don't worry about that famous hole-in-the-middle business. If your speakers are in phase and if the high-frequency dispersion is all it should be, extra-wide separation of speakers won't produce exaggerated stereo.

Oh, just one more thing. Try to get as healthy a distance as possible between you and your speakers. The farther away you get from any speaker, the less like a mechanical contraption—and the more like music—it usually will sound.

A couple of columns back I talked about the sudden flood of fine-sounding speakers now found around the $50 notch. But to reassure anybody who's itching to spend a year's pay on audio gear, let me announce that the newest speaker I've heard weighs in at a cool $1690.

For that trifling consideration you get the Acoustech Ten. No squeak-easy this. It is comprised of a matched pair of full-range electrostatic speakers, each with two built-in solid-state amplifiers (one for each end of the frequency range). Like the Sigma Transcendent and the KLH Model Nine, the new Acoustech is tall, slim and room-dividerish in appearance. Sound good?

Setting up a spanking-new stereo rig for a non-technical friend of mine the other day, I was asked which record companies make the best-sounding stereo records. Now there's a tricky question — particularly since the sound of an individual disc may be affected by anything from the temperature of a recording studio to what the engineer had for breakfast.

Nevertheless, some companies rate high marks for consistently good recordings. To my way of thinking, the most dependable of the big outfits is London. Their orchestral discs truly are outstanding, always seeming to sound rich, spacious and detailed, all at once. I'd put Deutsche Grammophon next, mainly because their discs sound almost as though they were pressed on silk instead of vinyl. Among the smaller independents, I'd give the palm to Vanguard, Elektra and Connoisseur Society (those 45-rpm LP's). Anyone want to argue?

[*Continued on page* 116]

Hi-Fi Today

Continued from page 115

I've noted a trend of late toward the notion that pseudo-stereo records are preferable to the straight mono variety. (Pseudo-stereo is my own term for those discs that rechannel a mono recording to put all apparent bass on one side and treble on the other.) Without getting involved in acoustic theory, I'd like to assert that this idea is pure hogwash in my estimation.

Sure, pseudo-stereo can be justified as one way to bring old mono treasures to a public that's overwhelmingly stereo-conscious. But hours of listening have led my own ears to tell me that undoctored mono sounds better than the rechanneled variety any day. Perhaps we should get used to the idea, once and for all, that mono is mono and stereo is stereo —and never the twain shall meet.

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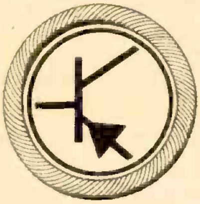
(signed) GORDON W. FAWCETT

Electronic Scouts



MOST EVERYONE knows about the Merit Badges that Boy Scouts can earn. But one thing the Boy Scouts of America seemingly hasn't known about is electronics, and non-Scouters only can wonder why.

Way things stood, a Scout could try for a Merit Badge in everything from agriculture to zoology—everything, that is, save electronics. But with the addition of electronics as one of the 106 Merit-Badge subjects, the Scouts appear fully to have entered the Twentieth Century at long last.

Each would-be Merit-Badge earner must satisfy his counselor that he successfully can meet the published requirements for a specific Badge before it will be granted. In the case of the new Electronics Merit Badge, the applicant must

1. (a) Show how to read a schematic diagram.
   (b) Draw a simple circuit and label all components using correct schematic symbols.
   (c) Explain the purpose of the components in the circuit.
2. (a) Explain the proper method of soldering and unsoldering electronic parts.
   (b) Wire the circuit drawn in Requirement 1 on a chassis or breadboard.
   (c) Explain to the counselor how to avoid heat damage to the components.
3. Do one of the following:
   (a) Remote-control application: Explain how an electronic circuit can be used for remote control. Suggested circuits: use of an electric eye in opening doors; use of a switch and relay with a transistor circuit to control a model-train system; use of a transmitter to control the flight of a model plane; use of a simple audio oscillator in a toy electronic organ. The device must be built.
   (b) Electronic-brain application: Explain the binary number system. Make up and work out five problems in addition and subtraction. Convert the binary to the decimal system. Build a simple flip-flop circuit, using either transistors or tubes. Demonstrate the circuit to the counselor.
4. Discuss the job opportunities in the field of electronics.

