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ELECTRONICS ILLUSTRATED

July 1963 A Fawcett Publication Vol. 6, No. 4

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ADDRESSES
Editorial and Advertising Offices: 67 West 44th St., New York 36, N.Y. Subscriptions: Change of address Form 3579 to Subscription Dept., Fawcett Bldg., Greenwich, Conn.

ELECTRONICS ILLUSTRATED is published bi-monthly by Fawcett Publications, Inc., Fawcett Place, Greenwich, Conn. W. H. Fawcett, Jr., President; Gordon Fawcett, Secretary and Treasurer; Roger Fawcett, General Manager; Roscoe K. Fawcett, Circulation Director; Donald P. Hanson, Assistant General Manager.

Second-class postage paid at Greenwich, Conn., and at additional mailing offices.

Subscription price $4 for 12 issues in U.S. and possessions and Canada. All other countries $6 for 12 issues. Foreign subscriptions and sales should be remitted by International Money Order in U.S. funds payable at Greenwich, Conn.

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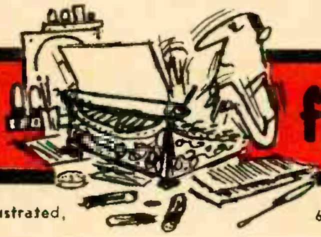
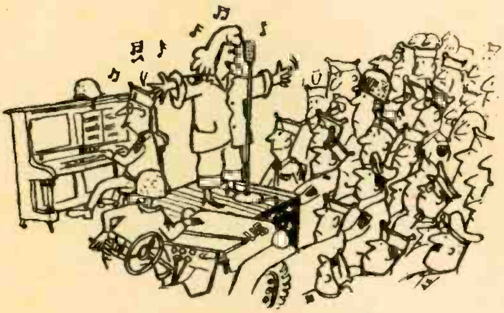
COVER—Painting by David Lockhart. Ektachrome by Mike Bonvino, EI Studios.

FEEDBACK from our readers



Write to: Letters Editor, Electronics Illustrated, 67 West 44th St., New York 36, N. Y.

● *The Other End*



Your RADIO PROPAGANDA HANDBOOK (May '63 EI) was darned well done but I think you went off the track about Marlene Dietrich's vocals and the war effort. I thought it was her *legs* that inspired *our* boys. How about showing them?

George Keller
St. Louis, Mo.

● *Correction*

I liked your CB MARKETPLACE directory (March '63 EI), especially the price you gave on Lafayette's TM-58 SWR bridge and RF power meter—$7.95. Shouldn't that have been $27.95?

Harold Finch
Paterson, N. J.

You are right, Harold. We goofed.

● *Pro & Con*

Please accept a CBer's thanks and praise for the special Citizens Band issue (March '63 EI). The theory articles cleared up quite a few questions and the projects were great.

George Dresser
Peekskill, N. Y.

My regrets to your staff on that all-CB issue. Maybe it's the ham in me, but I think you wasted a heck of a lot of paper.

Chuck Marty
Troy, Ohio

Mr. Dresser, meet Mr. Marty.

● *Hooked*

Man, what a lot of trouble one magazine can cause. You aroused my interest with HOW TO WIN A DX AWARD in the Jan. '62 issue and then it all started. I tore out and purchased a short-wave set. I needed a tape recorder and a set of foreign dictionaries to make out the DX broadcasts. Two dozen technical books and a typewriter were musts. Antennas started springing up all over the place and I soon learned that if you want good DX you don't sleep—hence, the bags under my eyes. The post office is making money on me for the first time in years and I believe my wife is about ready to pack up and leave. Time to quit? I'm having a ball!

D. N. Williamson
Dayton, Ohio

● *A Girl*

I noticed your new column, EI AT LARGE, in the May issue, the one about women in electronics being given equal treatment. It was heart-warming to me. Cheers for that distaff-minded company. I confess (but only to you) to being a secret reader of EI and an electronic enthusiast. But I'm afraid my girl friends wouldn't understand.

Joan A.
Pittsburgh, Pa.

Get smart, Joanie. Try it on the boys.

[*Continued on page* 6]

FEEDBACK

Continued from page 4

● *Long Story*

I was a little confused by your description of current flow in HOW TO USE SILICON RECTIFIERS (Jan. '63 EI). You state that the flow is from anode to cathode—the same direction in which the schematic's arrow points. I was under the impression that the flow of current is from negative to positive—in spite of the arrow.

Albert Pecaites
Cleveland, Ohio

The question you bring up, Al, could lead to a long, long answer and has, in point of fact, led to a great deal of confusion. In short, just blame old Ben Franklin, who announced 200 years ago that electric current flows from positive to negative. The current theory held sway until relatively recent times and electronic symbols were drawn to conform to it. A diode symbol, for instance, pointed in the direction of Franklinian current flow. Our article referred to this current *theory. The electron theory, telling us that electrons flow* from negative to positive, *is* now *generally accepted but the old symbols have stuck.*

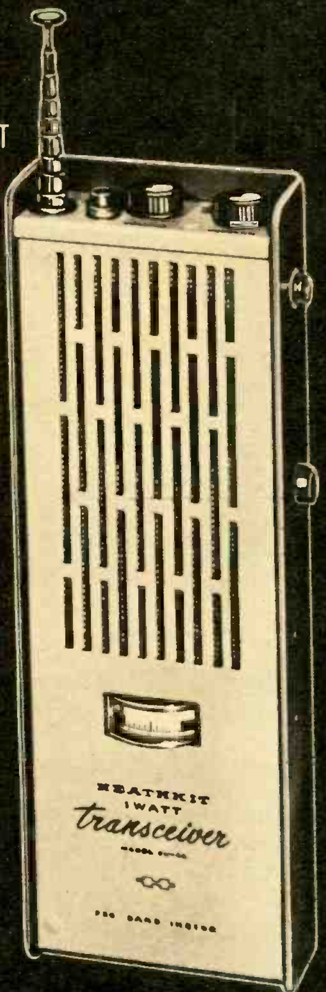
● *Cheep, Cheep*

Your 79¢ walkie-talkie soup-up (Jan. '63) works great but your price is too high. Philmore puts out the same type of transformer for 60 cents. Just for the record, I don't work for Philmore or wear kilts.

Royce Showalter
Houston, Tex.

[*Continued on page* 8]

NEW FROM HEATHKIT



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FEEDBACK

Continued from page 6

● *SSB Without BFO*

I read your article on tuning SSB with BFO way last September. It was good, but I have no BFO and still tune single sideband. I have two pretty good SW receivers with magic eyes. When both sets are on, the local oscillator of one closes the eye of the other. So when I get an SSB signal on one set I tune the other rig just below the first to supply the missing carrier. When the eye closes on the first receiver, I have the carrier. The signals are very clear.

W. Harris
Brooklyn, N. Y.

That's a clever idea—one we've never heard before.

I don't have BFO but I get SSB by using my Q-multiplier. I set it in the broad peak position and it acts as a BFO when the adjustment control is just past the point of oscillation.

Jeff Newbro
Great Neck, N. Y.

Another clever one.

● *Big If*

I'm just starting in electronics and want to know if it is all right to get a CB license to operate a walkie-talkie, which I have, for talking with other CB stations.

G. Esser
Pittsburgh, Pa.

Handi-Talkies and walkie-talkies must carry a certificate (FCC form 452-C) in order to be used legally in the CB service.

● *DX Awards*

When trying for one of your DX Awards, can we count a country twice if we get two QSL's from it?

Todd Murphy
Bronxville, N. Y.

No. EI's DX Awards are made solely on the basis of the number of different countries DXed.

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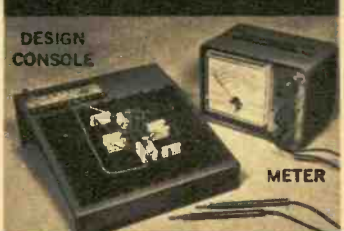

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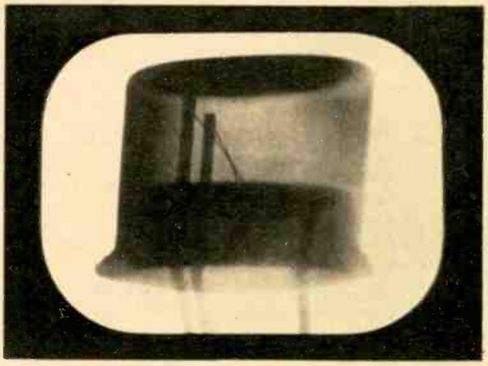
LOOK OUT ABOVE . . . The gent in our picture, who looks like he might be walking the plank the hard way, is merely doing his all for science—or perhaps he's letting his all run to his head. His real job is demonstrating a new permanent-magnet system by Westinghouse to overcome space weightlessness.

The unique feature of the magnet assembly on each foot is the way it can be turned on or off. It also can "remember" the direction of its greatest magnetic pull. The wearer has the ability to lift his feet for walking. The device combines the natural magnetic field of permanent magnets with the voltage-controlled characteristics of electromagnets. The magnetic "circuit" is composed of a three-layer construction made up of a ceramic magnet sandwiched between two pieces of soft steel that funnel the lines of force into the outer areas. Two metal keepers are mounted at the ends.

The circuit's on-off feature and its "memory" have to do with moving concentrated magnetic lines of force from one pole to the other. This can be done by moving the keepers manually or electrically by applying short pulses of current to coils of wire, weakening the field at one end. The "memory" bit means simply that the magnet assembly keeps the strong field at the end where it was moved last.

X-Ray Eye . . . The ML-589 is a vidicon TV camera much like all the others, except for one feature. It is sensitive to X rays. Most vidicons can see only visible light. The ML-589's associated equipment irradiates a target with X rays and the tube then picks up the image in the manner of X-ray film. The tube, made by Raytheon's Machlett Labs, will be used mainly in nondestructive testing of metals. It sees through ⅛-inch steel or ¼-inch aluminum to reveal the innards of electronic components (see photo).



Angry-106 . . . is what the Army came up with as a name for its newest baby—the AN/GRC-106 transistorized, single-sideband Jeep radio. The rig can reach 50 miles over unfriendly terrain while bouncing along at field speed. Angry weighs just 100 pounds (half the weight of the set it replaces), is light enough to be manpacked—or maybe menpacked—and its SSB circuitry gives GI's a tenfold increase in range over normal AM sets. It can withstand rigors of weather and hard Army travel that its predecessors could not. Handy and compact (two units mount one atop the other), the high-frequency rig puts out 400 watts in the 2-30-mc range. General Dynamics gets the manufacturing credit for the radio.

. . .electronics in the news

Some Shack . . . The U.S. Navy's Kingsport is the world's first ship outfitted specifically to communicate with and control satellites. That bulge midships

is a 53-foot radome housing a 30-foot parabolic antenna. Three 500-KW generators power the ship's equipment.

Light Gyro . . . Aiming for near-perfect stability in guidance systems, Sperry is developing a closed-circuit laser that may become the gyroscope's successor. Because the gyro depends on a machine-made wheel to sense motion, it is prone to slight drift. The ring laser uses the constant velocity of light to sense motion. Our photo shows a prototype table-top arrangement of four helium-neon-

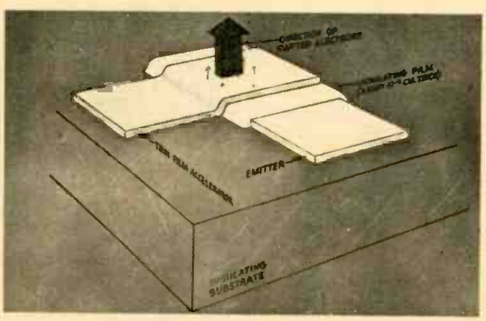
gas tubes with mirrors at the corners. Two light beams speed continuously in opposite directions around the ring. Any drift in the ring's bed produces a frequency shift in the beams.

...electronics in the news

Bedside Console . . . When you hit the resort road this summer you may find

your favorite hotel equipped with bedside data consoles. These Honeywell remote-control units command the room's temperature, lights and TV. Panel lights tell the weather forecast and one indicates you're wanted at the desk.

Tunnel Cathode . . . General Electric is developing something new in the way of vacuum tubes. The special feature of this tube is its *tunnel* cathode. In conventional tubes a metal cathode must get red-hot before electrons begin drifting through the vacuum. In the tunnel cathode electrons flow from a cool metal layer through an extremely thin insulator to a counter electrode maintained at a few volts positive potential. The

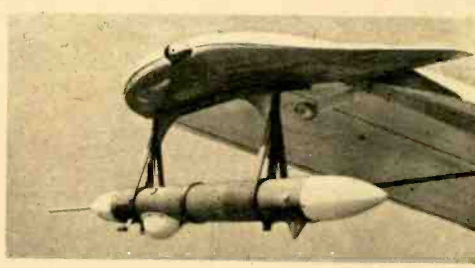


counter electrode is so thin that electrons, already headed in the right direction, pass right on through to the plate. In the photo, the emitter electrode appears as the bottom white layer, the insulator is in center and the counter electrode is on top. The big arrow represents electron drift. The tube has low capacitance and temperature and is insensitive to radiation (as transistors are not). It's a good candidate for outer-space electronic gear.

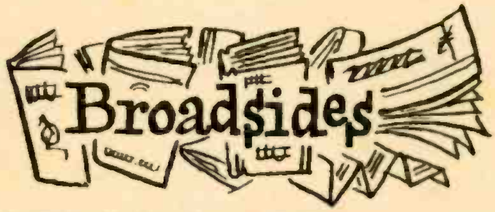
Liquid Laser . . . The frontier in laser development keeps receding like the tide. Hughes Aircraft scientists have given it another shove with a laser that uses organic liquids instead of the usual solids or gases, though in its rigging is a ruby rod. In the Hughes laser a beam of coherent light from the ruby is

pumped through the liquid, which acts as a kind of tuner or optical channel selector. Out comes laser light at wavelengths never before attained. In our photo, nitrobenzene is poured into the laser's tank. The ruby rod is at right.

A Bomb . . . That mean-looking gadget with an antenna for a nose happens to be a domesticated and miniaturized weather pod made by Bendix. It is used in obtaining meteorological data for research and weather predictions. The Met-Pod, carried by manned aircraft or



drones up to altitudes of 40,000 feet, gathers information on air pressure, temperature, etc. When a drone is the carrier, the unit can enter the centers of severe storms. The data are relayed to ground stations via a UHF telemetering band. Met-Pod carries its own two-hour power supply.



Broadsides

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

Almost 150 manufacturers of **Citizens Band and amateur radio equipment** are represented in a new catalog available free from Harrison Electronics Corp., 227 Greenwich St., New York 7.

Building instructions for an inexpensive **AC/DC power supply** are available free from Stancor Electronics, Inc., 3501 Addison St., Chicago 13, Ill. The compact, transistorized unit is intended primarily for operation off 12 volts DC, powering mobile CB or ham equipment, but also can be run off 117 VAC.

A Directory of Accredited Private Home Study Schools lists 56 correspondence schools and the subjects they offer, including a large variety of courses in electronics. The pamphlet, issued by the National Home Study Council, has a cross-reference arranged by subject. For a free copy write NHSC, 1601 18th St., N.W., Washington, D. C.

A General Electric how-to on **Ways to Brighten Your Home With Light** includes diagrams and sketches that help plan custom lighting installations. Free copies may be obtained from GE's Inquiry Bureau, Dept. TPC-12, Nela Park, Cleveland, Ohio.

Engineers—and even the average space-age citizen—might be enlightened by a 12-page discussion on **Automatic Tracking Antenna Systems**. Tracking techniques for IRBM's, ICBM's, satellite launchings, etc., are described. The booklet is available at no charge from Radiation, Inc., Melbourne, Fla.

Batteries are more or less taken for granted these days, but how many engineers or experimenters know the history of their development, the chemicals they're composed of, or techniques for testing them? RCA's **Battery Manual** includes all this and more, plus an application chart for RCA models. Send 50¢ to Commercial Engineering, RCA Electron Tube Div., Harrison, N. J.

Nothing fits all your CB needs like Hallicrafters' versatile *new transistorized CB-5*

AC Pedestal Power Supply, Battery Pak and Tone-Coded Squelch accessories optional at extra cost.

Wherever and however you use citizens band, no transceiver made gets around with the effortless efficiency and consistent high performance of the new CB-5.

A fraction over 3 inches high, 10 inches wide and 8 inches deep, its 18-transistor design solves all normal space problems in mobile or airborne use.

Weight: 6¾ lbs. It has no vibrator, of course, and battery drain is negligible.

Specifications: 5 watts in; 100% modulation capability; 6 crystal-controlled channels; 1 uv sensitivity for 10 db. S/N ratio; 45 db. adj. channel rej.; PTT ceramic mike; 6 kc. selectivity at 6 db.; 18 transistors, 9 diodes, 3 instant-heat transmit tubes. Price: **$199.95.**

Hallicrafters CB-3A . . . Unsurpassed for range and reliability. $159.95.

- 8 channel, crystal-controlled convenience.
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- Optional S-Meter and "Racket Buster" Noise Eliminator with knock-out front-panel mounting.
- 100% modulation capability; output over 2 watts; 6 kc. selectivity; sensitivity less than 1 uv for 10 db. S/N ratio.

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Who can say what major business decision this year will be influenced by his knowledge about such divergent subjects as . . . Railroads or Rockets . . . Farming or Foreign Affairs . . . Books or Boating.

Within these pages, he finds information and products that help him form his opinions.

He's the man that gets the business . . .

. . . and he reads this magazine, just as you do.

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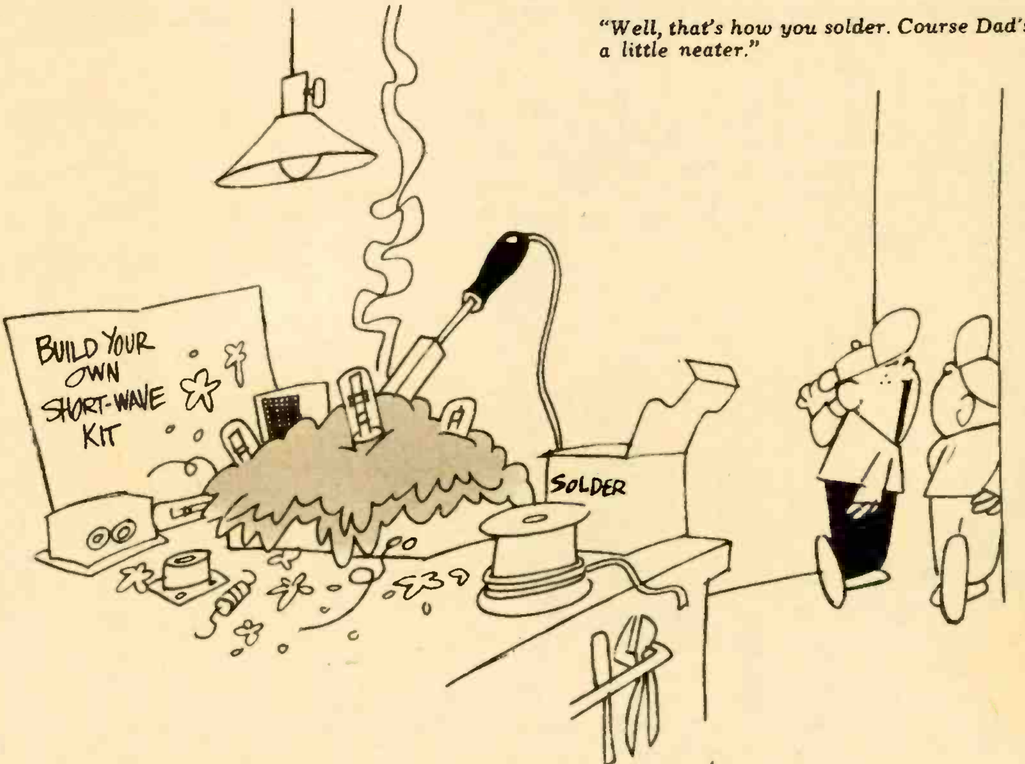


"Well, that's how you solder. Course Dad's a little neater."

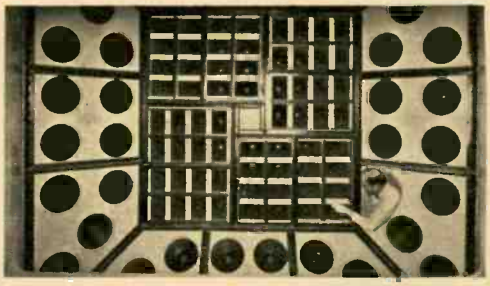
ED BLOUNT'S $200,000 HI-FI SET

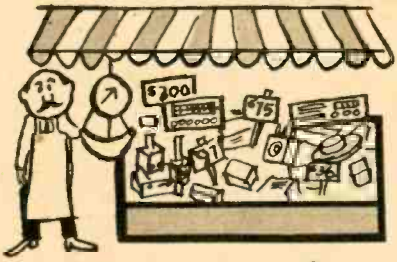
OUT IN THE Arizona desert, Ed Blount presides over what undoubtedly is the most expensive hi-fi setup ever built. Ed works for Goodyear Aircraft, owner of the strange rig which costs about $200,000.

As might be expected from its price, Ed's hi-fi equipment has a very special purpose. You'll never hear Bach or Beethoven on it because, if you did, the incident would be your terminal experience in high fidelity, and the world as well (egad, what a way to go!). The rig's 112 speakers pour out 150 decibels of sound, enough to mutilate a chunk of steel or shatter a gem-stone.

The $200,000 apparatus is part of a big acoustic facility that gives vibration tests to components for atomic-age planes and missiles. These inanimate guinea pigs are suspended in one of three concrete chambers and subjected to high-intensity sound piped in from a main baffle-room (shown in photo below) which contains 48 woofers and 64 trumpet-type mid-range speakers. Amplitude (0 to 150 db) and frequency (37 to 10,000 cps) are rigidly controlled.

All this sound comes from reverse-biasing one tiny semiconductor diode to produce white noise which, when amplified a few million times, would drown out a thousand freight trains or all the tom cats ever born. Music played on the set could be heard clearly in Phoenix, 20 miles away.





Electronic Marketplace

LOW-DRAIN PA . . . Requiring only 4.5 amperes at 12 volts, the Knight KN-3230M all-transistor 30-watt public-address amplifier can be plugged into

your car's cigarette lighter and set up in a few minutes. It is about the size of a cigar box, measuring 3½x10¾x6 inches, and it weighs 11 pounds. Black finish, aluminum panel. Allied Radio Corp. $69.95.

Lab in Kit Form . . . Want to learn about computers? The DI-TR kit, which includes 20 transistors and ten diodes, will get you off to a good start.

Accompanying manuals describe eight computers you can assemble and operate. About $60. Tesla Research Foundation, Box 11275, Phoenix 17, Ariz.

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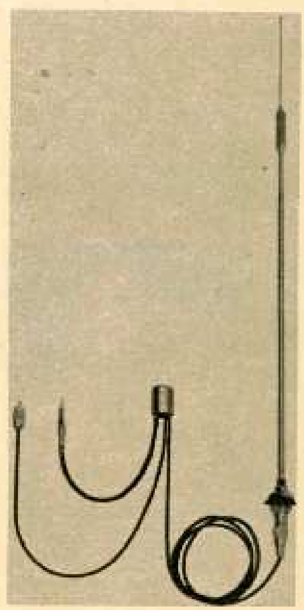
Marketplace

Waker-Upper . . . An easily installed fire alarm system for the home features a blaring horn that sounds off within seconds after a blaze starts. Designated the ML-290, the system includes six sen-

sitive thermostats, 150 feet of wire, a lantern battery, a manual test button and full instructions. Additional thermostats can be added as desired. $29.95. Lafayette Radio Electronics Corp.

Dual-Band Car Antenna . . . No need to cut extra holes in a car body for a CB antenna. The M-103 fits in the opening for a car's regular antenna, and it covers both CB and the broadcast band.



Switching from one to the other is automatic. The center-loaded antenna is only 46 inches high. Antenna Specialists, Cleveland, Ohio.

Marketplace

To Please the Eye . . . Short-wave receivers long have been noted for their severe, functional appearance. This is acceptable in the shack but not in the living room, so Hallicrafters is putting

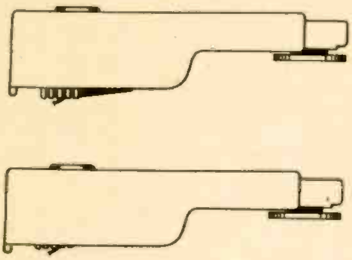
them into attractive walnut cabinets. First to be introduced are the Model WR-1500 (shown) at $144.50, and the WR-1000, at $89.95. Hallicrafters Co., 4401 W. Fifth Ave., Chicago 24, Ill.

Head Degausser . . . With continued use, the heads in a tape recorder can become magnetized, a condition which makes for noise and distortion. This trouble is eliminated in current models of Roberts 997 and 1057 machines by a self-contained demagnetizer. Brought

into play for about a minute once a week, the automatic demagnetizer effectively ends residual magnetism problems (until the next time, of course). The 997 lists for about $450, the 1057 for about $340. The manufacturer is Roberts Electronics, 5978 Bowcroft St., Los Angeles 16, Calif.

Marketplace

Scratch-Proof . . . Place more than 3 grams of pressure on one of Shure's Gard-a-Matic stereo cartridge assemblies and—you guessed it!—the cartridge retracts into the shell. Designed specifically for use with the Garrard



Type A and Type AT6 turntables, the Gard-a-Matic series tracks at 2 to 2½ grams and has a claimed frequency response from 20- to 20,000 cps. Price, complete with plug-in head: $49.50. Shure Brothers, Evanston, Ill.