Electronics And Black Gold

Continued from page 57

The next thing to bear in mind is that the crude coming out of the ground contains not only oil, but natural gas and water as well. It is a fairly easy matter to separate the gas and the liquid right at the site. But the oil company also wants to know just how much water there is in the crude it buys.

With the installations currently in use, the desired information is gathered electronically, stored at the site until needed, then sent to the central station on request. There it is read out automatically on a teletypewriter.

The automatic well tester is called a cut recorder. This device simply records the amount of water in the crude, using electrostatic principles. The dielectric constant of the oil goes up with the addition of water, and this is measured by a phase null indicator.

When the central station wants information on the well in question, it interrogates the cut recorder by wire, and the answer comes back to the station by wire. At the central station the data is fed into a computer, which in turn actuates a teletypewriter for printing the figures.

In the custody transfer system, the computer also totals the amount of oil going from leases into a pipeline (which is a common carrier, like a railroad tank car or a seagoing tanker). The computer pro-rates the payment among the various leases, depending upon the figures derived from the automatic well tests. The computer actually writes the checks, thus making every aspect of the extraction process completely automatic.

Even the laboratories of many an oil company house a strange complex of electronic instrumentation, mostly for some aspect of analytical chemistry.

Nucleonic techniques also are used widely in the petroleum industry. At Shell Development, for example, there are both electron and deuteron accelerators, used for the creation of radioactive particles. Along with these we find the instruments common to nuclear work, such as scalers, counters and rate meters.

In short, as we already have noted, there is almost no end to electronics in the oil industry. Few ever would guess it, but electronics' role in black gold is staggering. And it's growing bigger day by day.

Logging Illegal DX

Continued from page 71

set up on a brute-force basis and don't suffer much from the odd offband broadcaster.

But services relying on mobile transmitters—aeronautical, marine and land mobile—obviously are of an entirely different nature.

A skeptic might predict nothing will be done about this situation until it does cause a disaster. Only then would real international pressure be put on the offending nations to cease offband operations and behave as proper citizens. And even if such an event did occur, it's doubtful that the Commies, to mention only one group, would end all illegal broadcasting.

Meanwhile, of course, DXers can take advantage of this bit of international free-for-all'ing by trying for some of the offband broadcasters. Assuming a QSL is the goal, it's best to submit a routine report (but with the frequency clearly indicated) on the chance that the station will reply. If lucky, you will find yourself with a gem of sorts—a quirky kind of QSL bearing an offband frequency, much as a misprinted stamp might contain an erroneous figure or letter.

And even if a particular station chooses to ignore your report, there's no need to be dismayed. After all, once you know the exact frequencies where all SWBCing is supposed to take place, logging illegal DX becomes relatively easy. It'll take some careful digging, but you'll be surprised at just how much abounds in the not-so-free spaces between the legal SWBC bands. —*Alex Bower*