For Pedal Pushers . . . Your guests won't laugh when you sit down at the keyboard of this handsome instrument, knock off a few stupendous chords and then announce, "I made it myself!" The Heath people know from experience that their customers stop at nothing, so they didn't hesitate to market this all-

transistor electronic organ in kit form, complete with bench. The built-in amplifier and speaker on the dual-keyboard serenader will rattle windows if you crank the gain up far enough. About $355.


BEST BUYS IN STEREO AND MONO HI-FI
Transistorized Stereo/Mono 4-Track Tape Deck RP100
Semikit (electronics in kit form) $299.95 Wired $399.95
New Stereo FM Multiplex Tuner ST97
Kit $99.95* Wired $149.95*
FM-AM Stereo Tuner ST96
Kit $89.95* Wired $129.95*
*Incl. FET
70-Watt Integrated Stereo Amplifier ST70
Kit $99.95 Wired $149.95
40-Watt Integrated Stereo Amplifier ST40
Kit $79.95 Wired $129.95
28W Integrated Stereo Amplifier HF81
Kit $69.95 Wired $109.95
FM Tuner HFT90
Kit $39.95 Wired $65.95
Incl. FET Metal Cover $3.95
AM Tuner HFT94 Incl. FET
Kit $39.95 Wired $65.95
Stereophonic Dual Preamplifier ST84
Kit $59.95 Wired $89.95
Stereo Power Amplifiers
Kit Wired
70W HF87A: $74.95 $114.95
100W HF89A: $99.50 $139.50
28W HF86: $43.95 $ 74.95
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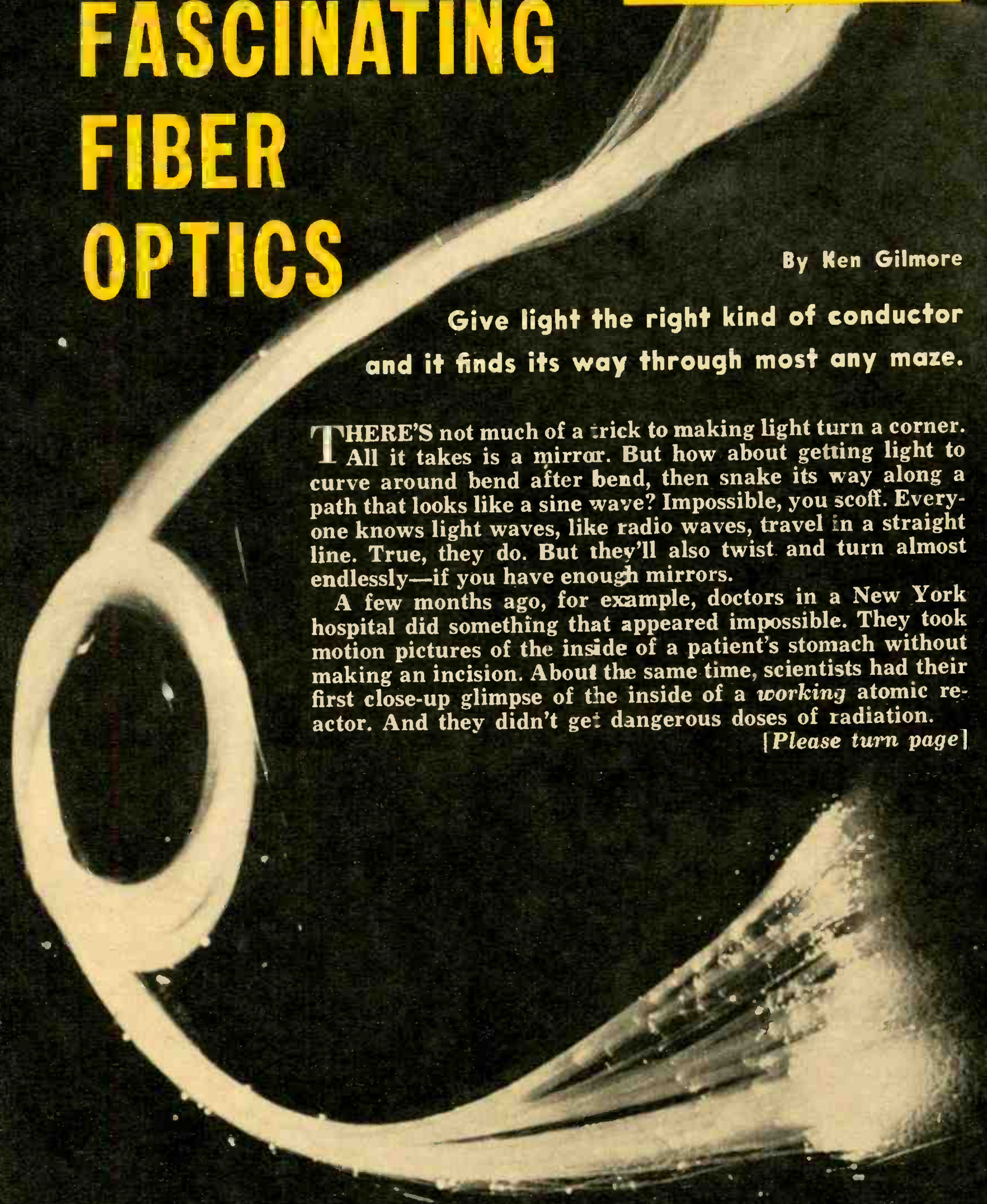
FASCINATING FIBER OPTICS

By Ken Gilmore

Give light the right kind of conductor and it finds its way through most any maze.

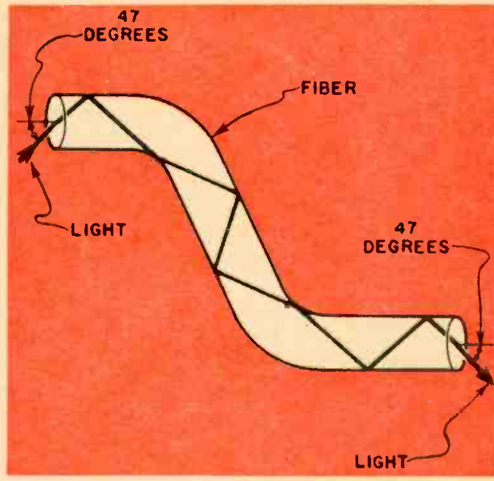


THERE'S not much of a trick to making light turn a corner. All it takes is a mirror. But how about getting light to curve around bend after bend, then snake its way along a path that looks like a sine wave? Impossible, you scoff. Everyone knows light waves, like radio waves, travel in a straight line. True, they do. But they'll also twist and turn almost endlessly—if you have enough mirrors.

A few months ago, for example, doctors in a New York hospital did something that appeared impossible. They took motion pictures of the inside of a patient's stomach without making an incision. About the same time, scientists had their first close-up glimpse of the inside of a *working* atomic reactor. And they didn't get dangerous doses of radiation.

[*Please turn page*]

Fiberscope will transmit image from end to end whether it's curled in a loop or lying straight. See letters in viewer between the man's fingers.



How light is reflected from side to side as it goes through single fiber. The angle of exit always equals angle of entry (47 degrees here).

Both these feats were accomplished with the fiberscope—a bundle of microscopic glass fibers which, fed into almost inaccessible places, will transmit clear, sharp pictures of what it sees.

The fiberscope is only one product of the new science called *fiber optics*, a field so new that even its name hadn't been coined ten years ago. Yet a flood of application ideas has started to flow from fiber optics laboratories. Already in use or in stages of advanced development are devices which can:

- Protect your bank account or insure the security of secret military and diplomatic messages.
- Make color TV tubes less expensive to manufacture.
- Reduce X-ray dosage without sacrificing picture quality.

Fiber-optic devices can perform as they do because they handle light in a rather special way. Light waves, of course, belong to the same electromagnetic spectrum where you find radio waves. We've been putting radio waves through their paces for years. But as for light, we haven't gone much beyond the stage of turning it on to keep from bumping into things in the dark.

Fiber optics began in 1870, although no one knew it then. A British physicist named John Tyndall illuminated the inside of a tank of water, then pulled the plug out of a hole in the side.

As the stream of water spurted out and arched to the floor Tyndall noticed a strange thing. The light coming out of the hole didn't travel in a straight line as it was supposed to do. Instead, it curved around and stayed within the stream of water, illuminating the floor at the point where the water struck!

Researchers later confirmed the fact that light rays will, indeed, follow a

Message becomes hash in scrambled optical fibers, can be decoded only by special decoding fibers.

curved path if "imprisoned" within glass, plastic or other transparent rods, regardless of how tortuously the rods are twisted. Nobody thought of anything to do with Tyndall's discovery until the 1930's. Then a dental supply house released a curved plastic tube attached to a flashlight. Dentists used it to view hard-to-reach places in patients' mouths. The plastic tube was a fiberscope.

It was also in the 1930's that a Dutch scientist named A.C.S. van Heel got an inspiration. He had noticed that the faceted eye of an insect is made up of a bundle of light-transmitting rods. The facets are the ends of the rods and each rod transmits a part of the image falling on the eye to the bug's visual nerves. Van Heel decided that images might be transmitted similarly through a bundle of small glass fibers. Each fiber would convey a small part of the total image.

He built a glass-fiber seeing tube based on the bug-eye principle and it worked as predicted. Furthermore, the individual fibers from which the tube was made were fine enough to be flexible—much like those in modern fiberglass curtains.

As a result, van Heel could twist the tube—later dubbed a fiberscope by British researcher Narinder Kapany—and see things that were hitherto unseeable: the back of his head, the rear of a cabinet, the inside of his own ears. Bending the fiberscope didn't impair its image-transmitting ability a bit. The picture was just as bright and clear with the scope tied in knots as with it laid out straight.

Other scientists set out to learn more about what happens when light goes through a tiny glass fiber. One of the first things they verified, of course, was that light sent through a bent tube doesn't actually bend at all. It makes its way from one end of a fiber to the other by bouncing back and forth from wall to wall (see drawing). A single ray may be reflected from side to side as many as 4,000 times in only 1 foot of glass fiber.

What's ahead for fiber-optic devices? One of them may produce the world's first unbreakable code and protect your bank account at the same time. In an

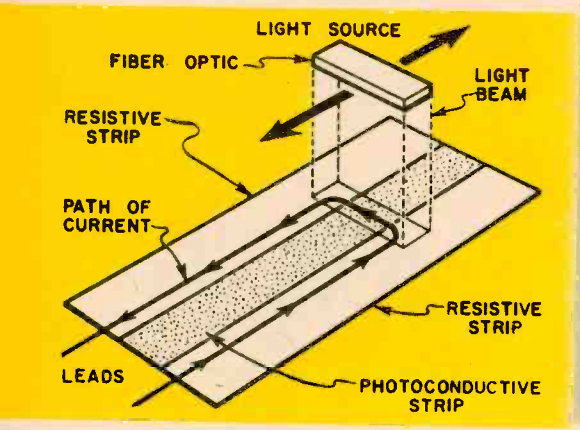
There's no future for forgers when a bank has a fiber-optic device to decode scrambled passbook signature, compare it with one on draft.

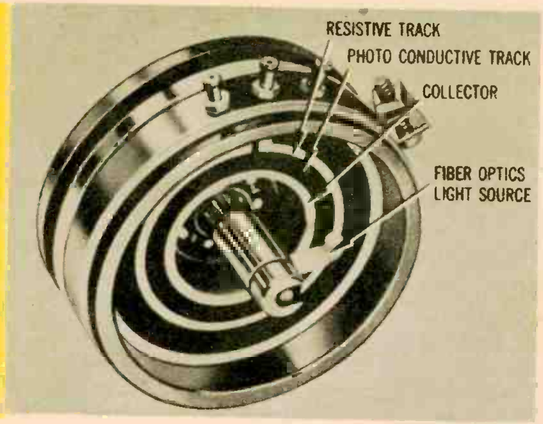
ordinary fiberscope, each fiber occupies the same relative position on each end. Suppose, though, that the fibers weren't in a parallel bundle, as usual, but that they were all mixed up.

If this were the case, the tiny bits of the picture would be scrambled at the end where they come out, and the picture would show up as a jumble of meaningless dots. View this scrambled pattern backwards through the same bundle, or through another one scrambled in the same way, and the image is recreated. Scientists say that not even code-breaking computers can crack a message so encoded.

A commercial version of this device, sold by RCA and called the Sinagard, is already beginning to show up at a few banks around the country. With the Sinagard system, your passbook contains your signature in coded form (see photo). However, the bank teller has a device which unjumbles the scrambled pattern and allows him to compare this original signature with the one you have just written on your withdrawal slip. The result is that no one can steal your passbook, forge your signature and then withdraw money from your account.

Even more exciting are the improvements fiber optics is bringing to electronic devices of many kinds. For example, when the electron beam hits



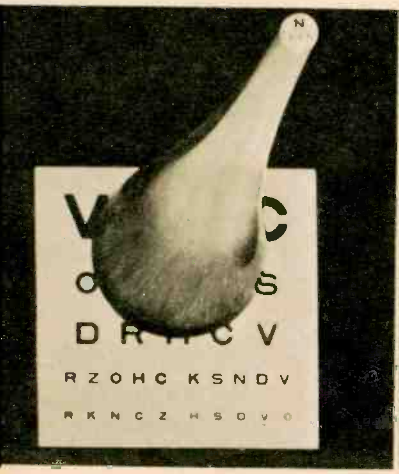


Movable fiber-optic rod in new pot directs light on photoconductive strip, makes path for current.

the phosphor layer on a TV tube, a large part of the light created is scattered and absorbed by the glass face of the tube. But, with a fiber-optic bundle substituted for the regular face on the cathode-ray tube, part of the phosphorescent material will be stuck on the end of each glass fiber. And each fiber will transmit practically all the light that strikes its coated end.

One interesting application of this idea is a fiber-optic fluorescent screen. With it, a doctor could subject his patients to far smaller doses of radiation and still get a good picture, since it would require far less X-ray power to produce a bright image.

It should be possible to build a less costly color TV tube by using a similar principle. Present color tubes are expensive because extremely small particles of three different kinds of phosphors—one for each of the three primary colors—must be put on the tube face in a precise pattern. A cheaper tube might be made with only one phosphor. Its fiber-optic face would consist of glass fibers of the three colors.



A special cone-shape fiber-optic tube can reduce or magnify image. It all depends upon which end of the tube you are looking through.

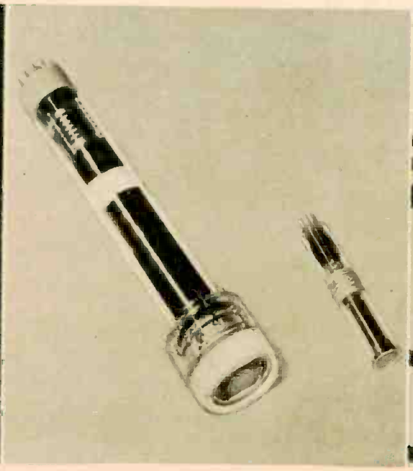
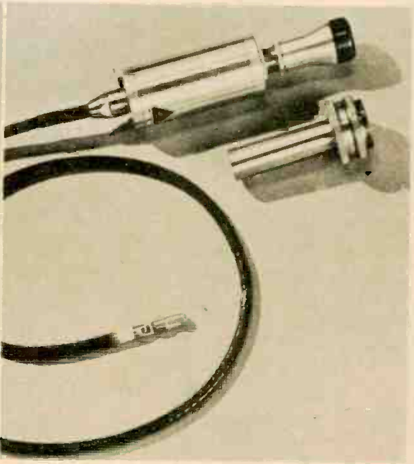
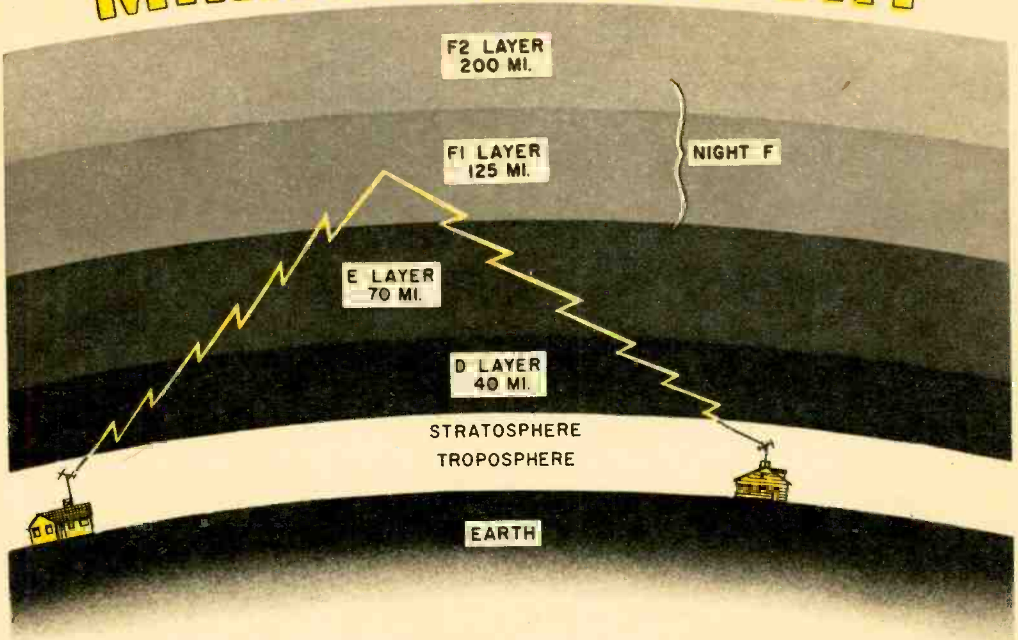


Image orthicon (left) and vidicon fiber-optic tubes are made by RCA. Vidicon contains 500,000 parallel lines, can resolve 600 TV lines.



Experimental fiberscope boasts its own built-in lamp. Object next to eyepiece is adaptor for connecting output to TV camera.

Radio's MIRROR IN THE SKY



Signals that go up and then come down have met the ionosphere.

By Saunder Harris

THE phenomenon of long-distance radio communication is easy to explain. You just say, "The radio waves bounce off the ionosphere and come down on the other side of the world, like light reflecting from a mirror."

But just what *is* the ionosphere, and how does it do what it does? Let's go along with an upward-bound radio wave and see what we can find out.

The signal we're watching might come from any high-frequency antenna. It has two parts at the beginning. One, called a groundwave, spreads out from the antenna along the earth's surface. Its energy is absorbed gradually by the earth and it dies in 100 miles or so. The second part of the signal, called a skywave, travels upward at an angle which depends on the frequency used and the antenna design.

As we watch, the signal soars through the troposphere and then the stratosphere, where the air is rarified and extremely cold. We at last emerge into a vast sea of electronic turbulence at about 40 miles up. This is the ionosphere, where giant tides of invisible electrical particles churn around like ocean waves. We find two types of matter here: gaseous atoms and molecules which are electrically neutral, and ions which exhibit a positive or negative charge. It is the ions that give the region its name and signal-reflecting abilities.

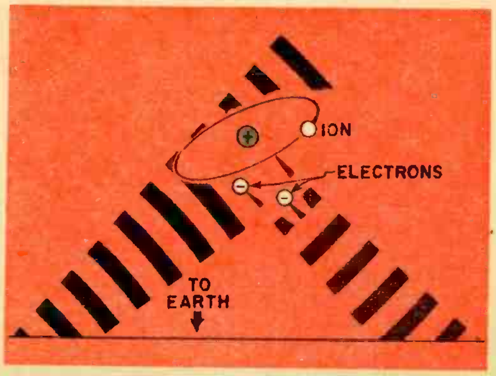
Ions start out as plain atoms and molecules that, at some point, are hit by ultraviolet rays from the sun or by other space radiations, such as cosmic rays. In the collision an atom of gas loses one of its negatively charged electrons and becomes a positive ion. The free electron represents a negative ion. The ionosphere is filled with a fantastic number of free electrons—some 20 million times as many in a given volume as at the earth's surface. These tiny particles play a much more important role in reflecting radio waves than do the larger positive ions.

Research has taught us a lot about the ionosphere's electron sea. Its height and degree of ionization vary with the time of day, the season and the 11-year sunspot cycle. It is more heavily ionized during the day because of the sun's intense radiation. Heavy sunspot activity affects the ionosphere in the same way. The more sunspots—the better reflector is the ionosphere. At present the ionosphere is a relatively poor reflector because we're right at the bottom of a sunspot cycle and the sunspot count is the lowest in a decade.

The ionosphere is divided into some four layers. At about 40 miles up lies the D layer. Centered around 70 miles altitude is the E layer. Strange clouds of ions sometimes drift out of the E layer, forming what is called the sporadic-E layer. Next up the ladder, at 125 miles, is the F1 layer and around 200 miles we find the highest layer, F2, which may extend up to 500 or 600 miles.

D is the densest layer in terms of all particles, but neutral, nonreflective atoms are in the majority and free-electron life is relatively short (the electrons eventually reunite with positive ions to form balanced atoms). As we go higher, free electrons increase in both numbers and life span, making up ionospheric layers—the F layers—which are highly reflective to radio waves of high frequency. (After dark the F layers unite and descend several miles, forming a "night F" layer.)

When our radio wave charges into the F layers an amazing thing happens. The free electrons—and, to a lesser extent, the positive ions—are set in motion by the changing electrical field of the wave, and each particle absorbs some of the wave's energy. The particles begin oscillating at the same frequency as the signal from the earth and



Ionospheric particles absorb energy from rising signal (black), then transmit new signal (gray).

each becomes a tiny transmitter, generating a new wave in time with the upcoming signal. Eventually all our wave's energy is being absorbed and its forward progress is stopped.

The only oscillating energy now available is that from the electrons, and it is being directed toward the earth at the same angle that our wave made with the earth on its approach. The result is what we call a reflected radio wave but, as we can see, the energy going down is in truth a newly created signal traveling in a different direction rather than a true reflection of the old wave.

When the reflected wave reaches the earth a few hundred or several thousand miles from the transmitter it can be picked up by a receiver tuned to its frequency. Or, it may be turned upward again by the earth and do another skip off the ionosphere. This is called multiple-skip propagation. Enough skips enable a signal to go all around the earth.

Ionospheric propagation of radio waves can become an immensely complicated science, and an exact one. The choice of a proper frequency is important for successful skip contacts. Signals at frequencies too high or too low may simply be absorbed and not reflected, or they may pass right on into outer space. To choose the optimum frequency, you must consider the present condition of the constantly-changing ionosphere, the time at transmission and reception points and the season.

Be a Fast-Draw Champ! Build Our Novel

ROBOT GUN-SLINGER

By Harvey Pollack

MOST anyone can become a tolerably good fast-draw shot by buying a pistol or revolver and a holster. All he has to do is practice. But to be a real top gun you need something more competitive than a tin can or a paper target.

Since they don't shoot it out at high noon nowadays and Boot Hill is crowded, anyway, the best way to sharpen your draw-and-shoot time is to do battle with a substitute bad man. That's the role in life for our Robot Gun-Slinger. When you stand up against this ugly critter you know the chips are down. If you're not fast and accurate with that first shot—the only one that counts—he'll plug you for shore, pardner.

Fast-draw shooting has become increasingly popular as a hobby, leading to the formation of some 265 fast-draw clubs with a combined membership of more than 7,500. Every year there are scores of shoot-ups and shoot-offs that lead to titles for the winners. In the old days the losers got toted out of town on a horse but now they just go home and start practicing for next year.

The Robot Gun-Slinger is a highly accurate shooting opponent designed for both hobby shooters and for more serious practice by law-enforcement officers. Success in real shooting encounters, policemen and combat veterans will tell you, depends on much more than getting your weapon free of the holster and pulling the trigger. It hinges on how long it takes you to get into *effective* action after being warned of danger. That first shot must be more than fast. It also must hit a vital area of your opponent.

Our Gun-Slinger simulates a live opponent in that he's life size and can be made to look as much like a man as you desire. The target area is a plate sized to represent the vital area of the body—the area law officers are taught to shoot for.

In action, you get into shooting position opposite the Gun-Slinger and then step on a mat-switch. After a random period of time (which you cannot know in advance) the dummy's eyes light up. That's your signal to go for your gun. If your bullet or pellet strikes the robot's vital-area target within a predetermined time,

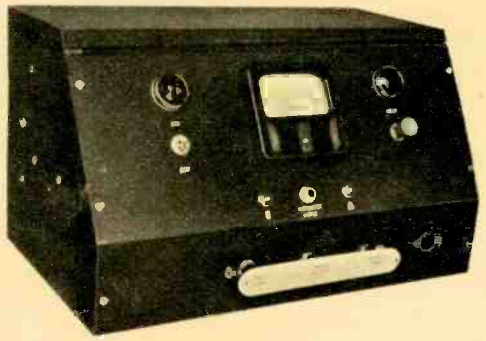


Fig. 1—Control console. White strip protects timing controls from being turned accidentally.

the eyes blink off and the old boy is dead. If you're not fast enough or your bullet misses, his shootin' arm flies up with a resounding crack and a flash of light, and you've had it.

The Gun-Slinger's timing circuits determine the length of the random time period. You set the draw-and-shoot interval, continuing to decrease it as your responses and accuracy improve. A meter on the control console tells you your draw-and-shoot time when you've out-shot the dummy. When you're able to get off an accurate shot in two-fifths of a second you're traveling in championship company. Billy the Kid would take to the hills when you hit town.

Let's examine in more detail how the Gun-Slinger works. Facing the dummy, you step on the shooting mat. After the random time interval—from a fraction of a second up to 15 seconds—his eyes light up, signaling you to draw and fire. Any one of three things can happen next:

- You draw, shoot and hit the chest area before the timing mechanism puts the dummy's arm into action. If you do this, he dies. His eyes go out, signifying a hit, and a meter on the control console shows the time to a hundredth of a second between the draw-and-fire signal and the impact of the bullet on the chest area.
- You hit the chest area, but too late—that is, *after* the preselected time interval you set for yourself. In this case, the dummy's arm comes up and he fires (not real bullets, of course;

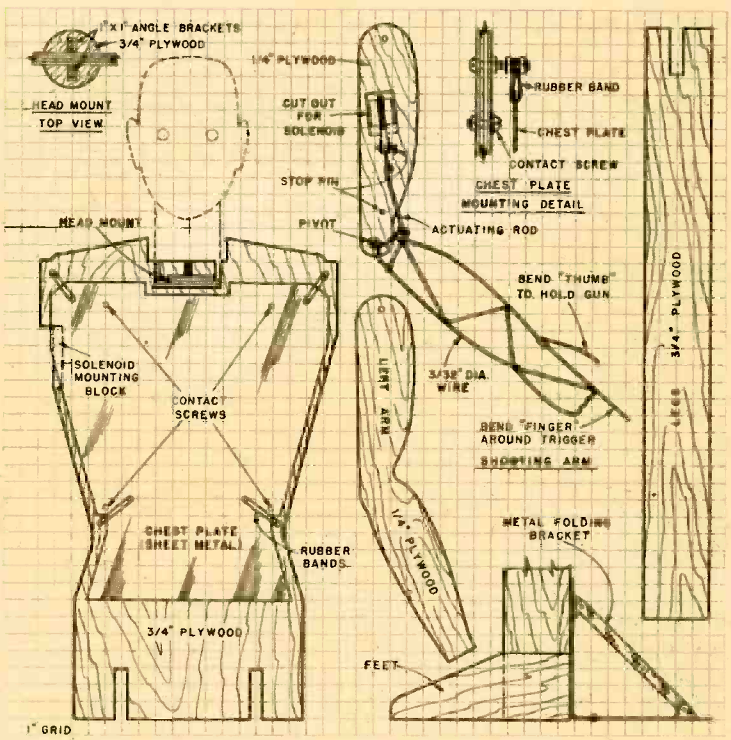


Fig. 2—If you are handy with woodworking tools, construction of the dummy should go easily. All details are shown here; each square equals 1 inch. The torso and legs are made of ¾-inch plywood. If you use powder ammunition, the wood will have to be thicker and the hefty steel chest plate must be held in position by supports stronger than rubber bands. Spacing between chest plate and contact screws behind it is determined by trial and error. It was ⅛ inch in author's model but depends on clothing, ammunition. Four chest-plate contact screws are wired together. Construction details of the head are shown in photo in Fig. 10.

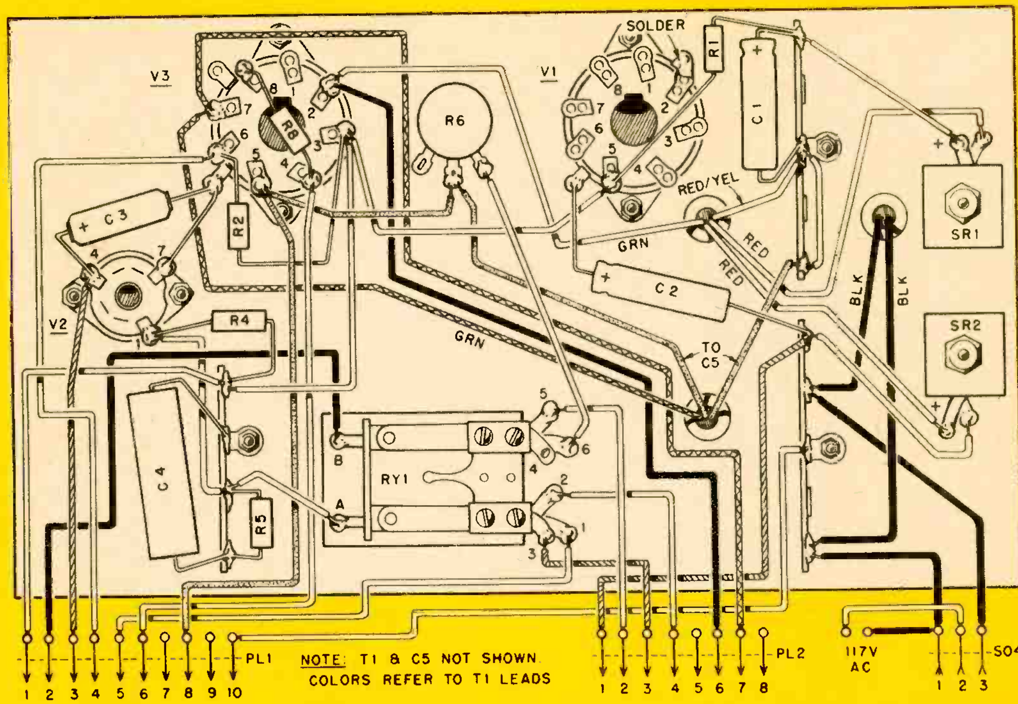
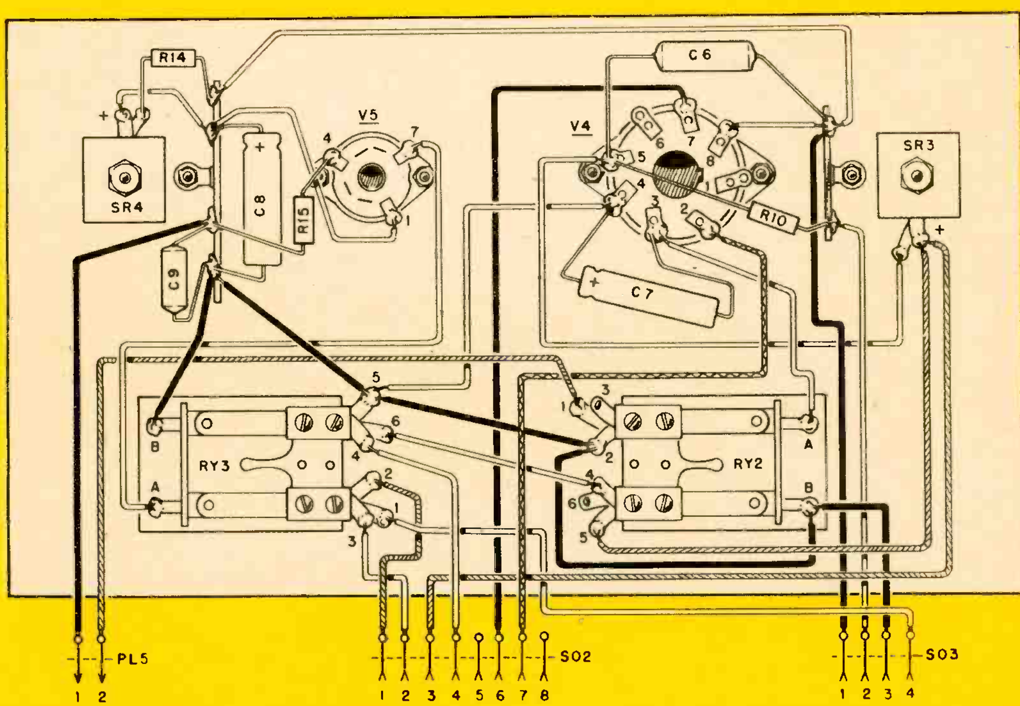


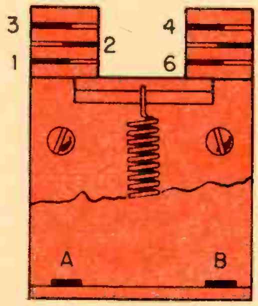
Fig. 3—Power and control chassis. To simplify construction, this may be combined with relay chassis shown below. The wiring between the two may be direct, eliminating several of the cable connectors.

Fig. 4—Relay chassis. Note polarity marks on SR3 and SR4. Connector destinations aren't shown since SO2 merely mates with PL2, PL5 with SO5, etc., on the other chassis and on the control-console panel.



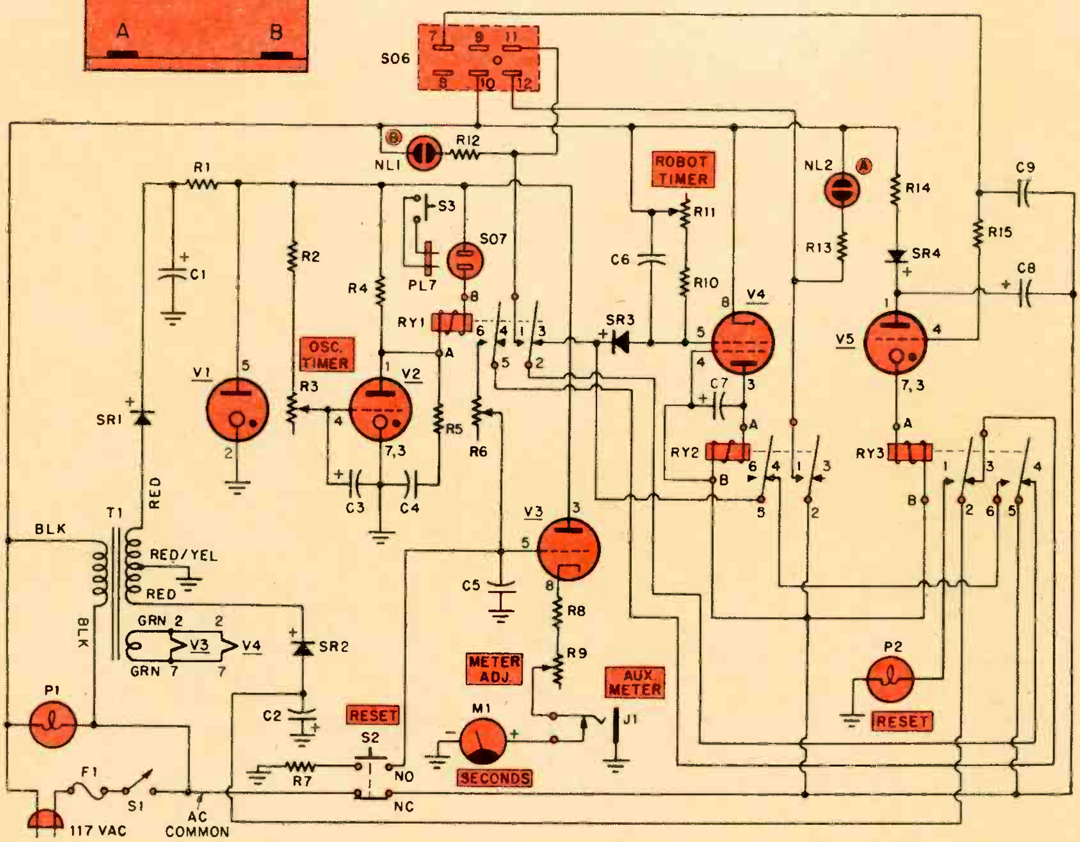
PARTS LIST

Resistors: ½ watt, 10% unless otherwise indicated
R1—220 ohms   R2—68,000 ohms
R3, R6—10-megohm linear-taper potentiometer
R4—270,000 ohms   R5—10,000 ohms
R7—100 ohms   R8—4,700 ohms
R9—5,000-ohm linear-taper pot.
R10, R12, R13—100,000 ohms
R11—1.5-megohm linear-taper potentiometer
R14—68 ohms   R15—1 megohm
R16—100,000 ohms, 1 watt
Capacitors: 150 volts or higher
C1, C2, C7, C8—12 mf electrolytic
C3—8 mf electrolytic
C4—2 mf metallized paper
C5—8 mf metallized paper (Lafayette CF-116 or equiv.)
C6—.5 mf paper   C9—.1 mf paper
S1—SPST toggle switch
S2—Two-circuit (one normally open, one normally closed) push button (Lafayette SW-35 or equiv.)
S3—Tapeswitch mat (Lafayette SW-28 or equiv.)
SR1-SR4—65 ma, 380 PIV selenium rectifier (Lafayette RE-50 or equiv.)
RY1, RY2—DPDT relay, 5,000-ohm coil (Guardian 200 series or equiv.)
RY3—DPDT relay. 110 VDC coil (Guardian GP series. GPD coil, GP-11 contacts.)
V1—OD3 tube   V2, V5—5823 tube
V3—6J5GT tube   V4—6K6GT tube
T1—Power transformer. Secondary—250V center-tapped @ 25 ma, 6.3V @ 1A. (Stancor PS-8416 or equiv.)
P1-P4—117 V, 3-watt candelabra base bulb and 1-inch socket
NL1, NL2—Miniature neon-lamp assembly (Lafayette TM-60 or equiv.)
NL3—NE-51H neon lamp
M1—0-1 ma meter (Lafayette TM-60 or equiv.)
J1—Closed-circuit phone jack
F1—5-amp fuse and holder
Connectors: All Cinch-Jones
*PL1—P-310-CCT   *PL2—P-308-CCT
*PL3—P-304-CCT   *PL4—P-303-CCT
*PL5, PL7—P-302-CCT
PL6—P-406-CCT
*SO1—S-310-CCT   *SO2—S-308-CCT
*SO3—S-304-CCT   *SO4—S-303-CCT
*SO5—S-302-CCT   SO6—S-406-AB
SO7—S-302-AB   *SO8—61F10
*Optional; see text
Misc.—8x14x8-inch cabinet (Premier SFC-502 or equiv.). Two 5x7x2 aluminum chassis (Bud AC-402 or equiv.). Two 7-pin miniature tube sockets. Three octal tube sockets. 115 VAC solenoid (Guardian type 12, Allied Radio 75 P 828. Olson Radio SW-215.). Terminal strips, cover strip for front controls, hardware. 4-conductor cable (Belden 8454 or equiv.)



RELAY LUG DETAIL

Fig. 5—Schematic of control console. When there is no pressure on the mat-switch (S3), V2 should glow briefly every few seconds. This intermittent glow is the simplest test for oscillation. Wiring should be completed up to this point and a test made with AC power on to see that V1 glows constantly and that V2's on-and-off rate can be varied by the setting of R3 (osc timer).



flame from his gun is simulated by a neon lamp in the gun barrel). Again, your draw-and-fire time is indicated to the nearest hundredth of a second (if under 2 seconds).

● You miss the chest area. When this occurs, the dummy shoots back and his eyes remain lit. Time is not indicated because time needed to miss a target is of no importance.

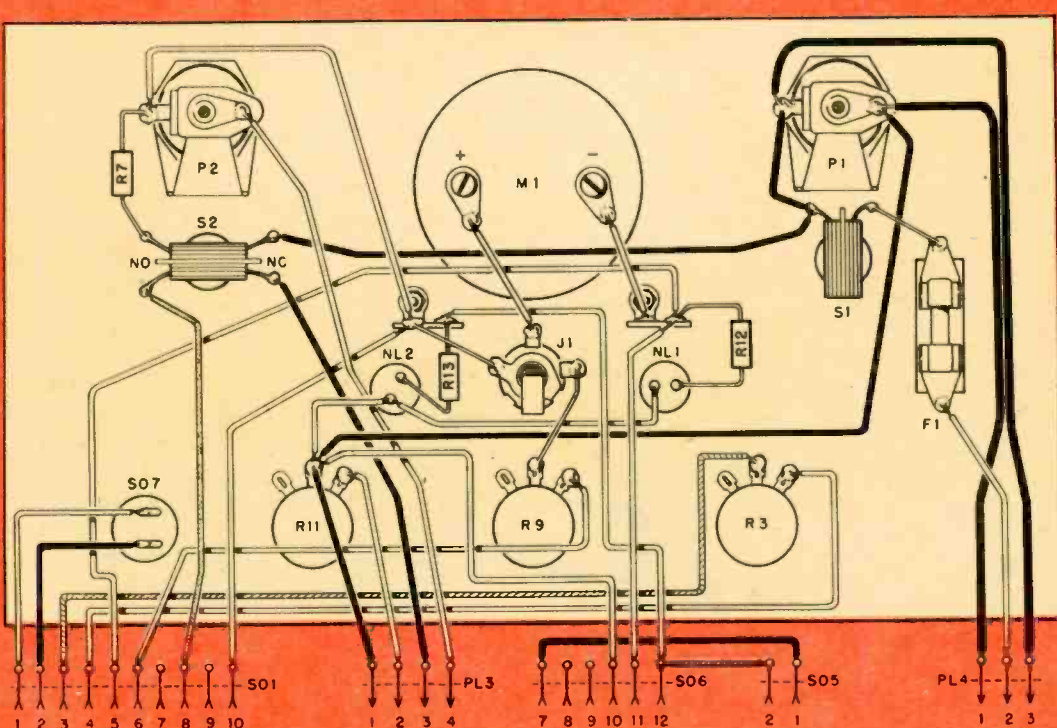
A fourth possibility is that you draw and fire before the eyes light up. This is indicated by zero time on the meter. The robot was killed before he had a chance to come alive . . . you coward!

Design Features. Timing of the dummy's actions and the speed indicator for the duellist are controlled electronically. Panel lights on the control console indicate when the AC power is on, when the dummy's eyes light, when the fire-back circuit is activated and when a hit is scored.

There are three covered controls on the control-console panel (Fig. 1). The left (*osc timer*) is used to set the maximum time interval that the duellist must wait for the draw-and-fire signal. The center control (*meter adjust*) is used to set meter M1 to zero seconds (full scale to the right). The right control (*robot timer*) is used to set the dummy's reaction time; that is, the time interval between the lighting of his eyes and when he fires back. This time may be from 1/10-second to about 4 seconds, depending upon the skill of the opponent he is to match. A fourth control, R6, located on the control chassis (Fig. 3), calibrates M1 and requires adjustment but once. M1 requires special markings. Zero should be at its high-scale point, 1 at the center, and 2 at the normal low-scale point. Space between markings can be divided for whatever accuracy you want.

A mat-switch (S3, Fig. 5) serves as the shooting platform. When you step on it, timing begins and from then on everything is automatic. After the

Fig. 6—Control-console panel. Check push button S2 with ohmmeter before wiring to be sure of which contacts are normally open (NO) and which are normally closed (NC). F1's holder may be post type.



shooting cycle has been completed you note your time, step from the mat and depress the reset button (S2, Fig. 5) to restore the equipment to start condition. A centisecond electric time clock may be connected to the leads that go to the dummy's eyes (SO8, Fig. 9). The dummy may be located as much as 100 feet from the control console for long-range practice.

The shootin' iron used with the author's model was a Crosman CO2 pellet gun. This gun is available in single-action, western styling and a fast-draw hip holster. The impact energy of the lead pellet from such a gun is enough to activate the chest plate. For gun clubs that operate with powder shells, a heavier-gauge steel plate, rather than sheet-metal, must be used.

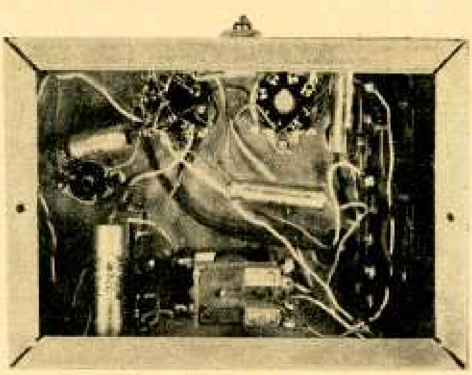
Before building the Robot Gun-Slinger, carefully study the circuit's operation, explained later in our article. Understanding the operation of the timing circuits is vital to getting everything to work properly. In a device of this complexity a single wiring error can lead to hours of troubleshooting.

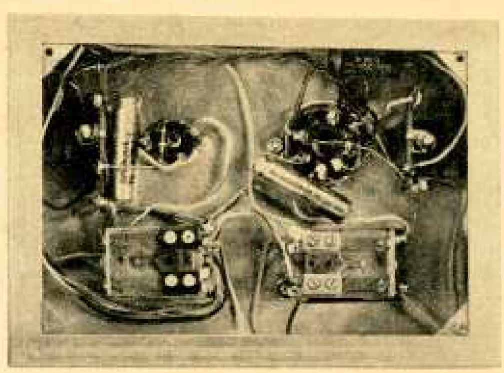
Electronic Construction. Wiring and parts layout is unimportant and lead length and dress are not critical. Construction can be on one or two chassis. The author chose to build the circuit on two chassis, on which the pictorial diagrams are based. To simplify instructions, we've shown cable connectors on groups of wires going from one chassis to the other and to the control panel. These connectors can be omitted in favor of direct wiring to keep the cost down. If you decide on direct wiring, use color-coded wire so you don't get lost going from one chassis or panel to the other. Mechanical changes may be made but *do not* change the value of the electrical components.

How it Operates. Random-time generator V2 (see Fig. 5) is a cold-cathode thyratron in a relaxation-oscillator circuit. It operates much like a sawtooth sweep generator. Let's assume power is turned on by S1. The time lapse before V2 fires (conducts) is determined by C3 and the setting of R3. V2's plate normally is at B+ potential (140 volts). C3 charges through R4 and when the voltage at the end connected to the grid of V2 reaches a certain positive level, V2 fires and its plate voltage falls to 66 volts. If you have not yet stepped on the mat-switch, V2 will cycle on and off constantly. When you step on the mat-switch, S3, you connect the coil of RY1 from the B+ buss to the plate of V2 in parallel with R4. If V2 hasn't fired, there is no voltage drop across R4 and consequently RY1's coil is not energized.

Another way of looking at it is this: When V2 conducts, its plate and the side of RY1's coil connected to it fall to 64 volts with respect to ground. This puts about 74 volts across RY1's coil, energizing it. When you step on the mat and close S3 you catch C3 at some unknown point in its charging cycle. It continues to charge (for a short or long interval) until the voltage is high enough to fire

Fig. 7—Underside of author's power and control chassis (left) and relay chassis (right). All components may be combined on one chassis approximately 5x9x2 inches to simplify the wiring and construction.





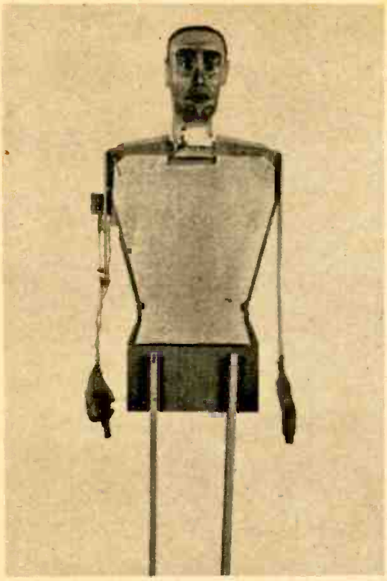


Fig. 8—Note sheet-metal chest plate which is suspended at top and bottom.

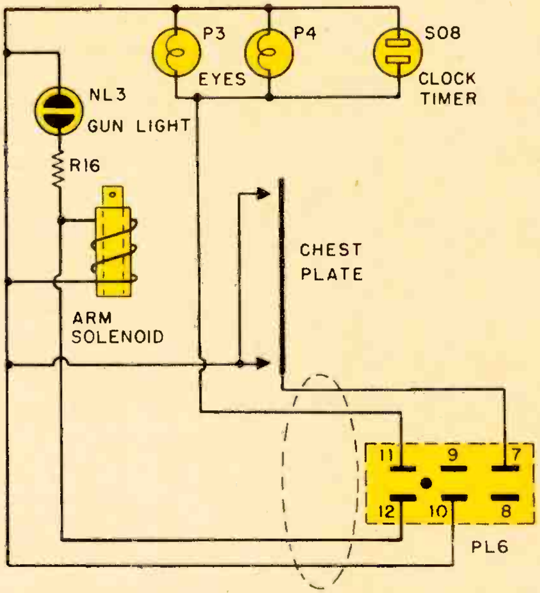


Fig. 9—Dummy's schematic. Lead is connected to lug 10. PL6 runs to the AC line and is always hot.

V2. The random time interval, therefore, depends on where in its charging cycle you catch C3. As an example, let's say C3's charge time before firing V2 is 10 seconds. This means that every 10 seconds V2 fires and its plate voltage falls. If you happen to step on the mat at the last second before V2 fires, you have 1 second to go before the dummy's eyes come on. If you step on the mat 2 seconds after C3 starts to charge, you have 8 seconds to go. The time is random, you see, because when you step on the mat you never know where you are in that 10-second interval.

Since RY1's coil resistance is low, V2 continues to conduct and RY1 stays energized until S3 opens.

● Meter Timing Circuit. Just before RY1 pulls in, the plate current of meter-timing tube V3 is exactly 1 ma, causing M1 to read full scale. Initial adjustment of this current is made with R9, (*meter adjust*). When RY1 is energized, the following things happen:

Closed contacts 1 and 2 of RY1 cause the robot's eyes to light and an external timer plugged into SO8 (see Fig. 9) to start. Pilot light NL1 on the control console also lights.

The circuit is completed between the *AC common* buss, the NC contacts on S2 and normally-closed contacts 4 and 5 on RY3. The end of capacitor C5 connected to the grid of V3 begins to take on a negative charge from the negative terminal of SR2 through normally-closed contacts 2 and 3 on RY3, contacts 5 and 6 on RY1, and R6. The current through V3, a cathode-follower, begins to drop as C5 charges. (The negative bias on V3's grid increases.) Full-scale drop-off is set for exactly 2 seconds by R6. If nothing else happens, the meter drops to zero in two seconds. If a bullet hits the chest plate during this 2-second period, AC is applied to the grid of V5, causing it to conduct and energize RY3. This causes contacts 2 and 3 of RY3 to open, removing the charging voltage from C5. Meter M1 then stops falling and indicates the time interval between the closing of RY1 and the closing of RY3.