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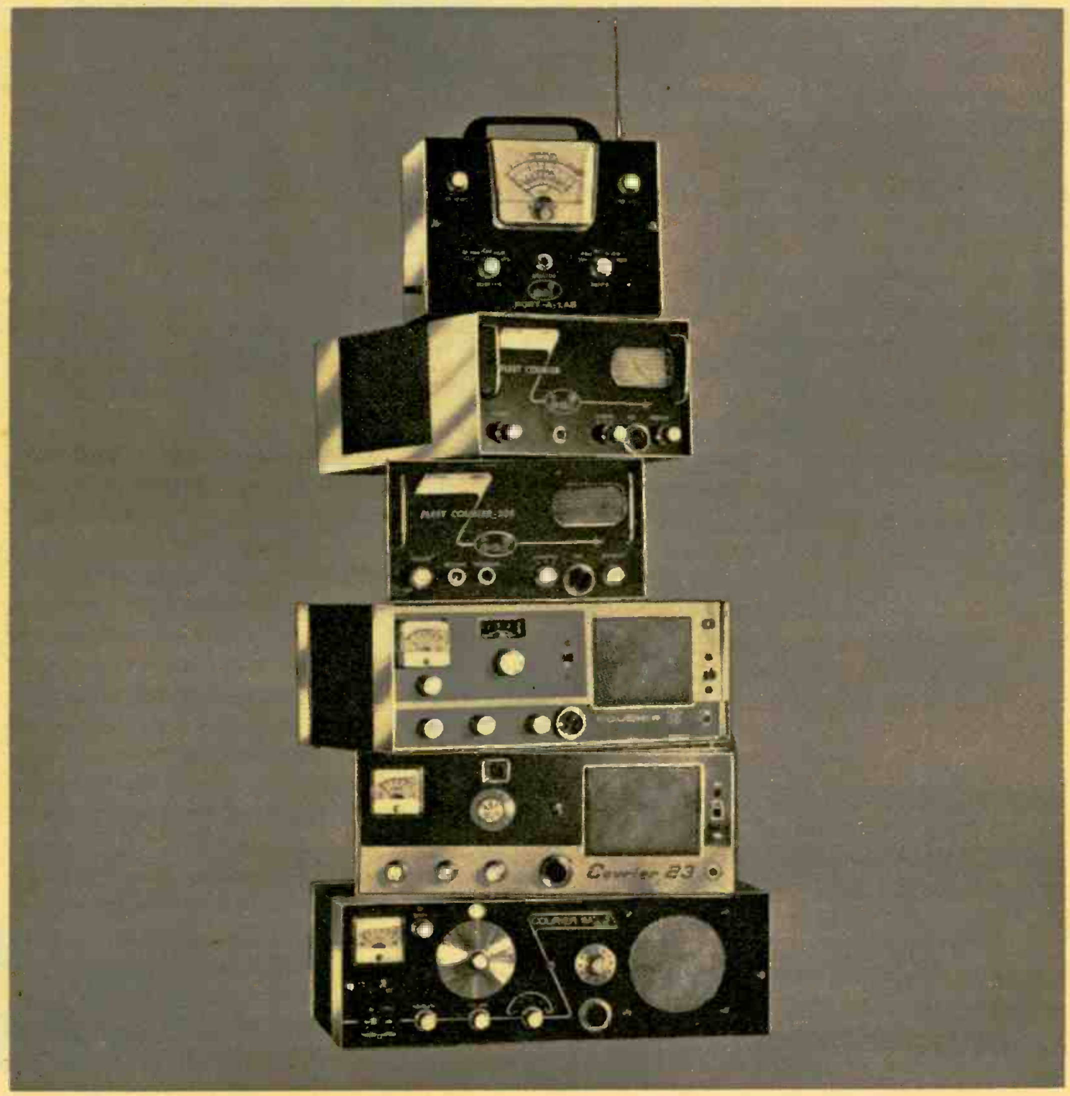