● Dummy Reaction-Speed Timer. The time interval between the lighting of the dummy's eyes and the firing of his gun can be adjusted over a relatively wide range (1/10 second to about 4 seconds). The time is determined by V4 and associated components in this manner: Since RY1 and RY3 are de-ener-

CHECKOUT AND ADJUSTMENT

Remove all tubes from sockets and set all controls to maximum resistance. Timing adjustments should be made with a stopwatch (1/10 second accuracy) or a centisecond electric timer. Do not connect cable to dummy for steps 1 to 13.

Procedure	Correct Indication	Possible Trouble
1. Remove the AC plug and P1. Close S1. Connect ohmmeter across P1's socket.	Approximately 60 ohms.	AC short. T1's primary open.
2. Replace P1. Connect ohmmeter from pin 5 of V1 to chassis.	10,000 ohms.	B+ short. C1 leaky or polarity incorrect.
3. Plug in V1. Set S1 to ON.	V1 should glow. P1 should light.	R1 open. SR1, V1 or T1 defective.
4. Plug in V2. Rotate R3 to minimum resistance.	V2 should glow and go out regularly. Adjust R3 for 10-second intervals between flashes.	R2, R3, R4, R5, C3, C4 or V2 defective.
5. Step on mat-switch S3.	RY1 should energize. NL1 should light. V1 should glow steadily.	Mat-switch defective, RY1's coil defective.
6. Plug in V3.	Filament should glow.	V3 defective.
7. Depress then release S2.	Meter should indicate about half scale.	V3, R8, R9 defective. J1 contacts open.
8. Set R9 to full clockwise. Depress then release S2.	M1 should deflect full scale (to the right).	Value of R8 incorrect. Readjust R9.
9. Depress S2 and release after test.	When RY1 closes; meter should drop fast to 0.	R6 open. C5 defective.
10. Adjust R6. Depress S2 and release after test.	R6 sets meter drop-off time to exactly 2 seconds.	C5 or R6 incorrect value.
11. Plug in V4.	Filament should glow.	V4 defective.
12. Depress S2 and wait. (Release after test.)	When RY1 closes, NL1 should light and M1 should drop. About 4 seconds later, RY2 should close and NL2 should light.	V4, R13, P3, R11, R10, C6, C7, RY2's coil SR3 or RY1 contacts defective.
13. Adjust R11 (robot timer).	Adjust R11 so that NL2 lights 1.3 seconds after NL1 for average competition; less time for fast guns.	R11 defective.

Connect robot to the control console. Step on the mat-switch. The following should happen: After a short wait (up to 10 seconds) the dummy's eyes should light, followed 1.3 seconds later by gun's raising. Meter should drop to zero in 2 seconds. NL1 and NL2 should react at same time as the eyes and gun respectively. Continue tests:

Procedure	Correct Indication	Possible Trouble
14. Plug in V5 and be sure chest plate is not touching back contacts.	V5 should not glow. RY3 should not pull in.	V5 defective. C9 open.
15. Push chest plate against contacts.	RY3 should close. PL2 should light. (No effect on meter.)	V5, R14, SR4, C8, RY3's coil, P4, R15, C9 defective.
16. Depress S2.	RY3 should de-energize. P2 should go out.	S2 defective.

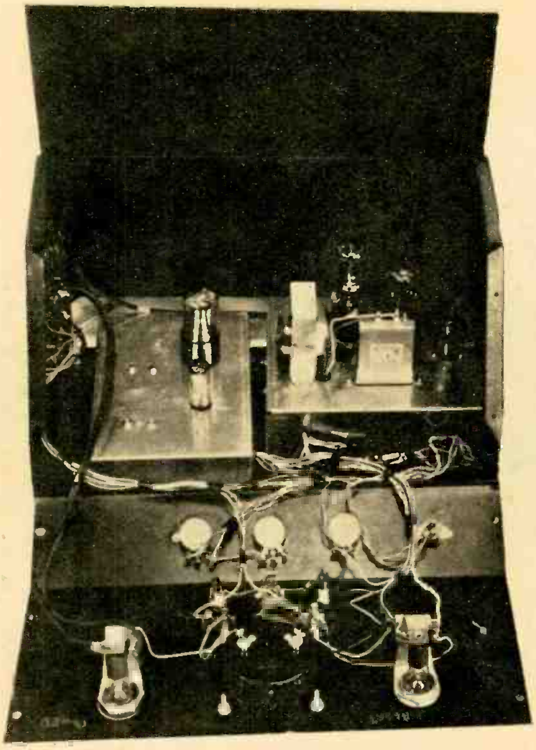
Finally, check each of these sequences:

17. Step on mat-switch. Allow eyes to light, meter to drop, arm to come up. Push chest plate. The eyes should go out, arm should remain raised. The meter should indicate more than 1.3 seconds and P2 should light.

18. Step off mat-switch and depress S2. Step on mat-switch and repeat step 17, except push chest plate after eyes light but before arm comes up. The eyes should go out but the arm stays down. The meter should indicate less than 1.3 seconds and P2 should light.

19. Step off the mat-switch and depress S2. Step on mat-switch and let circuits go through cycle without touching chest plate. The eyes should light and stay lit, arm should come up, meter drops all the way, P2 does not light.

If the tests up to No. 16 are successful but incorrect thereafter, the trouble is either incorrect relay contact wiring or defective relay contacts. As a final test, check J1's wiring by plugging another 0-1 ma meter in J1. The panel meter should be inoperative while the second meter takes over.



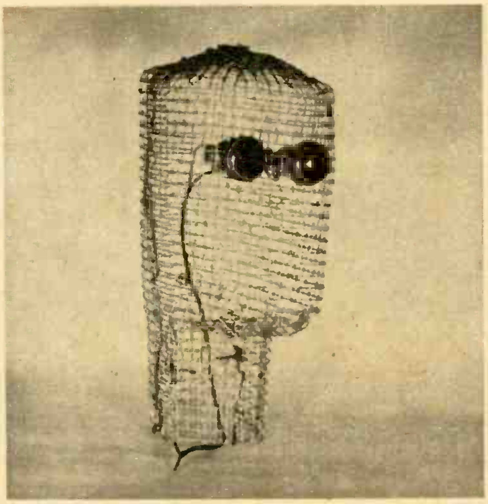


Fig. 10—Dummy's head is formed of ¼-inch wire mesh. Install eyes, then cover with plaster.

Fig. 11—Inside of control console. Power and control chassis at right, relay chassis at left.

gized—that is, the eyes are not lit—AC is applied from the *AC common* buss to SR3 through contacts 4 and 5 on RY3 and contacts 2 and 3 on RY1. This keeps the side of C6 connected to the grid of V4 charged negatively. V4, therefore, is held at cutoff and RY2 remains de-energized. When contacts 2 and 3 on RY1 open as RY1 is energized, the dummy's eyes light and the charging voltage is removed from C6. C6 discharges through R11 and R10 at a rate determined by the setting of R11 (*robot timer*). As C6 discharges, V4's plate current increases and eventually RY2 is energized. The solenoid controling the robot's gun arm is activated by contacts 1 and 2 on RY2. Pilot light NL2 on the control console also lights to indicate the solenoid has been energized. Contacts 4 and 5 on RY2 open at the same time but this causes no change in action (these contacts have a role to play later on).

● Chest-Plate Action. If you don't hit the chest plate, timing meter M1 indicates a full 2 seconds. You must then step from the mat-switch and depress *reset* button S2. If you score a hit, two things can happen, depending upon whether you are fast or slow compared to the robot's reaction time.

Slow Hit. A slow hit means RY2 has closed and energized the robot's gun-arm solenoid. When the chest-plate is hit by a pellet, it touches the contact screws mounted behind it causing V5 to fire and energize RY3. Several things now happen: The eyes go out since contacts 4 and 5 on RY3 open; pilot light P2 (*reset*) on the control console comes on to indicate that a hit has been made. As contacts 2 and 3 on RY3 open, the charging voltage is removed from C5, even though contacts 5 and 6 on RY1 are still closed.

Thus, M1 stops dropping and indicates the interval between the signal-to-fire and a hit. But the robot's gun arm will remain raised since RY2 has latched closed.

Fast Hit. A fast hit means that RY2 has not yet been energized. When this happens, the hit causes contacts 5 and 6 on RY3 to close, connecting the *AC common* buss to SR3 through contacts 4 and 5 on RY2. This immediately recharges C6, making the grid of V4 negative and cutting it off. Hence, RY2

[*Continued on page* 101]

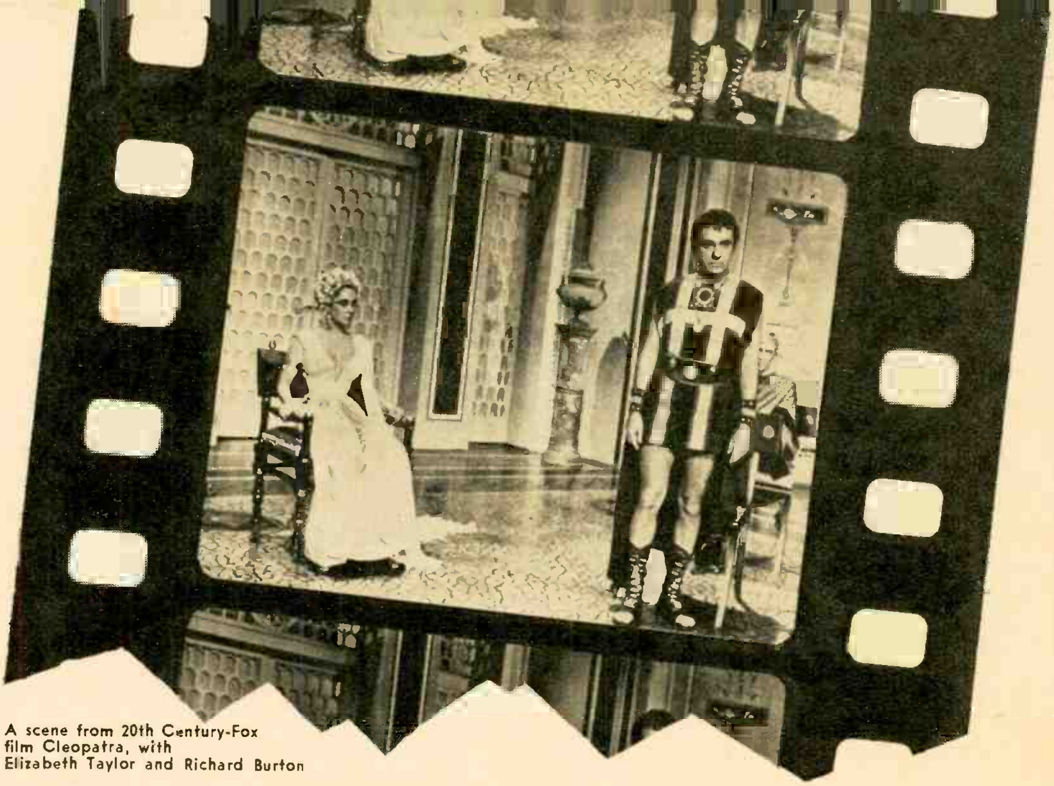
Proprietor of our Prize CB Shack is Jon C. Baptiste, who operates 10W1539 in Muskogee, Okla. He has a Browning R-2700 receiver and matching 23/S-Nine transmitter, plus an RME 4350A ham receiver. His main antenna is a Mosley 3-element beam. On the wall hangs a home-brew field-strength meter that doubles as a wind-speed indicator at the flip of a switch. Jon is a professional photographer, uses CB as a link between studio and his car.

PRIZE SHACKS

YOU CAN WIN $20 with a picture of your ham, CB or SWL shack! Just send the photo, along with a list of your equipment, to EI Prize Shacks, 67 West 44th St., New York 36, N. Y. We prefer 8x10-inch glossy prints. Negatives should be available if you send a snapshot. Color pictures cannot be reproduced. Pack your picture well to prevent damage in the mails, and be sure to put your name and address on the back of each print. Enclose a note describing your activities in SWL, CB or ham radio. Unused pictures are returned.

This extensive ham-shack layout belongs to the Agees, John and Kate, of Los Alamos, N. M. He is K5ODN; she's K5ODG. The equipment includes a Johnson 500 transmitter and Hallicrafters SX-101 and SX-62A receivers. In the center is a Johnson antenna matchbox and above that a Magnecord tape recorder. The recorder is handy for running automatic CQ calls, for signal checks on the transmitter and for signal reports to other hams. Tool rack is at left.

A folding table in a well-decorated corner is the listening post of SWL Paul Pietras, who lives in East Greenwich, R. I. The receiver is a Hallicrafters S-38E. Paul's antenna is a 75-foot long-wire mounted about 25 feet up. He became an SWL at the age of 13 and, after two years at the hobby, he now has 50 countries verified. Paul is a high school sophomore—or was last term—at Bishop Hendricken High School in Warwick, R. I. Note QSL's on board.



A scene from 20th Century-Fox film Cleopatra, with Elizabeth Taylor and Richard Burton

Cinema Sound

Sync is the secret when sound track and movie get together.

By James Madison

SOUND IN THE MOVIES is one of those everyday phenomena we take for granted—until it fails. Then, depending on the neighborhood, you'll hear anything from the rustling of a bored audience to hoots and catcalls.

The process of putting sound on film is an involved one, and the skills needed to fill a theater with good sound many hours

Annotated score and stopwatch are never far from producer as sound goes on track.

Two mixers at Reeves Studios control sound from two tape decks and turntable in back.

Pic-Sync is name given to a Fairchild tape recorder which is synced closely with film.

a day are manifold and exacting.

The problems that surround the recording of sound for film are varied. If the picture is shot on a Hollywood sound stage everything is under control. Huge, barn-like buildings, sound stages resemble nothing more than oversize recording studios. They are soundproofed, access is controlled to prevent accidental interruption and they are provided with a full complement of special recording equipment.

On a sound stage you are sure to find a forest of microphones on booms and a jungle of cables that requires a sizeable crew just to keep the right lines going to the right terminals.

But what do you do when you're shooting on location? Next time you think of it, notice how much stray noise you find in even the quietest place. If dialogue were recorded while the action is being shot at such a location all that noise would find its way onto the sound track.

There's the problem of level. Marilyn Monroe whispers, "Do you play chess?" and it has to carry to the far reaches of the balcony. Seconds later, the full orchestral might of the News of the Day blasts forth.

Most difficult of all is the problem of sync . . . synchronization. Sync is the magic ingredient in movie sound. It makes words fit the movement of the lips which speak them. If you've seen foreign films with the translation dubbed in you know the discomfort associated with the sight of lips that are not producing the sound you hear. Experts work on the basis that the synchronization must be accurate to a single frame per half hour, which is about .00002% accuracy.

Producers solved the outside noise problem by shooting the action on location and dubbing in dialogue, narration and sound effects later. These sound elements are produced in a sound studio and suffer none of the interference that occurs elsewhere. The question of level has been solved with stable amplifiers and speakers mounted in finely tuned enclosures.

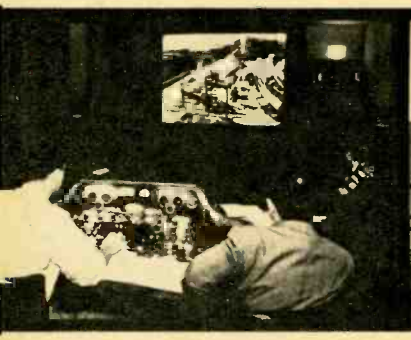
Sync is something else. The action may have been shot anywhere, but the script calls for footsteps, a few offstage noises, some tense dialogue and a low chord. All this must be blended or mixed properly, and in perfect sync.

The sound used in projection is in almost every case recorded on an optical sound track (or tracks) along the edge of the film. A photoelectric cell reads this track and feeds the signal to the amplifiers.

Film moves past the projection lens in 24 start-stop actions per second, which would prevent its being used to produce sound. So the track is read 24 frames from the lens, after the film has resumed a steady, uninterrupted motion. That's the reason for the loop of film you see in a projector.

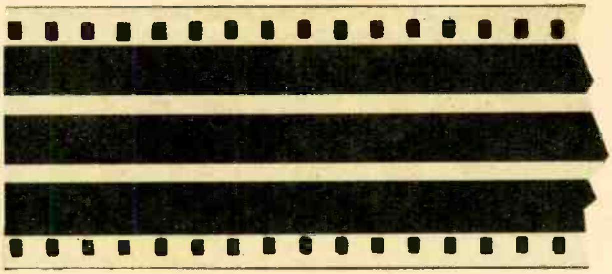
Theater sound or playback systems are made up of good equipment, but the

Re-recording theater: dialogue, sound effects, music go on the sound track as film is run off.



This 35mm negative-positive recorder produces a standard negative or direct positive.

Bank of optical printers is geared for fast reproduction of movie film sound tracks.



Much movie sound is now recorded on 35mm magnetic film; this sample has three ferrite tracks.

yardstick can't be the one used by hi-fi enthusiasts. The equipment merely is good for the purpose it's being used for. Most theater equipment is designed for a response from only 80 to 8,000 cycles—a considerable distance from the 20-to-20,000 cycles the audiophile looks for. But the response is flat and distortion is held to a minimum.

Though theater sound equipment is not of true hi-fi quality, the limiting factor is the sound track. The width of the optical track restricts frequency range.

A typical sound track carries material from many sources. Part of the dialogue is recorded on the scene. Music recorded especially for this film may be on tape, and other music may be picked up from previous recordings.

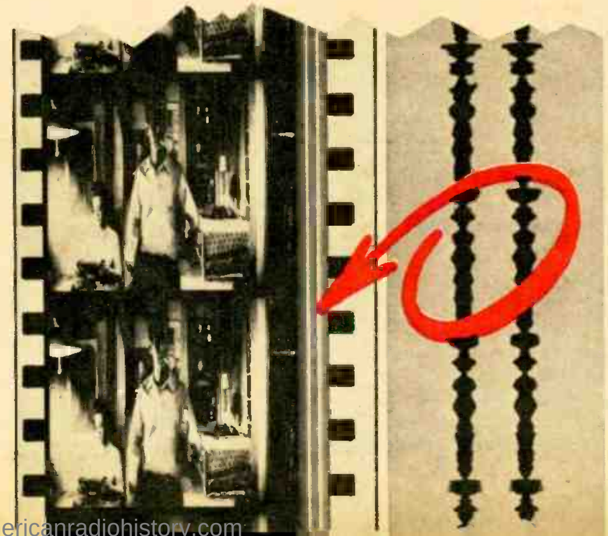
After the action is shot, a producer turns to the sound. Major producers have their own sound studios, but independent and industrial film producers turn to outside sources, such as Reeves Sound Studios in New York City, where our photographs were made. Here the skills of engineers and every type of sound reproducer—record turntables; tape decks; film phonographs, as the optical playbacks are called, and other special equipment—are brought to bear. The result is a finished sound track that is ready to print on the film.

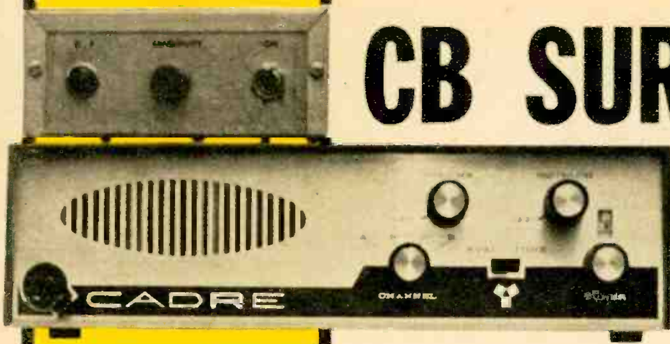
A cue sheet is worked out, based on the cut version of the film. The sound elements are chosen and each checked for level and length. The musical background is taped, scene by scene, and then the film is made into endless loops, each containing a single phrase or action. These are projected in a screening room. A few words of dialogue are read over and over onto a magnetic tape cemented to a perforated film that makes an endless loop exactly the length of the picture film. "Please close the door," reads the actor. "*Please* close the door! Please *close* the door! Please close the *door!*" It goes on and on, until the producer is satisfied with both the dramatic values and the sync. The magnetic sound film passes an erase-record head each time and so erases each previous reading.

The dialogue, narration, sound effects and music are then mixed onto a master tape. Carefully monitored and checked against the cue sheet, the master tape incorporates all the elements used. When edited tape has been approved it is played back through the tape deck onto the optical recorder, where a reel of film moves at a steady 24 frames per second. A lens system projects the modulated image onto the film. A negative image of the sound track on an otherwise clear film is the end product. The final positive print combines the negatives of the sound track and picture strip.

You may like or dislike the motion picture, but you know the sound is the best a few dozen experts could make it.

Optical sound tracks appear as two thin lines to right of these distorted Cinemascope frames showing a scene from the Robert Rossen production of The Hustler, with Piper Laurie, Paul Newman. Closeup of sound tracks (negative) is at right.





CB SURE-LIGHT

By Herb Friedman
2W6045

When the lamp flickers, modulated RF is in the transmission line and you're getting out.

HOW often have you called another Citizens Band station or your own mobile unit, received no response and wondered whether you really were transmitting? Many rigs have an on-the-air light but most indicate merely that the B+ is on. They *don't* tell you whether RF is going to your antenna. But EI's CB Sure-Light lets you know for certain whether your modulated signal is getting out.

The Sure-Light samples the RF in the transmission line. If there is RF, the lamp lights. When the RF is modulated, the lighted lamp flickers. No flicker—no modulation. No light—no RF. It's as simple as that.

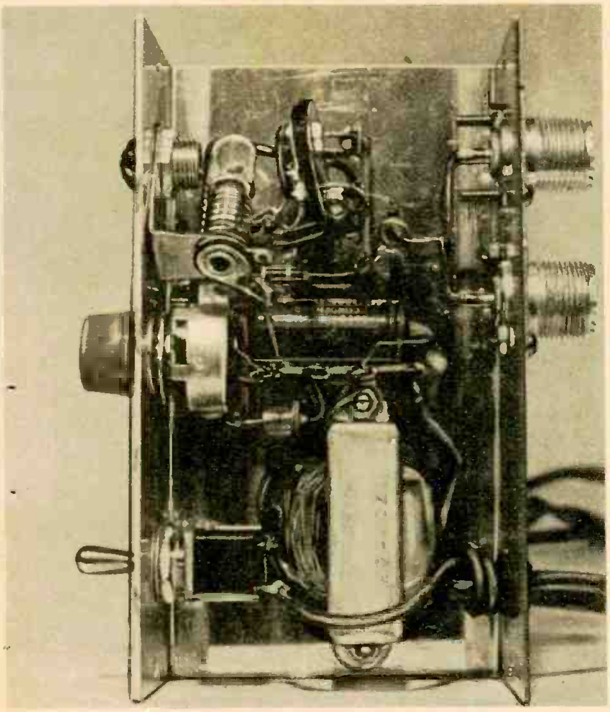
The Sure-Light, which is self-powered, is connected in series with your transmission line through J1 and J2 and doesn't require modification of the transceiver.

Construction. The Sure-Light is built in the U-section of a 5x3x2-inch Minibox. While the parts layout is not critical, follow the pictorial closely and keep the RF leads as short as possible.

Q1 can be any low-cost transistor, such as a 2N301 or 2N307. Though Q1 is designed for chassis mounting, it can be soldered directly to the terminal strip. Bend two terminal strip points toward the front panel at a 45-degree angle. Bend small hooks in Q1's emitter and base leads. Place the hooks in the tie points and solder them quickly, using as little heat as possible. Use an alligator clip as a heat sink on each lead when soldering.

Q1's collector is its mounting flange. Do not attempt to solder the lead from PL1 to it. The heat would destroy Q1. Fasten a solder lug to the flange with a 6-32 screw and make the connection to the lug. Since the power supply is negative with respect to ground, take care that the polarity of SR1 and C3 is correct to prevent trouble.

Adjustment. Connect the transceiver output to J1 and the antenna to J2. Set sensitivity control R2 fully counterclockwise and turn on all power. As you transmit, turn R2 until PL1 glows slightly. (If R2 is opened up wide, PL1 or Q1 may be damaged by excessive current.) When you modulate by talking into the mike, the lamp flickers at the modulation rate. Now you'll never have to worry about whether your signal really is getting out.

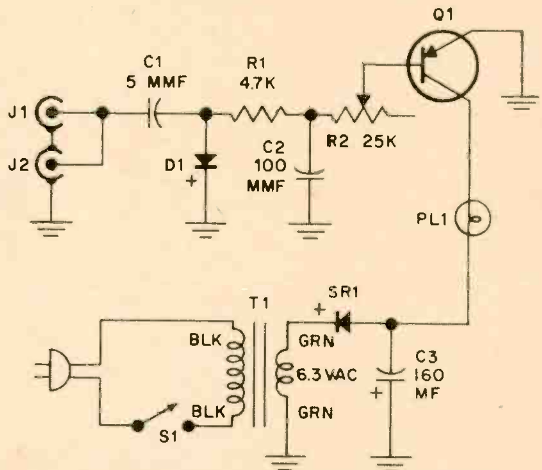


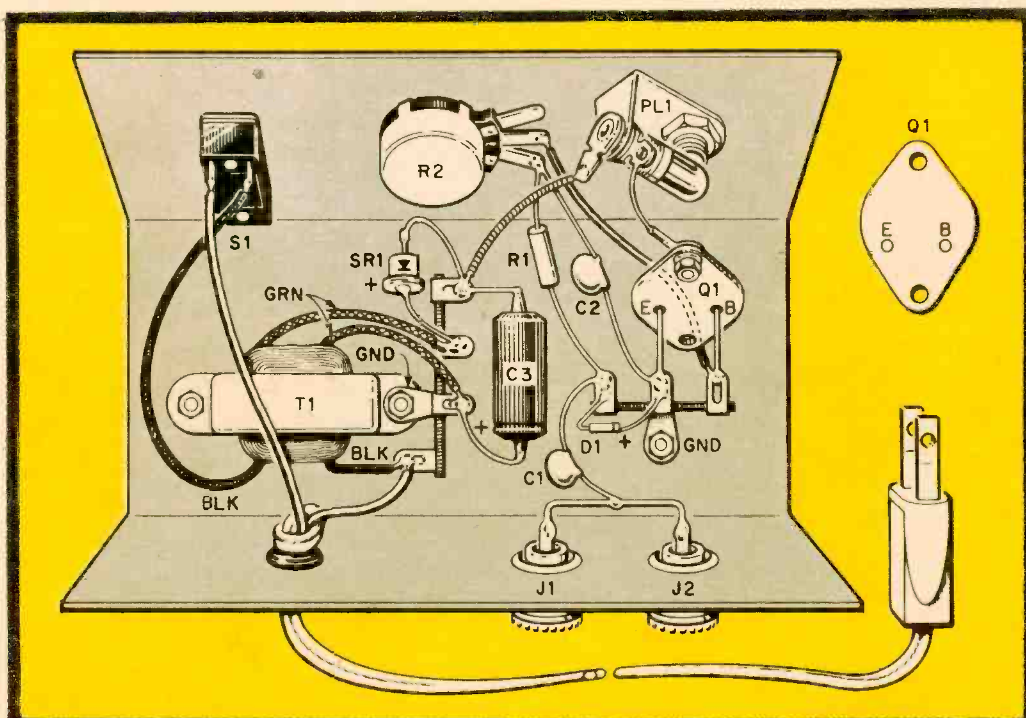
Grip leads of Q1 and D1 with pliers when soldering to prevent heat damage. Collector of Q1 is case, so scrape paint from around hole in mounting flange for good electrical contact.

PARTS LIST

R1—4,700-ohm, ½ watt, 10% resistor
R2—25,000-ohm, linear-taper potentiometer
C1—5 mmf, 500 VDC ceramic disc capacitor
C2—100 mmf, 500 VDC ceramic disc capacitor
C3—160 mf, 15 V electrolytic capacitor
S1—SPST toggle or slide switch
T1—Filament transformer: 117 V primary, 6.3 V @ .5 A secondary
D1—1N34A crystal diode
SR1—Silicon rectifier, 100 ma, 25V PIV or higher
Q1—2N301 or 2N307 (see text)
PL1—No. 48 pilot lamp and holder
Misc.—Terminal strips, coaxial jacks

RF, demodulated by D1, is applied to the base of Q1, causing it to conduct and to light PL1.



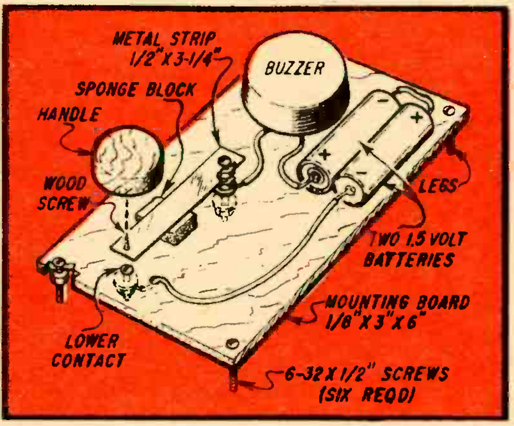


BEGINNERS PAGE

TELEGRAPH KEY

A MUST for learning and practicing Morse code is a code-practice set. Putting together your own is an interesting project if *you* build your key. After you learn code, you can build a code-practice oscillator (CPO).

The key shown here is constructed of materials you're likely to have around the house. The buzzer and batteries that you will have to buy will run the whole bill for materials to less than a dollar. The key should be built on a wooden base cut to the dimensions shown. If you have a piece of composition pegboard, so much the better. The punched holes in the material eliminate drilling.



Mount the 3¼x-½ inch metal strip first. Best metals for the job are aluminum or copper sheet. But any other metal will work as the moving arm of the key, if it is springy. The handle is a wooden radio knob or some other round piece of material attached to the metal strip with a wood screw.

If you use a knob with a ¼-inch shaft hole, offset the wood screw slightly so the knob will be centered.

After the strip and knob are in place, add the lower contact. A 6-32 machine screw positioned just under the key handle will do the job. The head of the wood screw must strike the lower contact when the handle is pressed down.

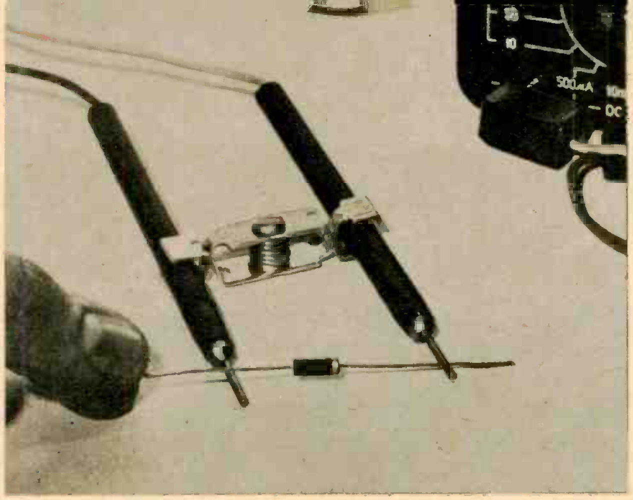
The buzzer is a 1.5-volt type (Lafayette MS-437). Two batteries, providing 3 volts, are used. This improves keying action and does not harm the buzzer. Alternatively, an old household buzzer may be used, but the voltage must be increased to about 6 volts. Four D cells connected in series (end to end) will provide this voltage.

After wiring is completed, you're ready to adjust the key. Slide a small block of sponge or foam rubber under the metal strip. This provides the spring action necessary for proper feel. Once in place, the block can be slid back and forth to change the tension on the metal strip. Adjust it according to your preference, but don't allow spacing of the key contacts to exceed about an eighth of an inch.

Learn to operate your key properly. With your forearm resting on the table, lower your hand so your first three fingers fall onto the key handle. Above all, don't squeeze the handle. To send, move your *wrist* up and down with a bouncing motion. This action is transmitted to the handle, which touches the lower contact and forms code characters.

Wrist action alone should close the key contacts. Avoid the usual tight finger approach and you won't develop a case of key cramps.

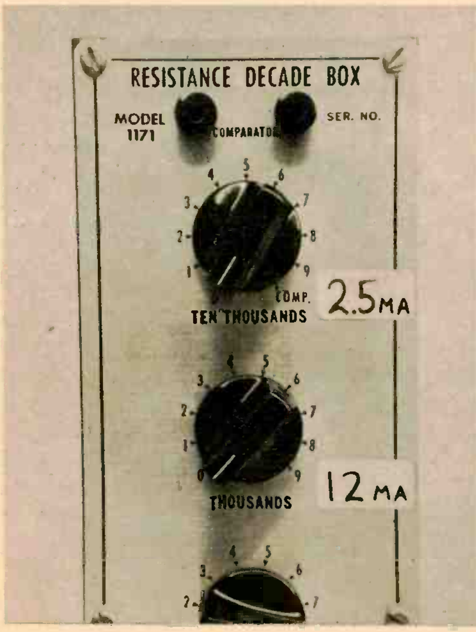
After you have learned the code and have the sending technique down pat, you can advance to a commercially manufactured key. They have more refined adjustments that enable you to regulate the key's action to suit your touch preference.—*H. B. Morris*



TEST BENCH TIPS

Quick Test Technique

When you have a number of small components to test with an ohmmeter or VTVM, the job will go much faster and easier if you use a Mueller #22 dual-clip to hold the prods as shown. You touch the part leads to the tips rather than vice versa.

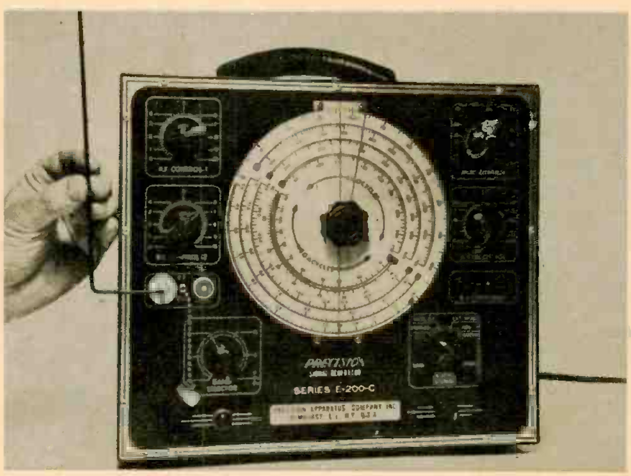


Decade Box Protection

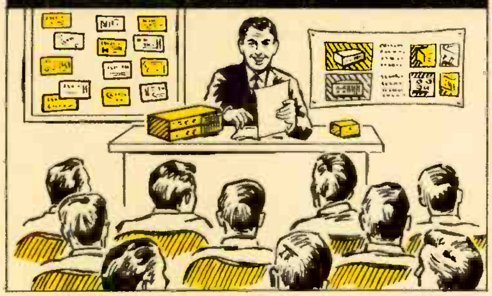
The instruction book for most precision decade boxes lists the current limits for each range of the decade. Exceeding these values will burn out the internal resistors. It's a good idea to ink in these maximum values on labels placed alongside the appropriate decade switch. Having the figures right in front of you will help protect the box against blowout.

Signal Broadcaster

When a signal generator is to be used for adjustment of a sensitive communications receiver, a short "whip" antenna connected to the output jack is usually enough for signal transfer between the units. An excellent antenna is a 12" length of buss bar bent L-shaped and soldered in a plug fitting the output jacks.



a Directory of CB CLUBS



THE most comprehensive list of Citizens Band radio clubs ever assembled is presented here by EI. We publish our directory with two purposes in mind.

Active CBers often want to join a club but do not know whether there is one nearby. Our list, arranged alphabetically by states and towns, will serve as their guide. Secondly, we urge nonaffiliated CBers to consider joining the nearest club—for the good of the Citizens Radio Service. Good clubs, we believe, can exert a beneficial influence on CB, helping bring about efficient use of the channels and proper and legal operating procedures—both of which are needed in most areas.

If your CB club is not listed here, send us its name and mailing address and we'll add it to our master list.

The Cee Banders
594 N. 68th Pl.
Birmingham, Ala.

Wiregrass CB Radio Club
Box 1001
Dothan, Ala.

Monte-Sano CB League
3632 Lookout Dr., SE
Huntsville, Ala.

Montgomery 5 Watters
Box 3022
Montgomery, Ala.

Ozark 5 Watters
1223 Turner St.
Route 4
Fayetteville, Ark.

Arkansas CB Radio Club
Box 534
Little Rock, Ark.

Central Ark. CB Radio Club
Box 534
Little Rock, Ark.

10-99 Citizens Radio Club
2314 Newport
Costa Mesa, Calif.

So. Calif. 11 Meter League
1001 Hi Point St.
Los Angeles 35, Calif.

Trans-Ceivers of So. Calif.
Box 591
Pico-Rivera, Calif.

The 11-4 Club
1975 W. Highland Ave.
San Bernardino, Calif.

5 Watt Wizards
Box 3364
San Bernardino, Calif.

So. Calif. CB Assoc.
Box 17296
San Diego 17, Calif.

Marin CB Radio Club
c/o Henry S. Porter
1410 Second St.
San Rafael, Calif.

Denver Radio Club, Inc.
1328 Holly St.
Denver, Colo.

CB Assoc. of Conn.
Route 1, Box 178
Essex, Conn.

Norwalk CB Radio Assoc.
Box 693
Norwalk, Conn.

Southern Conn. CB Assoc.
37½ Spring Hill Ave.
Norwalk, Conn.

Delray Beach Radio Club
Box 832
Delray Beach, Fla.

Broward CB Club
Box 8092
Fort Lauderdale, Fla.

Metropolitan Dade
Citizens Radio Club
1362 NW 102nd St.
Miami 47, Fla.

MCEU
Box 9516
Treasure Island, Fla.

Dixie Comm. Club
Box 2004
Decatur, Ga.

Middle Ga. CB Club
642 Bowden St.
Macon, Ga.

Rebel Comm. Assoc.
Box 6487
Marietta, Ga.

21 Radio Assoc.
(Honolulu, Hawaii)
% John McGraw
Qtrs. 46-D NAS
Navy 128
FPO
San Francisco, Calif.

Circle Radio League
Box 88
Alton, Ill.

Corn Belt CBers
216 Robinhood Lane
Bloomington, Ill.

Citizens Radio League
of Chicago
4818 N. Natchez Ave.
Chicago 31, Ill.

J. N. Shortwave Club
6412 Leavitt St.
Chicago 45, Ill.

Citizens Radio League
Box 28
Northlake, Ill.

Ottawa 5 Watters
Post Office Box
Ottawa, Ill.

Celestial CBers
1604 Charlotte St.
Pekin, Ill.

Illinois Valley CBers
c/o Charles Decker
751 N. Glenoak
Peoria, Ill.

Riverside 5 Watters
148 Burlington Rd.
Riverside, Ill.

Static Pushers CB Club
3229 Eighth St.
Rockford, Ill.

Tri-County CB Club
c/o Marvin G. Arians
Route 3
Sterling, Ill.

Little Egypt CB Radio Club
Box 43
Wayne City, Ill.

Fayette Co. CB Club
c/o Wayne P. Nichols
Route 1
Connersville, Ind.

CB Pioneers Radio Club
Box 113
Elkhart, Ind.

Calumet CB Assoc.
Box 413
Hammond, Ind.

Wabash Valley CB Club
c/o Fred Rowe
Monroe City, Ind.

11-4 CB Club
c/o Don Kochersperger
Route 5
Union City, Ind.

Cedar Rapids
Citizens Radio Club
c/o D. C. Wolcott
Rte. 1, 5003 6th Rd., SW
Cedar Rapids, Iowa

Iowa Sixnet (Dist. 2)
c/o Charles Sanson
308 N. Maple
Creston, Iowa

Citizens Radio Assoc.
1519 Cummins Pkwy.
Des Moines 11, Iowa

Iowa-Illinois CB Club
c/o P. C. Hart
Box 149
DeWitt, Iowa

Iowa Sixnet (Dist. 13)
61 E. Broadway
Fairfield, Iowa

Iowa Sixnet (Dist. 3)
c/o Orlan Cain
Route 2
Griswold, Iowa

Iowa Sixnet (Dist. 1)
c/o Terry C. Haye
401 N. 16th St.
Marshalltown, Iowa

IAMO Radio
City Hall
Moulton, Iowa

Iowa Sixnet (Dist. 11)
c/o Darrell B. Roberts
Route 1
Parnell, Iowa

Waterloo Radio Club
c/o Ken Barfield
524 McChane
Waterloo, Iowa

Iowa Sixnet (Dist. 12)
c/o Merle C. Plett
Route 2
Wilton Junction, Iowa

10-20 Club
Route 1, Box 112
Stafford, Kans.

Citizens Radio Club
of Wichita
Box 2638, Munger Sta.
Wichita 8, Kans.

Kentuckiana CB Club
Route 1, Box 196-C
Anchorage, Ky.

Fort Campbell CB Club
c/o Sgt. Roy L. Mitchell
Hq. 937th Engineer Group
Fort Campbell, Ky.

5 Watt Club
c/o Paul Jolly
Glasgow, Ky.

Harlan County CB Club
209 Oak St.
Harlan, Ky.

Ohio Valley CB Club
1221 Loeb St.
Henderson, Ky.

Central Kentucky CB Club
312 N. Hanover
Lexington, Ky.

Original 13 CB Club
175 Beechwood Rd.
Louisville 7, Ky.

Kentucky-Indiana CB
Radio League
212 Bolivar St.
Owensboro, Ky.

Bluegrass CB Club
190 Broadway
Versailles, Ky.

Emergency Comm. Org.
E. Baton Rouge Sheriff's
Dept.
Box 533
Baton Rouge, La.

5 Watt Wonder Club
4662 Lafaye St.
New Orleans 22, La.

Greater New Orleans
CB Radio Assoc.
Box 4195
New Orleans 18, La.

Shreveport Bossier Club
4426 St. Vincent Ave.
Shreveport, La.

10-4
12 Deering St.
Bath, Me.

11-Meter CB Club
c/o Fr. Joseph Tomaselli
3600 Claremont St.
Baltimore 24, Md.

Holiday CBers of Md.
5721 Moravia Rd.
Baltimore 8, Md.

Queen City 5 Watters
711 N. Mechanic St.
Cumberland, Md.

Mason-Dixon 5 Watters
c/o Robert Sebastian, Jr.
Route 5, Box 110
Westminster, Md.

Squares of Round Table
381 Main St.
Charlestown, Mass.

MCRA
Box 235
Cohasset, Mass.

Mohawk Radio Assoc.
23 W. Main St.
Erving, Mass.

Pioneer Valley 5 Watters
Box 989
Holyoke, Mass.

Cape Cod CB Radio Club
Box 131
Kingston, Mass.

5-Watt Whips
144 Wilder St.
Lowell, Mass.

Berkshire 5 Watters
Box 11
Pittsfield, Mass.

Channel Jammers
47 Pine St.
Swampscott, Mass.

Citizens Radio Mobileers
c/o Joseph Hotte
Pine Point
Templeton, Mass.

C-Bags
21 Starrett Rd.
West Lynn, Mass.

Channel Masters
Sanborn St.
Winchester, Mass.

CB Club of Owosso
15400 Steel Rd., Rt. 2
Chesaning, Mich.

Central Mich. Quinwatters
19159 Second St.
Chippewa Lake, Mich.

Citizens Radiophone Assoc.
3306 Kanter
Detroit 11, Mich.

11 Meter Mobile Club
21422 Roosevelt
Farmington, Mich.

Genesee Co. CB Club
1923 Weaver St.
Flint 6, Mich.

Southwestern Mich. 5
Watters
105 S. Maple St.
Hartford, Mich.

Kalamazoo CB Assoc.
Box 108, Central Sta.
Kalamazoo, Mich.

5 Watter CB Club
123 Denver
Lansing Mich.

Southeastern Mich. 11
Meter Radio Club
215½ N. Gratiot
Mt. Clements, Mich.

Crystal Wizards Club
5548 Miller,
Wolf Lake
Muskegon, Mich.

Blue Water CB Club
Peoples Bank Bldg.
1226 24th St.
Port Huron, Mich.

Metro 11 Meter Assoc.
14436 Cogswell
Romulus, Mich.

Blossomland 5 Watters
Box 85
South Haven, Mich.

Raisin River Valley
CB Club
306 E. Pottawattamie
Tecumseh, Mich.

Ground Planer CB Club
310 E. Plum
Wayland, Mich.

Carrier Breakers
5973 Harvey St.
Wayne, Mich.

11 Meter Mounties
c/o George Rochek
Route 2, Box 68
Cloquet, Minn.

Lakehead CB Assoc.
16 Industrial Ave.
Duluth, Minn.

Citizens Radio League, Inc
4601 Cedar Ave. S.
Minneapolis, Minn

Met Net
2587 Rainbow Lane
New Brighton 12, Minn.

Metro. Citizens Radio
League
396 Woodlawn Ave.
St. Paul, Minn.

Ramsey Co. 5 Watters
Navy Island
St. Paul, Minn.

St. Paul Radio Club
998 McClean Ave.
St. Paul 6, Minn.

Jackson CB Radio Club
Box 10746
Jackson, Miss.

Jackson Co. CB Assoc.
Box 574
Kreole, Miss.

Meridian CB Club
Box 1332
Meridian, Miss.

5 Watt Wizards
Box 229
Brookfield, Mo.

Ozark CB Radio Club
400 N. School St.
Desloge, Mo.

M-O-K
2318 Pennsylvania
Joplin, Mo.

Northeast Mo. CB Club
310 Jefferson
Kirksville, Mo.

Greater St. Louis
CB Assoc.
9304 Gravois Ave.
St. Louis 23, Mo.

Springfield CB Radio Club
1890 N. Campbell St.
Springfield, Mo.

BCHS Radio Club
c/o Dennis O. Halm
Nelson Route
Helena, Mont.

Park County 5-Watters
Box 151
Livingston, Mont.

Ninety Niners
c/o Dick Weiss
Eagle, Neb.

Silver State CB Assoc.
765 Gentry Way, No. 20
Reno, Nev.

CB 5ers
136 Court St.
Dover, N. H.

Tri-County Emergency
Comm. Net
Box 102
Dover, N. H.

Lakes Region CB Radio
Club
c/o Gene Blais
Pleasant St.
Laconia, N. H.

5 Watt Whips
c/o Eloise E. Elden
Anders Lane
Nashua, N. H.

CB Socialites
c/o Audrey Moulton
Main St.
Plaistow, N. H.

No. Jersey CB Club
9000 Franklin Tpk.
Allendale, N. J.

Blair House Comm.
116 St. George Ave.
Avenel, N. J.

[Continued next page]

Bayshore Radio Club
c/o Lentz Auto Shop
Belford, N. J.

So. Jersey 5 Watters
CD Rm., Co. Courthouse
Bridgeton, N. J.

MCEU (N. J.)
384 Lakeview Ave.
Clifton, N. J.

Lakeland 5 Watters
29 Taylor St.
Dover, N. J.

Union Co. Emer. Corps
Red Cross Headquarters
Elizabeth, N. J.

27ers
32 Martine Ave. So.
Fanwood, N. J.

Nat'l 11 Meter League
79 Garden St.
Hoboken, N. J.

CBRRL
c/o American Red Cross
612 Bergen Ave.
Jersey City, N. J.

Rancocas Valley CB Club
95 Shreve St.
Mt. Holly, N. J.

Jersey 5-Watters
284 S. 20th St.
Newark, N. J.

CB 32 Club of Del. Valley
c/o Dan McConnell
215 Morris St.
Phillipsburg, N. J.

Delaware Valley Citizens
Radio League
c/o Allen Miller
Seabrook Farms
Seabrook, N. J.

Garden State CBers
15 Halsey Ave.
Spotswood, N. J.

So. Jersey Citizens Radio
Club
Box 99
Stratford, N. J.

Union Co. Citizens Radio
Emer. Corps
544 Olive Terr.
Union, N. J.

Emer. Radio Comm. Service
405 Glassboro Rd.
Wenonah, N. J.

Cape May Co. CB Club
Box 121
Wildwood, N. J.

Greater Wildwood CD-CB
Net
5200 Arctic Ave.
Wildwood, N. J.

5 Watt Banders Radio Club
VFW Bldg.
Library St.
Williamstown, N. J.

Capital Dist. CB Club
Box 1332
Albany, N. Y.

Batavia Citizens Banders
c/o Colin Corke
Route 2, Root Rd.
Albion, N. Y.

Electric City CB Club
of Schenectady
70 Holly St.
Amsterdam, N. Y.

Suffolk CB 11 Club
180 Academy St.
Bayport, L. I., N. Y.

CBRRL
Long Island Chapt.
36 Acme Ave.
Bethpage, N. Y.

Southern Tier CB Club
Broome Co. Civil Defense
Office
Broome Tech. College
Upper Front St.
Binghamton, N. Y.

Five Watt Wizards
c/o Irwin H. Shanis
880 47th St.
Brooklyn, N. Y.

CB Social Club
99 Hazel Pl.
Buffalo 11, N. Y.

WNY CBers
5993 Godfrey Rd.
Burt, N. Y.

Southern Tier CB Club
c/o Harvey Lawrence
Box 116
Chenango Bridge, N. Y.

CBRRL
86-51 Broadway
Elmhurst 73, N. Y.

Sullivan Trail CB
92 Oakwood Ave.
Elmira Heights, N. Y.

WWS Chapt., MCEU
c/o R. C. Haxstun, Jr.
Route 2
Fort Edward, N. Y.

Tri-County Citizens Band
c/o L. Conklin
Park Ave.
Highland Mills, N. Y.

Mobile 11 CB Club
122 Warren St.
Hudson, N. Y.

Mobile Civil Emer. Unit
48 Montgomery St.
Ilion, N. Y.

Western N. Y. Citi-Banders
6994 Lincoln Ave.
Lockport, N. Y.

Queens Chapt., CBRRL
Box 1264
Long Island City, N. Y.

Lynbrook CB Club
600 Scranton Ave.
Lynbrook 22, N. Y.

Lakeland Comm. Club
c/o Martin Scolnick
Route 1
Mohegan Lake, N. Y.

5 Watt Wizards
c/o Edwin Frederick
15 William St.
New York, N. Y.

La Guardia Comm. Club
c/o Peggy Daly
987 Amsterdam Ave.
New York 25, N. Y.

Harlem Valley CB Club
c/o Albert Brian
Summit Ave., Box 705
Pawling, N. Y.

N. Y. State CB Assoc.
Peekskill Chapt.
953 Paulding St.
Peekskill, N. Y.

Dutchess Co. 5 Watters
85 Mansion St.
Poughkeepsie, N. Y.

CB 11
c/o John J. Cunin
Old Saddle Rd.
Ridge, L. I., N. Y.

Citizens Radio Club
28 Buffard Dr.
Rochester, N. Y.

The Mariners CB Club
Box 280, Route 2
Sanborn, N. Y.

Nassau CB Club
539 Heathcliff Dr.
Seaford, N. Y.