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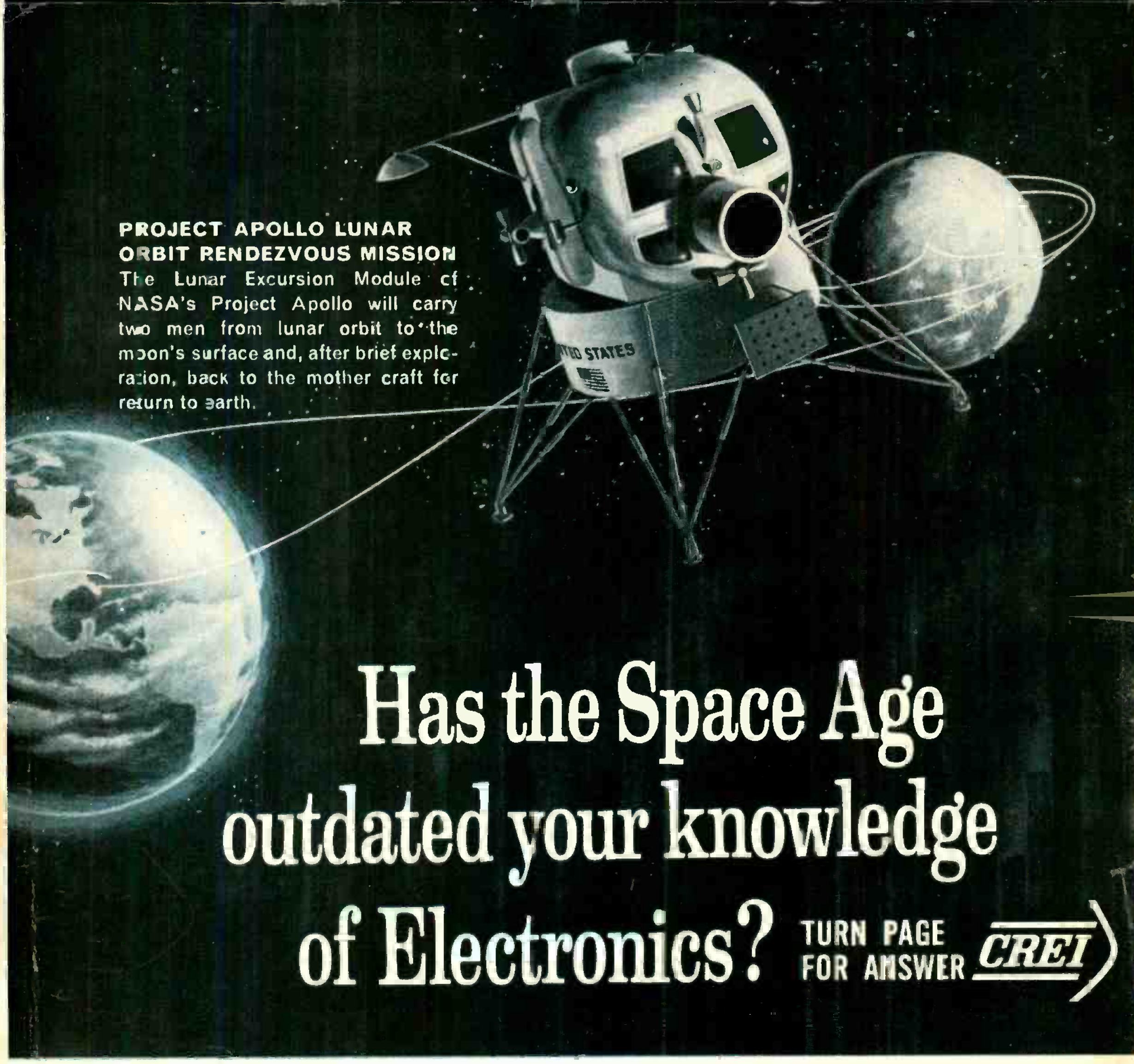

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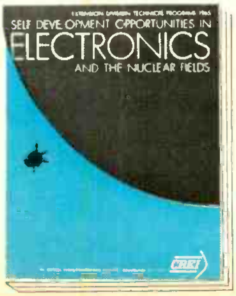

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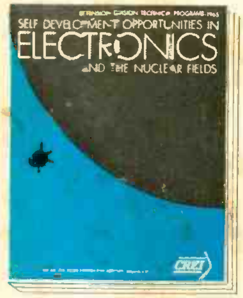

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