Nat'l 11 Meter League
Greater Staten Is. Chapt.
84 Grandview Ave.
Staten Island, N. Y.

Tri-County CBers
c/o Robert F. True
Hemlock Hill Lane
Suffern, N. Y.

Mobile Civil Emer. Unit
1203 Butternut St.
Syracuse 8, N. Y.

Ticonderoga CB Club
c/o Doug Spring
Ticonderoga, N. Y.

Niagara Frontier CB Club
c/o Barbara Urban
209 Fletcher St.
Tonawanda, N. Y.

Mid-Hudson CB Club
c/o Earl C. Huff
New Hackensack Rd.
Wappingers Falls, N. Y.

MCEU, Jeff Co. Chapt.
c/o Richard Gallup
Patricia Dr. Black Rd.
Watertown, N. Y.

Bronx-Westchester
CB Assoc.
108 N. Kensico Ave.
White Plains, N. Y.

Inter-County CBers
156 Broad St.
Williston Park, N. Y.

Asheville CB Club
c/o High Fidelity Sales
180 Baltimore Ave.
Asheville, N. C.

Central Tar-Heel CB Club
Box 25
Broadway, N. C.

Necklenburg Chapt.
c/o M. L. Linder
Route 11, Box 109
Juniper Dr.
Charlotte, N. C.

Fifth Dist. CB Assoc.
12 Park Ave.
Concord, N. C.

Durham CB Radio Club
Box 8124
N. Durham Sta.
Durham, N. C.

Elizabeth City CB
1114 Pennsylvania Ave.
Elizabeth, N. C.

2112 CB Club
Box 402
Ellenboro, N. C.

Cumberland CBers
1047 Tammy St.
Fayetteville, N. C.

5 Watt Club, Gastonia Co.
411 Chapel Rd.
Gastonia, N. C.

Greensboro CB
Service Unit
500 Battleground Ave.
Greensboro, N. C.

Coastal Carteret
Comm. CB
Operators
c/o J. P. Guthrie
Harkers Island, N. C.

Seedy CBers
122B Montlieu
High Point, N. C.

Lenoir Co. CB Club
Box 835
Kinston, N. C.

Mobile Emer. Comm. Unit
1010 Fairview Dr.
Lexington, N. C.

Lincoln 2-Way Radio Club
c/o Hal's Radio & TV Shop
Lincolnton, N. C.

Tri-Co. CB Radio Club
538 Pine St.
Mocksville, N. C.

Midstate CB Club
Rescue Bldg.
Salisbury, N. C.

Sandhills CB Club
Box 59
Southern Pines, N. C.

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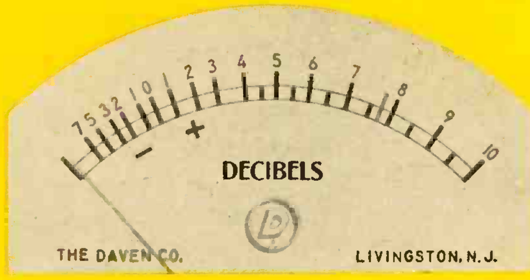


THE DECIBEL

By Herb Friedman, W2ZLF

How to understand and use the decibel without higher math.

THE DECIBEL frightens many electronic hobbyists, who see it as something dark and mysterious. But if you can grasp Ohm's Law you should have no trouble understanding the decibel.

In the early days of electronics the decibel was confined almost exclusively to the world of broadcast and telephone engineers. But today the concept is used just about everywhere—and it's inescapable in the areas of audio, ham radio and Citizens Band radio.

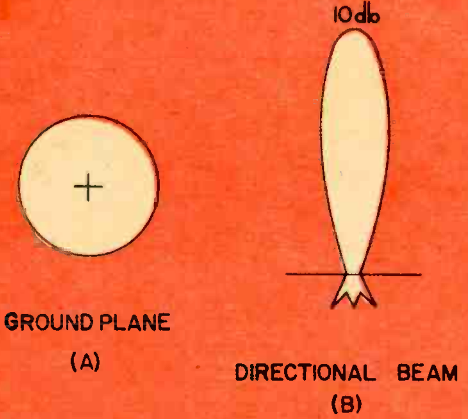
It's Just a Ratio. Telephone engineers found that the human ear perceives sound-level changes on a proportional, or logarithmic, scale rather than linearly. It is on this characteristic of the ear that the concept of the decibel is based.

For example, let's say you are listening to a hi-fi system when its output power is 10 watts. Logically you'd think that boosting the output to 20 watts would make the sound twice as loud, but it wouldn't. You'd notice only a slight increase in volume. In fact, it would take nearly a ten-fold power increase for your ear to sense twice the volume! Going a step further, the power would have to be increased 100 times —from 10 to 1,000 watts—for your ear to notice four times the volume. When a sound increases in intensity you receive an impression of increased loudness approximately equal to the *logarithm* of the ratio of two electrical powers.

The *bel* is the name given the unit that expresses the logarithm of this ratio. In mathematical language this is written as $\text{bel} = \log P1/P2$, where P1 is the larger power and P2 is the smaller power. In working with the formula you first divide the larger power, P1, by the smaller power, P2. The number you get is the ratio of the two. Take this number, look up its log in a table of logarithms and you'll have a reading in bels, or effective increase in loudness.

Let's try an example. Assume P1 is 48 watts and P2 is 6 watts. Forty-eight divided by 6 is 8, of course, and the logarithm of 8 is 0.9030. Stated another way, the ratio in bels of 48 watts to 6 watts is 0.9030. However, the bel is a fairly large unit, so the *decibel,* which is a tenth of a bel and usually referred to by the abbreviation db, is used instead. This modifies the formula slightly, making it $\text{db} = 10 \log P1/P2$. Using this formula in the previous example would give an answer of 9.030 db, just ten times as great. Whether the answer represents a db loss (—db) or a db gain depends on the circuit you are working with. We'll have more about this later.

Though the db is a *ratio* of two powers, it also can be used to express absolute power, provided we have a reference or zero-db level. (Take a look at microphone specs in an electronics catalog and you'll see the output stated as just —55db, —48db, etc.) In the early days of radio, many different reference levels were established, and there were almost as many different meters used to indicate these levels. By 1939 audio engineers had decided to do something about the lack of standardization. They came up with what is called the VU



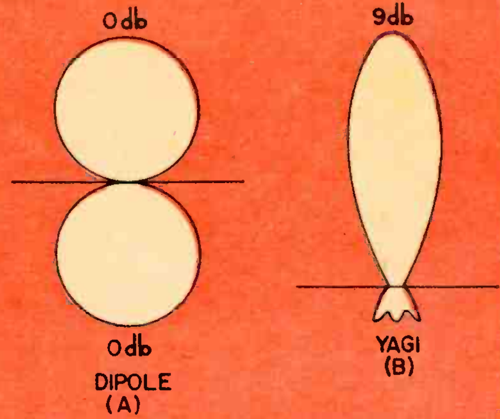


Fig. 1—Ground-plane, reference CB antenna, has 0db gain; directional beam, 10db gain.

Fig. 2—Bi-directional dipole, FM/TV reference, has 0db gain. Yagi, 9db forward gain.

(volume unit) meter and a standard reference level of 1 milliwatt (.001 watts) in a 600-ohm circuit.

This standard reference is referred to as 0dbm, which is another way of saying 0db is synonymous with 1 milliwatt of power output. A statement that power output is 10dbm is talking about a power 10db more than 1 milliwatt. The VU meter is calibrated so when connected to a 600-ohm circuit and when measuring sine-wave power, 0 VU corresponds to 0dbm and 3 VU corresponds to 3dbm. (The mike referred to with a —55db output, you see, gives you a fairly weak signal.) We'll show later how greatly a 1 or 2db difference in mike output can affect amplifier power output.

The db is also used to deal with the output power of transmitters, receivers and antennas, since this power is ultimately delivered to a speaker.

Using a db Table. You can solve most db problems without bothering with logs if you use the table shown with this article. Let's work a problem to see how it's done. One day you decide your 10-watt hi-fi amplifier can be souped up a little. You change a few tubes, alter the circuit slightly and, with the same input as before, the amplifier now delivers 20 watts. The ratio of the power change (P1/P2) is 20/10 or 2. Look down the column in the table headed *Power Ratio* until you reach 1.99 (this is close enough to 2 for our purposes). In the left column you see 3db. Therefore, the increase in output power from 10 to 20 watts amounts to a +3db improvement. If you had started with a 20-watt amplifier and reduced the output to 10 watts, the power ratio would still be 2, but now the 3db change represents a loss. It would be expressed as —3db.

Let's try a more difficult problem. Assume you are using a public address amplifier that is capable of delivering 25 watts of power. Your microphone, which has a —57db output level referenced to 1 mw, drives the amplifier to

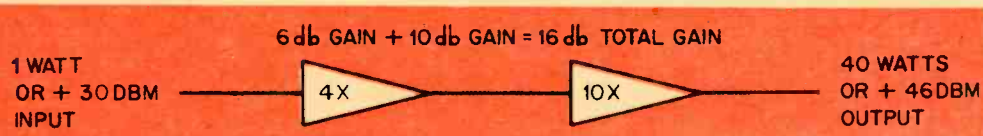


Fig. 3—Multiply power gains (4X, 10X) of series-connected amplifiers. Add corresponding db gains.

only 10 watts output when the gain control is set to maximum. You decide to purchase a new microphone. What should its output be to get the amplifier to deliver a full 25 watts? First, we find the ratio of the power we *want* to the power we *were getting*, which is 25 watts/10 watts, or 2.5. From the table we find that a power ratio of 2.5 equals 4db. Therefore, we need a microphone with an output 4db greater than —57db. The final answer, of course, is a microphone with an output of —53db (subtracting +4db from —57db). Such a mike, the formula tells us, will drive the amplifier to 25 watts.

At this point you may wonder about intermediate values above 10db. In the table the values after 10db are 20, 30, 40, 50, etc. How do you determine the power ratio of 16db? It's simple. Split 16db into 10db and 6db, find the corresponding power ratios, and then *multiply* them. Ten db represents a power ratio of 10 and 6db represents a power ratio of 3.98; their product is 39.80. To see how we would handle such a problem, refer to Fig. 3. This shows one amplifier with a power *gain* of 4 (4X in the figure) driving another with a power gain of 10 (10X in the figure).

The rule is that power gains (and voltage gains when the input and output impedances are equal) are multiplied. Therefore, the total power gain of the two amplifiers is 4×10, or 40. If you feed 1 watt to the first amplifier, the output of the second amplifier will be 40 watts.

Now, let's determine the *db gain* of both amplifiers. But first, another important rule is that logarithms are added, not multiplied. A power *gain* of 4 equals a power *ratio* of 4 which, from the table, equals 6db. A power *gain* of 10 equals a power *ratio* of 10, which equals 10db. By adding the logs, the total db gain is 6db + 10db, or 16db. To do it another way, try splitting 16db into 8db and 8db. The power ratio corresponding to 8db is 6.31. So $6.31 \times 6.31 = 40$.

To work the other way, that is, to go from power ratio (gain) to db, divide the ratio into convenient units. A power gain of 40 equals 8×5. Under the column headed *Power Ratio* in the table, note that a power ratio of 7.94 (sufficiently close to 8) equals 9db. A ratio of 5.01 (close to 5) equals 7db. Adding 7db and 9db we get 16db.

The voltage ratio. Instead of power,

[*Continued on page* 104]

DECIBEL TABLE FOR POWER AND VOLTAGE RATIOS

DB	POWER RATIO	VOLTAGE * RATIO
1.0	1.26	1.12
1.2	1.32	1.15
1.4	1.38	1.17
1.6	1.44	1.20
1.8	1.51	1.23
2.0	1.58	1.26
2.2	1.66	1.29
2.4	1.74	1.32
2.6	1.82	1.35
2.8	1.91	1.38
3.0	1.99	1.41
3.2	2.09	1.44
3.4	2.19	1.48
3.6	2.29	1.51
3.8	2.40	1.55
4.0	2.51	1.58
4.2	2.63	1.62
4.4	2.75	1.66
4.6	2.88	1.70
4.8	3.02	1.74
5.0	3.16	1.78
5.2	3.31	1.82
5.4	3.47	1.86
5.6	3.63	1.91
5.8	3.80	1.95
6.0	3.98	1.99
6.2	4.17	2.04
6.4	4.36	2.09
6.6	4.57	2.14
6.8	4.79	2.19
7.0	5.01	2.24
7.2	5.25	2.29
7.4	5.50	2.34
7.6	5.75	2.40
7.8	6.03	2.46
8.0	6.31	2.51
8.2	6.61	2.57
8.4	6.92	2.63
8.6	7.24	2.69
8.8	7.59	2.75
9.0	7.94	2.81
9.2	8.32	2.88
9.4	8.71	2.95
9.6	9.12	3.02
9.8	9.55	3.09
10.0	10.00	3.16
20.0	100.00	10.00
30.0	1,000.00	31.60
40.0	10,000.00	100.00
50.0	100,000.00	316.00

*May be used only when input and output impedances are equal

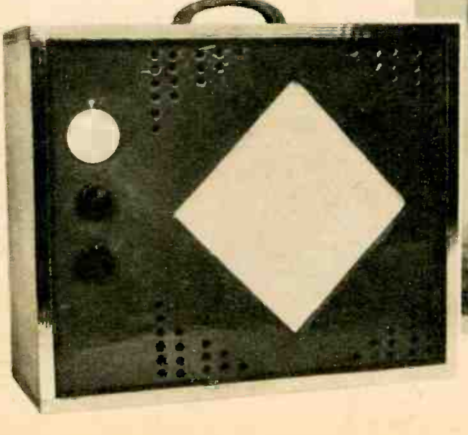
THE SUPER PORTABLE

By Harry Kolbe

FOR summer beach parties, large open-air gath-therings or outdoor swing fests you need a lot of sound, more than can be supplied by the average portable radio. EI's Super-Portable is designed to furnish the kind of big sound you need, having immensely more punch than factory-made models. And the sound is of excellent quality. Yet the Super-Portable can be built for about $30.

Construction is simplified because the radio is designed around preassembled AM tuner and amplifier units. You have only to make a few modifications to the amplifier (to improve its performance) and a half-dozen or so interconnections. The biggest job is the cabinet. But one evening in the shop with a hammer, saw and soldering iron and the entire job should be completed.

Cabinet Construction. The cabinet may be made of half-inch plywood or pressed board. Cut to the dimensions in the cabinet detail drawing. Using 1½-inch brads and wood glue, put together the sides, top, bottom, front panel and the internal partition.



The front panel is recessed 1⅛ inches and the internal partition is mounted 3⅛ inches from the side.

In the speaker compartment, mount two 12½-inch strips and one 12-inch strip of half-inch stock. These go ⅝-inch from the back of the cabinet and are used to support the rear cover.

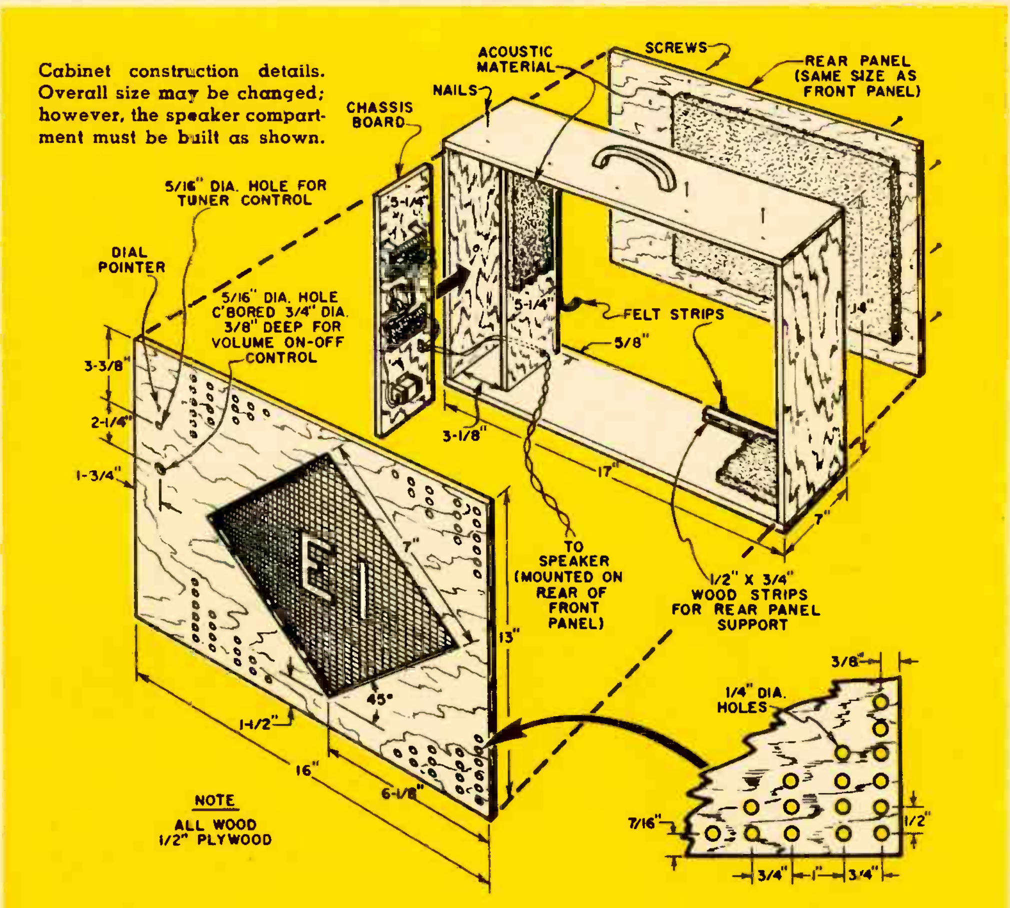
Cut out a 7x7-inch diamond on the front panel, then drill the specified number of ¼-inch speaker-port holes. Drill and countersink two ⅜-inch holes for the tuning capacitor shaft and the volume control. Paint or stain the cabinet to suit.

After the paint has dried, stretch and tack a piece of grille cloth over the speaker opening. Line the inside of the speaker compartment and the back cover with one-inch fiberglass. Tack four strips of ½-inch wide weather stripping along the back edge of the partition and rear-panel support strips. Mount the speaker with wood screws and remove its magnet cover.

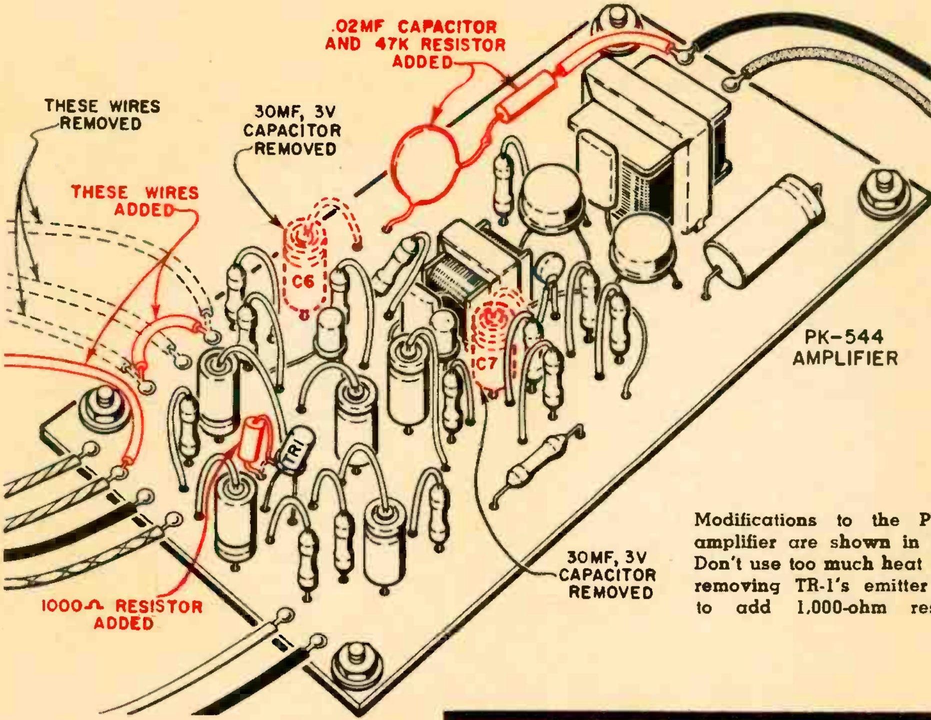
Amplifier Modification. The performance of the Lafayette PK-544 can be improved by making a few modifications. Start by removing the emitter-bypass capacitors shown in the pictorial (C6 and C7 on the schematic that comes packed with the amplifier). Clip the top leads at the surface of the printed-circuit board and unsolder the others.

Hold the emitter lead (toward the left side of the board in the amplifier pictorial) of the first transistor (TR-1 in the schematic) with a pair of long-nose pliers. Unsolder and remove the lead from the underside of the board. Clip

[*Article continued on next page*
Text continued on page 101]



Cabinet construction details. Overall size may be changed; however, the speaker compartment must be built as shown.

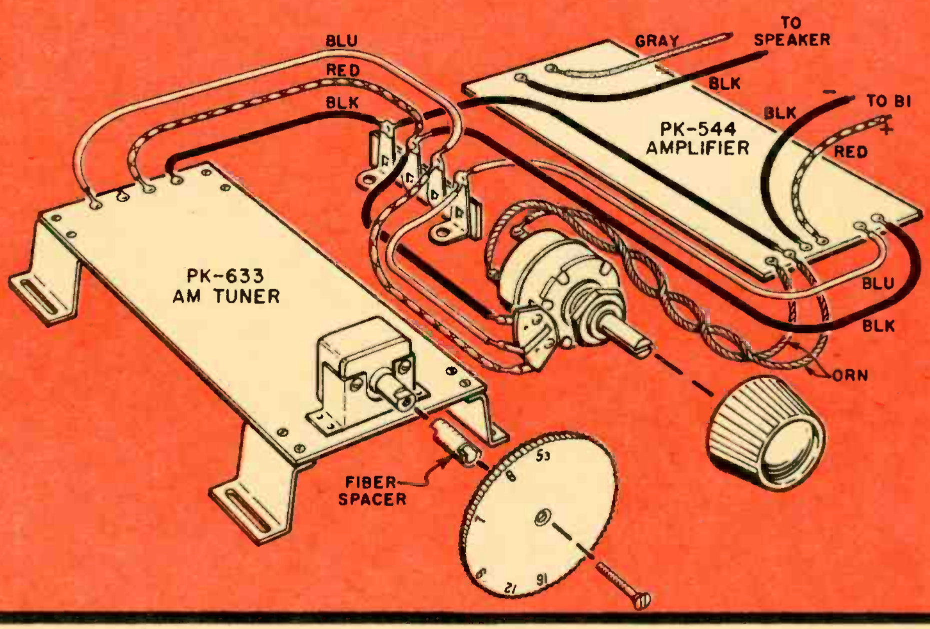


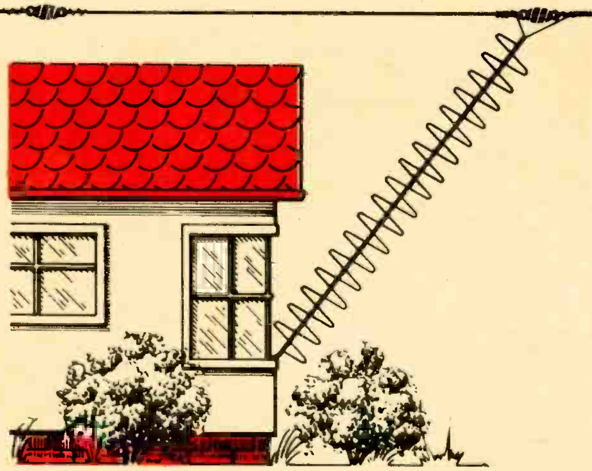
Modifications to the PK-544 amplifier are shown in color. Don't use too much heat when removing TR-1's emitter lead to add 1,000-ohm resistor.

Tuner, amplifier and volume control connections. File notches in fiber spacer to match tuning capacitor shaft. Mity-Amp amplifier connections are shown at end of the article.

PARTS LIST

Transistor amplifier: Lafayette PK-544 or Mity-Amp, see text (Lafayette PK-638)
AM broadcast tuner: Lafayette PK-633
12-inch speaker (Lafayette SK-86 or equiv.)
10,000-ohm, linear-taper potentiometer with SPST switch
9-volt battery (Eveready 246 or equiv.)
1,000-ohm, 1/2-watt resistor
47,000-ohm, 1/2-watt resistor
.03 mf, 50 V disc capacitor
Misc: Knobs, handle, fiber spacer





What SWR Means to You

Why isn't your signal getting out? The answer may be right here.

WHEN you start thinking of antenna systems for a Citizens Band or amateur station something called standing-wave ratio, or SWR, is likely to come to mind. A high ratio is bad. A low one (1:1 is the lowest possible) is good. But few of us ever try to calculate the exact effect of SWR on a signal.

Handbooks say the ratio of maximum to minimum voltage along a transmission line is called the *voltage standing-wave ratio*—shortened simply to *standing-wave ratio*. A more graphic definition might say SWR is an indication of how much of a transmitter's output power will get into the antenna.

For instance, if you have a transmission line with an SWR of 3 to 1 and your transmitter is delivering 100 watts of RF, how much signal is actually getting up where it counts?

A quick check of our chart shows an SWR of 3:1 gives you a power transfer efficiency of 75 per cent. So only 75 of your 100 watts is being transferred from transmitter to antenna. The remaining 25 watts is reflected back, dissipated as heat in the feedline and in the transmitter's output circuit.

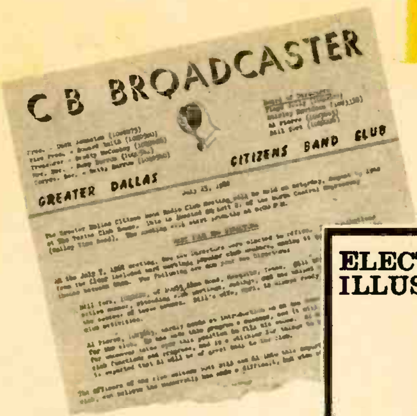
SWR can change the apparent input impedance of a feedline, making it appear either higher or lower than the characteristic value. RG8/U coax, for instance, has a characteristic impedance of 52 ohms. Even though your transmitter is designed to work into 52 ohms it still may not be able to transfer maximum RF power into the antenna system if SWR is excessive.

SWR readings usually are taken at the transmitter end of the feedline with special RF voltmeters (SWR meters). More accurate figures can be obtained with an SWR bridge circuit, which is more complicated and more expensive.

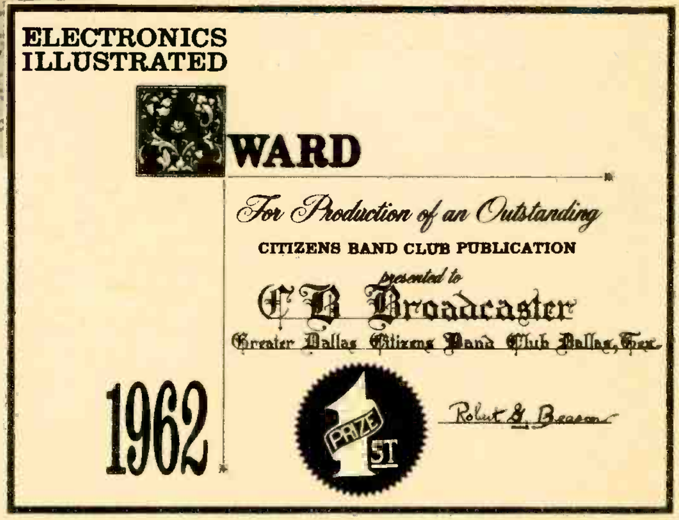
Look up your own SWR figure in our chart and then check the matching percentage of power transfer. It just may tell you why you're not getting out as well as you'd like.—*Bert Mann*

STANDING WAVE RATIO	PERCENTAGE OF POWER TRANSFER
1:1	100
1.2:1	99
1.4:1	97
1.6:1	95
1.8:1	92
2:1	89
2.5:1	82
3:1	75
4:1	64
5:1	56
6:1	49
8:1	40
10:1	33

PRIZE-WINNING CB PAPERS



CB BROADCASTER
Greater Dallas Citizens Band Club, Dallas, Tex.


ELECTRONICS ILLUSTRATED

AWARD

For Production of an Outstanding

CITIZENS BAND CLUB PUBLICATION

presented to

CB Broadcaster

Greater Dallas Citizens Band Club Dallas, Tex.

1962

1ST PRIZE

Robert G. Beason

WELL over 50 Citizens Band clubs publish some kind of newsletter, paper or bulletin on a regular schedule. It is our belief that a *good* publication can be a valuable asset to a CB organization. To encourage high standards we announced in the November '62 EI that five awards would be given to the most outstanding CB club publications. Here are the winners.

2nd PRIZE

CB NEWS & VIEWS
Citizens Radio League, Northlake, Ill.

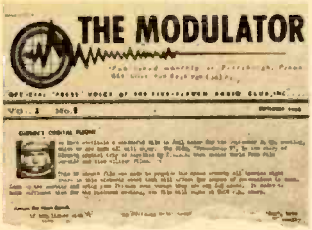
WHAT'S WRONG WITH

WHEN it comes to putting out a special-interest publication, there are mighty few hard-and-fast rules you can lay down without expecting arguments from *some* quarter.

We can think of only about one. And this comes after a sizable career of writing, editing, receiving and reading (yep, *reading*) papers from clubs, churches, schools, alumni groups, supermarkets, the boy-genius editor down the block and others too numerous to mention. The rule we state fearlessly is that any publication which carries the kind of material its readers want is a successful publication.

So it goes with papers published by Citizens Band clubs. If they satisfy the membership, who can argue that they're steaming down the wrong track? However, among the 50-plus CB club publications are those which do *not* please their readers. In not a few cases the editor would like to revamp his paper but is undecided or simply doesn't know what to do. The intent of this article is

HONORABLE MENTION



THE MODULATOR
Five-Eleven Radio Club,
Pittsburgh, Pa.

MONTGOMERY
FIVE WATTER
Citizen Radio Club,
Montgomery, Ala.

BAND-SPREAD
Tri-County Citizens Radio
Assoc., Southampton, Pa.

On the basis of content, layout and purpose, we chose the *CB Broadcaster,* published by the Greater Dallas Citizens Band Club, 1318 Michigan Ave., Dallas 16, Tex., as the most outstanding publication of its type in the country. The Broadcaster has a monthly publication schedule but comes out oftener when news or events warrant. The paper takes the unusual approach of considering each of the club's 250 members as a reporter. It is evident in the amount and scope of material gathered in 1962 (the period covered by the awards) that a large fraction of the membership takes the responsibility seriously. The Broadcaster's eight pages are newsy, well written and edited carefully. The paper does an excellent job of covering club activities, FCC news, operating tips, items about other clubs, personal news items and community programs where the club is involved. Overseeing publishing operations is Dick Johnston, 10W4075, the club's president (in 1962).

Second Prize goes to *CB News & Views,* published by the Citizens Radio League, Box 28, Northlake, Ill. It is edited by Ralph and Gwen Nelson, 18W3943, and goes to 400 readers.

Honorable Mention winners:

The Modulator, Five-Eleven Radio Club, 868 Glass Run Rd., Pittsburgh 36, Pa. Edited by Marvin R. Hess, 20W4725. Circulation of 250.

Montgomery Five Watter, Citizen Radio Club of Montgomery, Box 3022, Montgomery, Ala. Edited by Bobby Hale, KDB3601. Circulation of 150.

Band-Spread, Tri-County Citizens Radio Assoc., Box 53, Southampton, Pa. Edited by Joe Miller, 3Q1478. Circulation of 200.

THE CB CLUB PAPERS?

to give him some ideas.

We receive and read every copy of more than half the CB papers published in the United States. The most startling single deficiency we find in this group is the failure to list the address or phone number of the paper, the editor or even the club. We grant that most readers would know all these. But a copy might —and should—go occasionally to CBers outside the club. This is one way of recruiting new members. But if an outside CBer does receive a paper, gets interested in joining and then can't find a way of contacting the club, he loses his interest mighty fast. Ideally, every issue of a paper should carry the publishing address, the club's address and the name, address, call and telephone number of at least the editor and club president.

Any publication reflects on the club that puts it out, giving readers an insight into the kind of people who belong. While the writing and editing, being

[*Continued on next page*]

WHAT'S WRONG WITH THE CB CLUB PAPERS?

done by non-professionals, understandably might not match that in large national publications, there is no excuse for misspelled words so long as the club can afford a dictionary. Misspelled words tell you that somebody along the line didn't care enough to open the dictionary.

Most CB publications do well in covering club activities, such as upcoming meetings, speakers and special projects. To our way of thinking, however, that is only part of a paper's area of responsibility. The reporting and interpretation of new or revised FCC rules should be a regular feature. Passing on FCC news is one way of making members cognizant of their own operating procedures which might get them in trouble. In theory, every CBer has a copy of Part 19 and receives the amendments as they come out. In practice, it doesn't work quite that way. A great many licensees have *never* had a set of the rules and others have trouble understanding what is being said. The answer is a column of FCC news *and* interpretation.

Recipes may be good for attracting the interest of CB wives (who may be licensees themselves). But recipes appeal to women as wives and cooks. This kind of appeal should be left to the women's magazines. If you can't hold your feminine readers on the basis of CB material, forget them.

Small personal items about club members, we think, perk up any CB paper. Among other things, they bring in the names of many licensees, and most of us are interested in what fellow club members are doing (births, promotions, deaths, etc.). Nearly every publication now carries items of this type. Unfortunately, a few find it necessary to fall back on those little innuendo bits that most of us haven't seen since high school. "Who was the blonde that 2WXXXX went driving with Saturday night?" they whisper. Or, "Can 12QXXXX really be serious this time? How about it, Al?" Editors who specialize in parachute jumps without a parachute should feel free to indulge. Others ought to have better sense.

An extremely useful department is one devoted to operating tips. The tips, in essence, tell CBers how to carry on communications more efficiently, and efficient use of the band is highly desirable in any area.

Small construction projects, bits of theory and other technical or semi-technical pieces can be both interesting and educational. But only if there is someone on the staff who is capable of doing that kind of writing. Nothing falls quite as flat as an article written by an author who doesn't know what he's talking about.

Also to be avoided are articles about some CBer's illegal activities (such as working skip). These pieces encourage others to try the same thing and at times even tell how it's done.

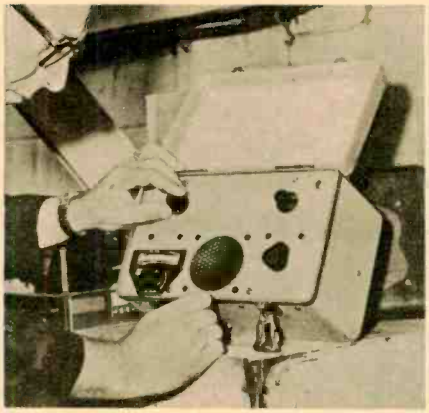
On the other hand, an item that tells why some club member got an FCC citation can be both interesting and instructive to others. Just don't embarrass the victim.

Our only complaint about stories and announcements concerning Civil Defense programs, monitoring schedules and so on is that not enough papers run them. The same is true for profiles on members, equipment swap columns and brief paragraphs about new CB gear on the market.

Last in our discourse comes the need to recognize limitations. Too many CB publications, perhaps given confidence by enthusiastic club members, seemingly want to rival the slick weeklies by running fancy art and complex layout schemes. Only trouble is that the neophyte artists available usually can't produce that kind of art and, if they could, the printing process and paper stock wouldn't permit reproduction—especially where the "press" is a mimeograph machine. No one could criticize ambition but, at the same time, you have to realize when something is impossible. We maintain that the simple and straightforward layout is best for a club publication.

PIGEON-POWERED RADIO

WHAT makes a homing pigeon home? Office of Naval Research scientists believe if they can find out what physiologic devices pigeons use to get back to their lofts, the information might lead to new navigation techniques. So, near Philadelphia an ONR team set up two radio tracking stations along a 20-mile path about to be used by a homing pigeon. Then they saddled a bird with a little transmitter powered by four mercury cells. A 40-inch wire, representing a modified half-wave dipole antenna, was connected, its leading end stiffened so as not to interfere with the bird's wings. The pigeon's owner, Morris Cohen (right in the photo above), threw the bird into the air. All the way to the loft the transmitter's 1-milliwatt beeps were tracked. The ONR team knew the exact route the pigeon took. Now, with recorded data and pigeon in hand, they're trying to figure out why.



Navy's chief pigeon-tracker, Dr. Sidney Galler, tunes the 140-mc receiver at one of two tracking stations in field.

Two tracking stations along the pigeon flight path have 8-element VHF beam antennas mounted on low wooden towers.

The 1-ounce crystal-controlled transmitter mounts on back of 12-oz. pigeon; antenna trails behind bird in flight.

THE HAM SHACK

BY ROBERT HERTZBERG W2DJJ

DOGHOUSE . . . Here are two more candidates for my private-stock unpopularity list that I started last issue. First is the phone operator who just can't sign off; he sends a final-final after he's already given his final. Second is the CW operator who uses a souped-up electronic keyer for his own transmissions and then pleads QRS when the other guy comes back at him with the same hopped-up speed.

Voice With a Smile . . . Pretty K2BPT has only to whisper a few cool CQ's into the mike on her Poly-Comm 6 mobile to draw all kinds of replies. The pile-up is

likely to have a distinct wolfish tone, too. All this amuses cool-voiced Shirley no end, as is plainly evident in our picture of her on the air in her car. K2BPT is Mrs. W. Vernon Hargreaves (an *XYL*; whatta blow!), wife of the chief engineer of Polytronics Labs. That neat under-dash transceiver shows where her loyalties lie.

The Lingo . . . Not a few brass-pounders look down their keys on phone operation and consider it a sissy method of communication. And they are particularly irritated by the widespread voice use of the international Q-signals. These signals, of course, were devised originally to facilitate CW exchanges between operators of different nationalities, as well as being a kind of CW shorthand. But I can see nothing wrong with using Q-signals on phone, the brass-pounders notwithstanding. Every hobby develops its own lingo, which gives it an individual flavor and identification. Ham lingo is part of the ham hobby and you're getting that unique flavor of the hobby when you hear QRM used to mean interference, QTH for location, QSB for fading, and so on.

Straight Dope . . . A good buy amongst the new technical literature is the RCA Transmitting-Tube Manual. Containing 320 pages and costing just a buck, the book is full of valuable operating information and has two dozen circuits. The section on SSB alone is worth the price. It's available from RCA distributors or by mail from Commercial Engineering, RCA Electron Tube Division, Harrison, N. J.

DX Europe . . . The Ham Shack will be carrying a European dateline in the next issue if everything goes well. The proprietor has the bags packed and we're shoving off for a tour of England and the Continent that may turn up some interesting paragraphs (we hope). We'll be dropping in on a good many hams over there, seeing the faces that go with long-familiar calls.

Sez Who? . . . The other day I put three operators in front of a receiver and asked them to rate a signal—the same one—with their mental S-meters. Each one gave me a different reading. Which goes to show once more the insignificance of most reports. Strength alone means little if interference makes the transmission unintelligible. The kind of report I like to get (and give) goes like this: "You're coming in okay and I can understand everything you say." This merely means that you're carrying on successful communication with the other station—at least on your end—and communication is the purpose of ham radio, isn't it?

Home base for America's electronic counterspies is the new State Department Building in Washington.

Want to Be a COUNTERSPY?

Electronic specialists are needed to foil the Communist spies.

By S. David Pursglove

THE world's first counterspy got his job on the day one prehistoric tribe learned that a neighboring band had sent someone over to spy on them. The man who went out with a stone club to take care of the chap was the first counterspy.

Methods have been updated but rival tribes are still at it. Most active in the trade at present, naturally, are the Western nations on one side and the Communists on the other. The modern spy, whether ours or theirs, is likely to rely heavily on electronic eavesdropping equipment. The counterspy, having abandoned clubs, also uses electronic gear—not to erase the spy, necessarily, but to detect his bugs so they can be put out of commission.

An aura of mystery surrounds spying and counterspying but there is nothing mysterious about the fact that our government employs a large force of counterspies. Furthermore, it is interested in hiring more men who are uniquely qualified for the electronic end of counterspying (that's a term you won't find used in official government circles but it's the best one to describe the job).

America's counterspy activities are centered in the Technical Services Division, Office of Security, Department of State. The employees fall into two classifications: electronic technicians and experienced professionals. For the professional, requirements are age 26 or older, a master's degree in EE or physics and experience specifically in electronic countermeasures. He must have been a U.S. citizen seven years, have no close relatives living abroad and must be will-

Top boss for all counterspy activities is the Secretary of State, Dean Rusk. Secretary is shown at work at his desk.

In sensitive post, security-wise, is Foy Kohler, our Ambassador to Moscow.

ing to accept assignment anywhere.

Technicians need outstanding qualifications also. They must be able to demonstrate technical competence and then leave the interviewer with the feeling that they are mature and have the ability to pick up the special orientation of the counterspy.

The pay of a counterspy is likely to be about what a person of his qualifications would get in private industry.

There's no question about the counterspy's work being interesting and nonroutine. The normally conservative top security officers at State describe the jobs as "unique and exciting assignments."

The State Department weeds out the escapists and romanticists in short order. Yet it seeks men with active imaginations who may be able to figure out what the adversary is going to do before he does it. The Security Office does not want equipment-oriented technicians. It wants "threat-oriented" sleuths who know and can use the equipment.

The electronic counterspy often works with measurements (magnetic field strength, for instance) which are inexact or downright misleading. His job is to weed out what is unimportant and act on the data he has left. And he must do his job alone. Exactly what he does do and the circumstances can vary widely with geography and time.

When Foy D. Kohler, U.S. Ambassador to Russia, wants to discuss something with one of his officers the two men go upstairs in the embassy building to a locked room guarded by an armed Marine. Inside, the diplomats can talk in normal tones without fear of Russian eavesdropping because the room has been made safe by "sweepers." These are electronics experts who have the special job of ferreting out and destroying or disabling eavesdropping equipment. After they sweep a room the chances of there being a hidden bug are virtually nil.

The Communists use highly sophisticated equipment and techniques in trying to pry out our state secrets (see HOW RUSSIAN SPY RADIOS WORK, Jan. '62 EI). Since 1950 we've found more than 130 bugs planted in U.S. embassies. In most cases, the finding was done by our electronics experts . . . the counterspies. Sweepers have found wired and wireless microphones, steam radiator bugs, carrier-current setups, tampered telephones and many other spy tools.

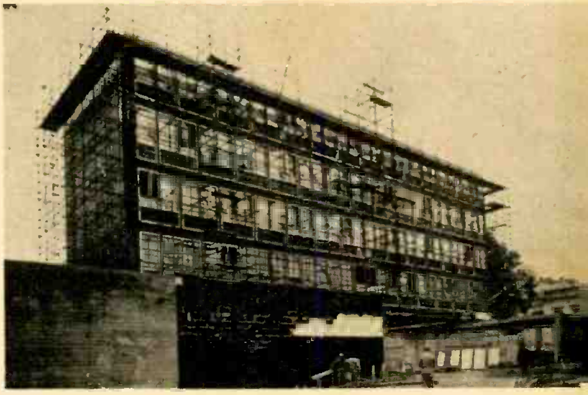
The most widely used eavesdropper is the microphone, either a wired job or a wireless model that feeds a radio transmitter. This kind of equipment once was easy to find because of associated vacuum tubes. Supplying the tubes with a sizable amount of power restricted such plants to certain areas and our sweepers knew where to look. Transistorized bugs with long-life power supplies have complicated the sweeping job immensely.

Dynamic mikes are relatively easy to spot with a magnetometer because of their magnetic fields. Unfortunately, many eavesdropping microphones are of the crystal type, which do not have a magnetic field and must be located by other methods. The famous re-radiating bug found in the Great Seal at our Moscow embassy was simply a little metal chamber that received an external signal, modulated it and bounced it back. About the only electronic equipment that could have found it was a sensitive metal detector.

Certain countermeasures are standard practice to our specialists in scientific eavesdropping. Dealing with a highly directional shotgun mike, which can pick up conversations from many yards away, is relatively easy. X rays sometimes can spot bugs in a wall. By monitoring a large segment of the radio spectrum you can pick up signals from wireless eavesdroppers ("You just listen for the ambassador's voice," says one counterspy).

There is a well-known device that bathes a telephone handset with random noise, in case it is altered to pick up conversations in the room. And turning on a radio that is tuned between stations makes a sound mask for voices. In the case of apartments, it is obvious that the flat next door may have listening devices plastered to the wall. The counter-

U. S. Embassy in Moscow is scene of never-ending struggle between their spies, our counterspies.



The first security job after completing our new Warsaw Embassy was hunt for eavesdropping bugs.

spy operation here is simple. You use your head and your special equipment to detect bugs and then you nullify or jam them.

The difficulty lies in the fact that as fast as we get proficient at finding certain kinds of bugs, *their* spies turn up with something altogether new. Then we need new techniques, new equipment and new men with new ideas.

One of the problems in foreign embassies is that the buildings are put up by local workers who, if they happen to be intelligence agents for their government, have months and years in which to sprinkle the structure with bugs. The first Americans in the new embassy are the electronic sweepers, who in a relatively short time must find and knock out the spying equipment left by departing workmen.

When the building happens to be in an unfriendly country which is especially active in the spy trade, the electronic sweeping can be quite a job. By no means all eavesdropping bugs turn up in Moscow, Warsaw, Budapest and other Iron Curtain countries. Sometimes our buildings in neutral or allied lands are rigged, too, if the local Communists are plying their spy sideline with fervor.

If you're interested in that kind of work and believe you have the qualifications, contact the Office of Security, Department of State, Washington 25, D. C. And be prepared for some pretty exciting and far-ranging assignments.

KIT EI REPORT

ELECTRONIC TACHOMETER

Knight-Kit

MENTION installing a tachometer in your car and your friends are apt to think you are about to go in for hot-rodding. Though a tach is useful in rodding, that's not its only value. The instrument can mean a substantial increase in operating economy even for the common family heap.

A tachometer, which is standard equipment in racing cars and many sports jobs, gives you an accurate and constant indication of *engine* speed in rpm. This tells you how hard your mill actually is working. A speedometer is handy for getting along with the law but it shows only over-the-ground speed, telling next to nothing about how well or poorly the engine is faring.

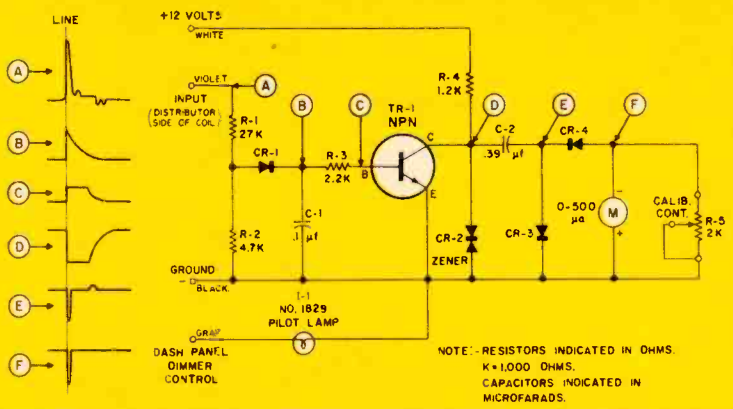
Since fuel consumption is greatest at low and high engine speeds you can, by watching your tach, keep your rig in its most efficient rpm range. Engine wear is excessive at high crankshaft speeds, and *all* engines have a maximum rpm figure you must not exceed. A red line on your tach can mark off this limit. The dangerous factor in excessive engine rpm is that you don't have to be going 110 mph to get into trouble. You can do it easily in first or second gear, when your engine is turning over fast and your wheels turn slowly. A speedometer never tips you off. A tach will.

When it comes to fast pickup for passing or a quick start you find that an engine develops maximum torque over a rather narrow rpm range. Only a tach can tell you whether you're in that range and operating most efficiently.

In the past tachometers were relatively expensive and bulky mechanical devices requiring a mechanical connection to the engine. But the new electronic models are small, less expensive and easy to install. In effect, they're simply counters which indicate rpm by keeping track of the shots of juice in the ignition system.

Allied Radio offers a tachometer in kit form in its $21.95 Knight-Kit model, available for cars with a negative ground (83 Y 944) or positive ground (83 Y 980). The instrument requires at least 9 volts for operation and can be used with either 6- or 12-volt ignition systems. With 12-volt systems a resistor

All parts of the tachometer. Assembly, calibration and installation are about a three-hour job.



Negative-ground tach schematic. Circled letters tie waveforms to points in schematic. Connections of CR-1, CR-4, meter, and TR-1 are reversed in positive-ground model. Pulses in battery line are amplified by TR-1. Pulse level and width are kept uniform by circuitry following. R5 is used to calibrate tach.

in the tach's circuit cuts the voltage to the required level. With 6-volt systems it operates off a separate 9-volt battery. The tach is usable on two-cycle engines having anywhere from one to eight cylinders and with four-cycle mills running to 16 cylinders. It obviously will give readings on inboard or outboard boat engines and other power plants, as well as on car engines.

Construction is simple and takes about two and a half hours. The steps consist of mounting 23 parts on a phenolic board.

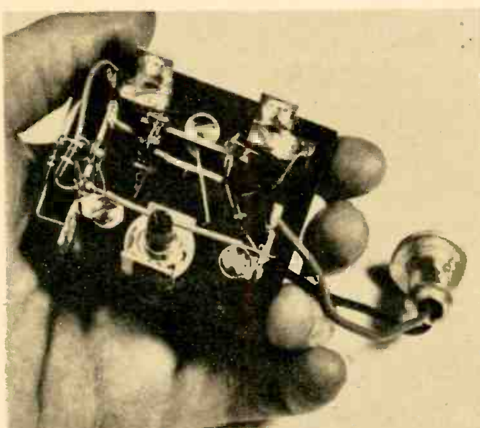
After you calibrate the tach with 60-cycle power, you mount the phenolic board on the back of the meter and insert the board and meter in the case.

The instruction manual is well illustrated, easy to follow and includes a complete section on installation. Two installations are suggested. For dash mounting you drill four small holes for sheet-metal screws. If you feel uneasy about drilling holes in a new car, a clamp is supplied for mounting on the steering column.

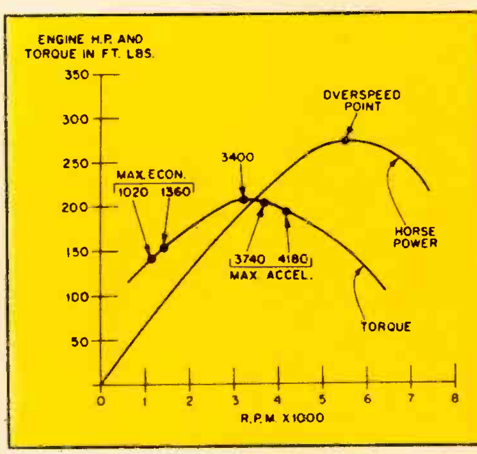
How it works: the tach, as mentioned earlier, is really a pulse-counter. Every time your points open, a high-voltage pulse is supplied to a spark plug, which ignites the fuel in its cylinder cavity. A pulse of a lower voltage is produced in the battery line as a result of the interruption of current to the ignition coil.

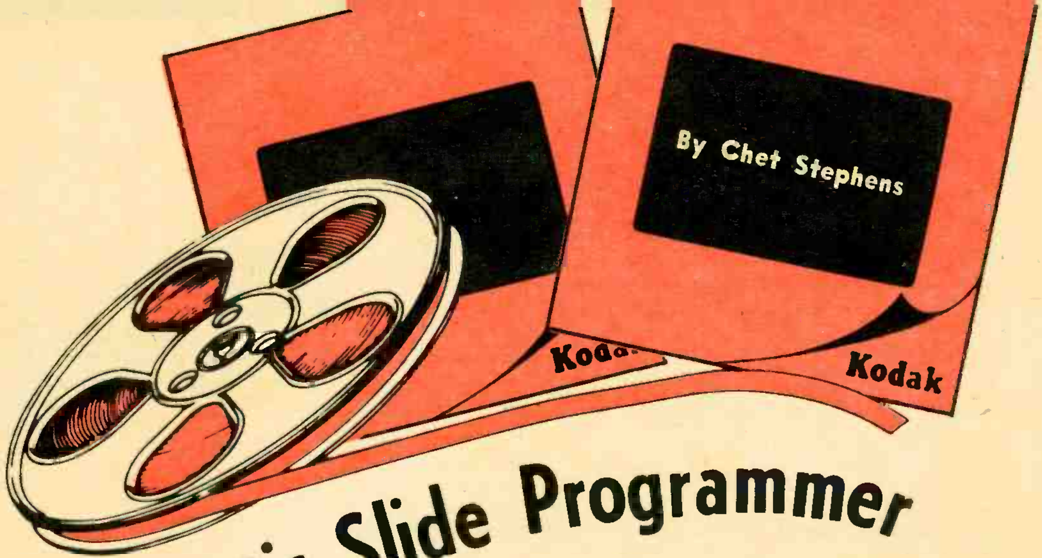
[*Continued on page* 103]

Completely wired parts board to be mounted on the back of the meter. At right is the panel light.



Engine hp/torque vs. rpm. Keep constant low speed for economy, high speed for acceleration.





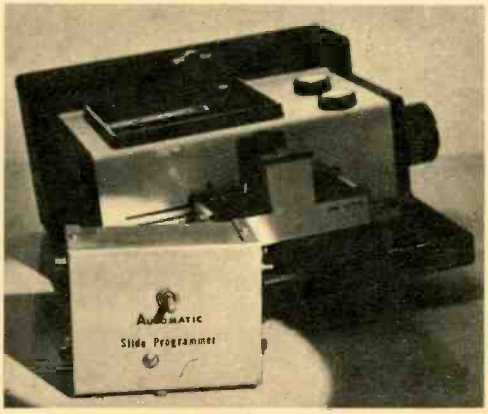
By Chet Stephens

Automatic Slide Programmer

Relax with your guests while the programmer and a tape recorder run the show.

WHEN you show your color slides from this summer's vacation you're naturally going to have a comment or two to make about each one. It's easy and you're enthusiastic at first but then boredom sets in with repeats and your tales lose some zing. Slide shows for friends, neighbors and relatives—always a risky business—can become downright dangerous. They might even insist that you look at *their* slides!

Our Automatic Slide Programmer now races to your rescue. The setup consists of an automatic slide projector and a stereo tape recorder. Your original, scintillating comments (perhaps accompanied by background music) play from one channel while your audience watches each slide. The slides are changed automatically, and in synchronization with your narration, by 60-cycle tone signals recorded on the second track.



Author's model used in conjunction with Kodak Supermatic Model 500 automatic slide projector.

The sync pulses are not heard by your viewers because they do not get into the audio circuit.

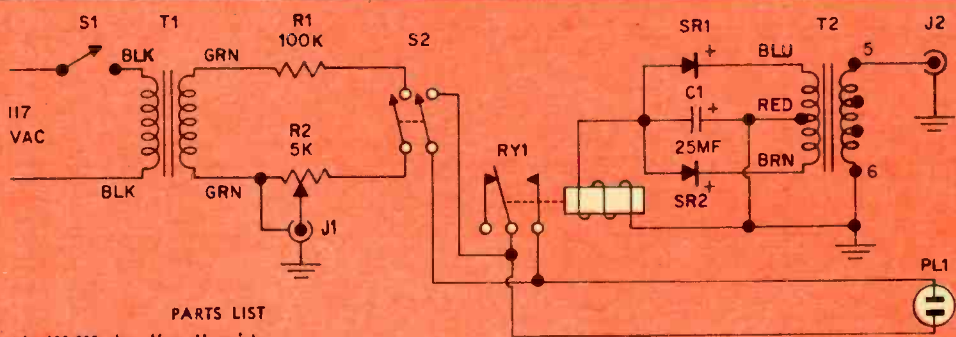
All the recording—narration and tone pulses—can be done in one operation while you look at the slides yourself. There's no need to record comments and then go back and try to put in the sync pulses with split-second timing.

Though designed for complete stereo recorders (that is, recorders with two speaker outputs), the Programmer also can be used with recorders that have a speaker output for one channel and only a preamp output for the other. With this type recorder you use the speaker track for the sync and feed the narration track through your hi-fi system.

Construction. The Programmer can be built in a 3x4x5-inch Minibox. Start by mounting pulse-generating components T1, R1, R2 and J1 on one end panel and mount projector-actuating components T2, C1, SR1, SR2, and J2 on the other end panel. Mount sync-pulse switch S2 and relay RY1 on the front panel.

Space was limited in the author's model so a miniature pot was used for R2. Since little current is drawn from transformer T1, it may be the smallest, least expensive type available. However, T2 must be the exact type specified. S2 is a DPST, spring-return toggle switch. If you prefer, you can use a push-button type.

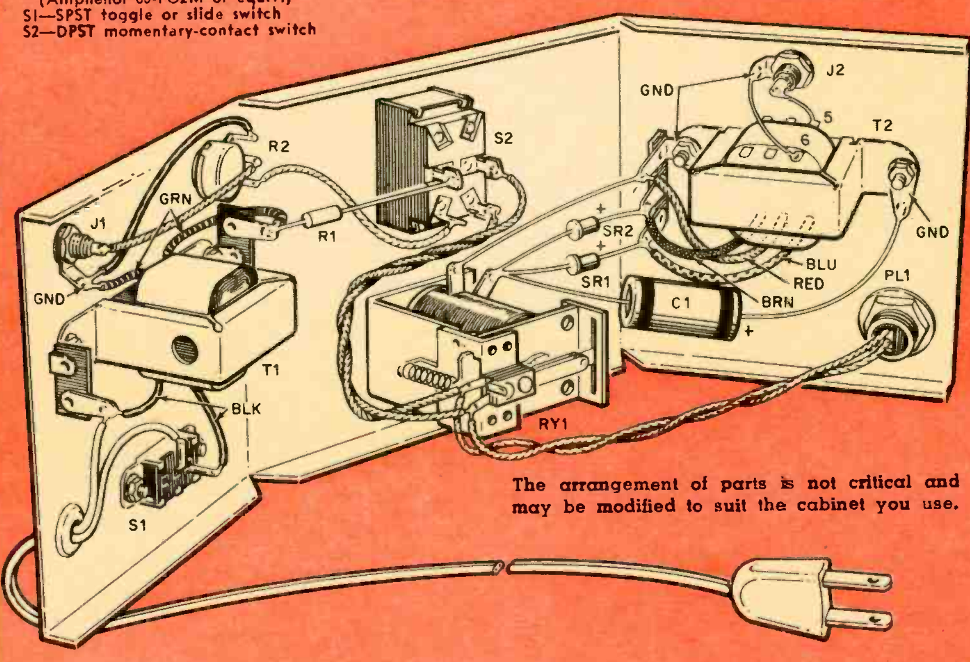
Before the Programmer can be put into operation, the projector or its control cord must be modified. If there is a control cord, replace its push button with an Amphenol type 80-MC2F1 female cable connector to mate with PL1 on the Programmer. If you expect to



PARTS LIST

R1—100,000-ohm, ½-watt resistor
R2—5,000-ohm potentiometer
C1—25 mf, 50 V electrolytic capacitor
SR1,SR2—Silicon rectifier, 100 ma, 100 PIV
T1—Filament transformer: 117 V primary, 6.3 V secondary (Lafayette TR-11 or equiv.)
T2—Universal output transformer (Lafayette TR-12)
RY1—SPDT relay, 2,500-ohm coil (Potter and Brumfield GB-5D or equiv.)
J1,J2—Phono jack
PL1—Two-prong, male chassis connector (Amphenol 80-PC2M or equiv.)
S1—SPST toggle or slide switch
S2—DPST momentary-contact switch

When S2 is closed, one set of its contacts applies AC to J1 to be recorded. S2's other set of contacts closes the circuit to PL1 which changes the slide.



The arrangement of parts is not critical and may be modified to suit the cabinet you use.

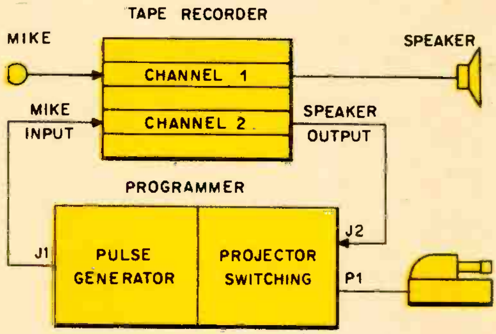
use the projector without the Programmer, make up an adaptor cable with the push button on one end and an Amphenol type 80-MC2M1 male cable connector on the other.

If there is a push-button switch on the projector and no control cord, connect the Programmer's control cable across the switch's contacts.

Operation. Connect the Programmer output at J1 to the tape recorder *mike* input. Set the recorder gain control to its normal position and turn on the Programmer. Close S2 and adjust R2 so the recorder's level indicator shows normal recording level. Start the recorder and hold S2 closed 15 seconds. Now connect the projector to PL1 and you're ready to put the show together. Start the recorder and project a slide. After you record your comments, close S2 for a half second or less to change the slide. If you want to start the slides before the narration, close S2 before you start talking. Each time S2 is closed the slide changes and a sync pulse is recorded. The slides change automatically when the tape is played back, exactly as they did when you made the recording.

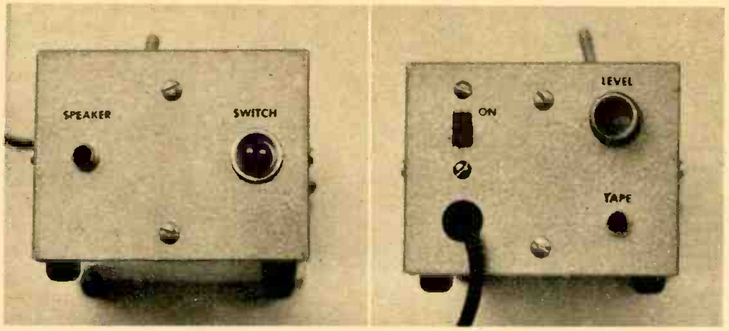
When setting up for a show, connect the recorder's speaker output from the sync track to J2. Turn the recorder on. The 15 seconds of sync recorded at the beginning of the tape is used to adjust the recorder output level to the Programmer. Slowly advance the sync-track, playback-level control on the recorder until you hear RY1 click. Advance the control another ⅛ turn. Let the tape run until you hear RY1 drop out. Stop the tape, connect the projector and you're ready to go.

Mono/Stereo Tape Recorders. The Programmer can be used with stereo-playback/mono-record type recorders. The only difference in operation is that the sync pulses are recorded before or after the narration. As an example, with the recorder on, read the narration for each slide quietly to yourself (not recording it). When you finish with each slide close S2 to record pulse. Later on, you use this track to operate the projector while you record the same timed narration on the other track.



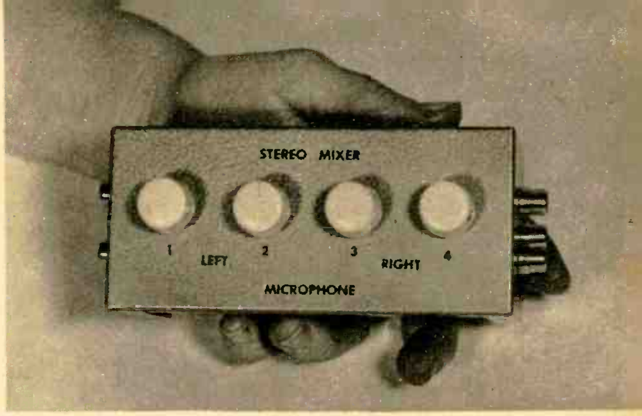
Block diagram shows connections of Programmer to the stereo tape recorder and slide projector.

How it Works. When S2 is closed, a pulse of 60-cycle AC from T1 is fed via J1 to the recorder and recorded on the sync track. When the tape is played back, the pulse output is fed to T2, which is connected in reverse to step up the voltage. The high-voltage AC from T2's secondary is rectified by SR1 and SR2. RY1 closes and changes slides.



Side views of Programmer. Speaker jack is fed the pulse output from stereo tape recorder. Knob on level control can be removed and shaft taped after you have established its correct setting.

Dressed-up project has been lettered with decals cut from sheets shown at bottom of page. Decals come in collections of most common words and symbols for a particular area such as audio, amateur, test equipment.



Give Your Home-Brews That PROFESSIONAL LOOK

Now your projects can have the polished appearance of commercially manufactured equipment. By taking our short course in customizing, you'll find that it's easy, inexpensive and doesn't take much time.

By Russ Cogan

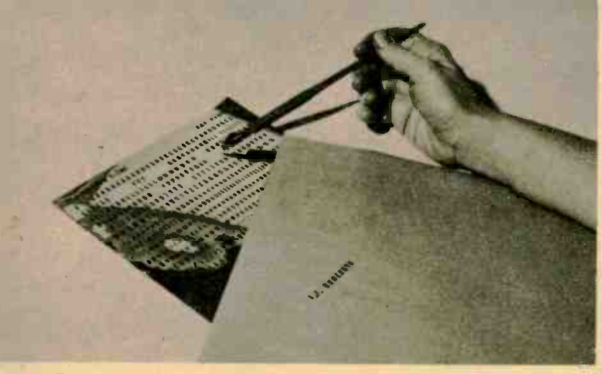
Spray paints are good for finishing unpainted aluminum and bakelite cabinets. First drill holes for shafts, pilot light, etc., then scrub and rinse thoroughly. Get surface absolutely dry. Next, build up paint with two or three coats rather than one heavy coat. The thinner the layers, the better will be the appearance.

Supplies are available from these sources:

Spray paint—Art-supply dealer or paint store
Hammertone spray paint—Allied, Newark, or Lafayette Radio Corp. or G-C Electronics Co., 400 S. Wyman, Rockford, Illinois
Decals—Under the G-C and Walsco labels from radio-parts distributors.
Planotype—The Planoscope Corp., 551 Fifth Avenue, New York 17, N.Y.
Transfer type—Letraset and Cello-Tak. From radio-parts distributors, art-supply dealers, or Arthur Brown Co., 2 West 46th Street, New York, N.Y.

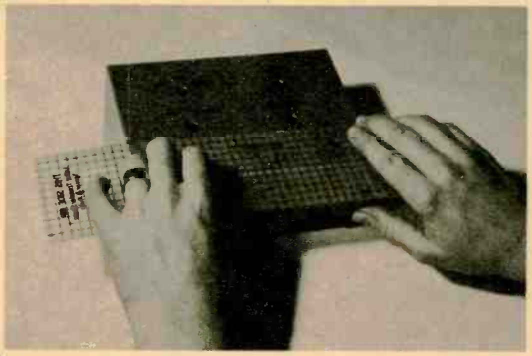
Lettering can be added in several ways, depending on the desired size, color and resistance to abrasion. Decals are available in black, white and gold and in several sizes (1/8 inch up). This is perfect for small cabinets. To provide protection from handling, give lettering a coat of Krylon spray or clear nail polish and let dry completely.

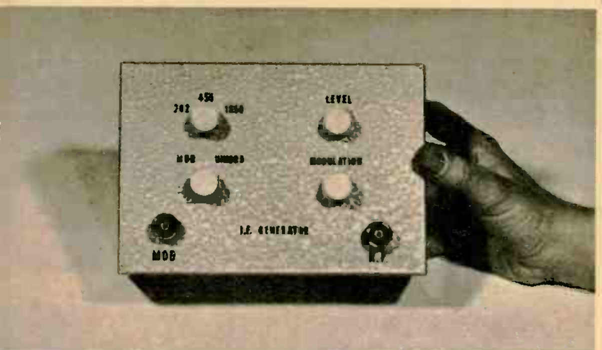
Cut the desired word or letters from the decal sheet and soak in warm water for about 30 seconds. Using tweezers, transfer the decal to the cabinet from the backing paper. You'll find this safer than holding the decal alone. Blot the excess water. Allow the decals to dry 24 hours or they'll rub off when handled.



Planotype adhesive plastic letters are available in many colors and sizes. They are abrasion-resistant and recommended for front-panel use. Using a sharp-pointed instrument, lift the letters off the aluminum backing sheet and arrange them in word groups on the layout sheet. Complete word groups are lifted with transfer sheet.

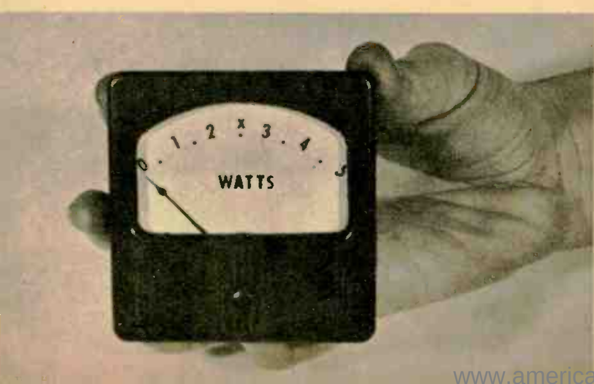
After the transfer sheet is exactly in place on the cabinet, simply rub the sheet with your fingertips to get the letters to adhere. As with decals, the best way to protect the lettering is to give it a light coat of Krylon spray or clear nail polish. A light coat of clear lacquer, however, will work just as well.





The completed project—commercial quality with the letter size proportional to the size of the instrument cabinet. Transfer type is available in many sizes and colors. It is applied by rubbing the acetate base on which it is mounted (below). While easy to apply, it rubs off and should be restricted to protected surfaces only.

Transfer type (right) is handy for recalibrating meter scales. Many high-quality surplus meters with common ranges (1 ma, 100 microamperes) are available for less than $3 on the surplus market. Remove the old scale and give it a few coats of white enamel paint until old markings can't be seen, and then apply type.



After you've sprayed a few coats of white enamel on the old meter face, apply a light amount of pressure to the letters with a stick to transfer them. Presto, a new meter. Dressing up your projects doesn't take as much talent as you'd think. When planning your next project, don't forget that its looks really can count a lot, too.

CRYSTAL CLEAR

TWO scientists in General Electric's Research Lab didn't mean to create a thing of beauty with their beaker-full of chemicals. But, with assists from Mother Nature and a photographer who happened to be handy, they unwittingly got cast as electronic-age Rembrandts. The two, Drs. Stephen Hamilton and Harry S. Blanchard, were working with a beaker containing a crystalline substance suspended in hot paraffin. Or, to put it *their* way, a supersaturated hexane solution of 4-iodo-2, 6-dimethylphenol. When the mixture began to cool, crystals formed in the paraffin and the beaker took on the appearance shown below. The large photograph is a close-up of the crystal networks. Crystals used in electronic circuits would have some resemblance to 4-iodo-2, etc.

By

Tom

Jaski

Are Radio Waves a THREAT TO HEALTH?

Pioneer studies have turned up some strange effects caused by the RF type radiation.

RADIATION presents two faces to the world. It's a friend. It's a foe. It kills. It cures. Radiation is a scare word to millions whose daily lives are made easier, more pleasant by it. Among them are those who owe their very lives to radiation. Above all, radiation is inescapable. Each one of us is subjected to it every day of our lives.

In its good guise, we see radiation bringing us television and radio programs and healing the sick. In its bad guise, we see it as a powerful beam from a radar antenna. A man is caught in the beam accidentally and his body tissues are cooked, literally. He dies. To him, invisible electromagnetic radiation becomes a death ray. When men start journeying through outer space we will live in fear of what intense radiation may do to them. And for decades we've known the fate of early-day X-ray workers who received overdoses of radiation.

There are different types of radiation, but *electromagnetic* radiation—which concerns us here—varies in only two principal qualities. These are wavelength and power. Electromagnetic radiation of longer wavelength (lower frequency) normally is known as radio waves. Of shorter wavelength are the microwaves, X rays and gamma rays. But they all have one thing in common—they're electromagnetic radiation.

The power/wavelength consideration leads to a question that has been asked for decades but never answered with finality. If an overdose of radiation at X-ray or microwave (radar) wavelength can injure or kill, do we face a similar threat from radiation of longer wavelength, such as that from broadcast-band radio stations or television transmitters? If such radiation *can* be injurious, the danger is nearly universal, for all of us are bathed in radiation from scores of radio and television stations that spew out millions of kilowatt-hours of RF energy every day.

A further consideration in this puzzler is the cumulative nature of radiation effects on the human body. Some effects are cumulative; others are not. In the case of cumulative effects, if a man is exposed to 5 roentgens of radiation on five successive days, the total effect would equal that of one 25-roentgen dose. Except in the near vicinity of extremely powerful transmitters, radiation fields are not strong enough to cause immediate injury. Radiation from a radio or TV station at a distance assuredly would be weak and would have small effect on the body. But what of those effects that are cumulative? What happens after years or decades of exposure?

The question usually is regarded as academic. No broadcast-station engineers have been reported killed or injured by radio waves from their equipment. The radiation they are subjected to is not powerful enough to cause thermal (heating) damage, as does a radar beam. But what about other effects? And *are* there other effects? The answer is *probably,* but we do not yet know whether such athermal (not caused by heat) effects are good or bad. Most likely they are both.

In the literature of the medical therapy, biological and biophysical sciences we come across instances where radio waves accomplished something that could not be done with heat. Such effects usually are considered *indirect* results of radio waves, which have a tendency to heat tissue. But we can cite a long list of instances where the effects are undeniably athermal.

One of the most recent instances of athermal effect was reported by a Soviet scientist with the unlikely name of Gordon. He found that irradiation with low-level RF (too low to cause heating) slowed the reflexes of experimental animals. Examination of the nerve tissue of these animals showed *concentrations* of a substance called acetylcholine. It normally is *distributed* in the nervous system and is essential to the functioning of the synopses (junctions of nerve cells).

DePereira Forjaz demonstrated that irradiation of chemical substances could speed up reaction, and Lepeschkin brought about changes in human blood serum which could not be traced to heating. Fleming in 1944 showed that RF energy of the proper amount and frequency could speed bacterial growth. Van Everdingen, a Dutch physician, found certain alterations of substances from animal livers could be accomplished only with microwaves of a certain frequency.

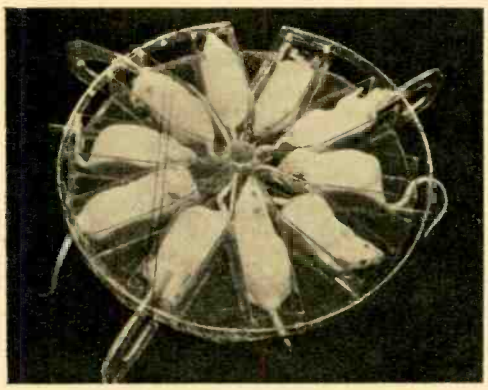
Soviet scientists discovered that small amounts of UHF energy could increase the eye's sensitivity to light while reducing its color sensitivity. Van Everdingen proved that certain amounts of irradiation could slow tumor growth while other quantities increased the rate of growth. There is a long list of instances in biophysics literature showing effects of low-level irradiation under laboratory conditions.

University laboratories once were occupied in establishing safe radio-frequency dosages for technicians who worked with radar. Now they are turning to more subtle problems of athermal effects. One such project at the Univer-

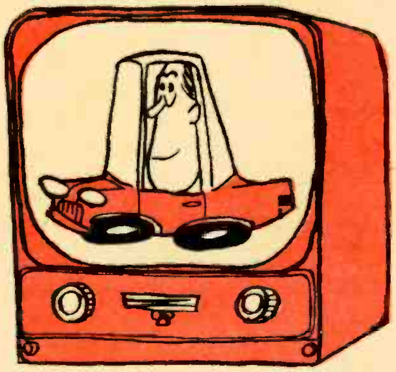
[*Continued on page* 105]

A special suit protects man inside from harmful biological effects of electromagnetic radiation of high power, like that found at radar sites.

Mice in thin plastic holders are irradiated in groups with microwaves in longevity experiment that was conducted at University of California.



TV Pattern Generator



By John Potter Shields

You'll be able to set your TV height and linearity controls perfectly with this inexpensive gadget.

BEEN seeing strange people in elongated cars with oval wheels on your TV screen? Those aren't outer-space critters. Your set's vertical height and linearity controls just need adjustment. Our simple, pocket-size TV Pattern Generator is perfect for the shape-up required. Total cost of parts is only about $6.

One of the big advantages of using the patterner is that you won't have to guess about the size of people or objects during rapidly-changing scenes during a TV program. Best of all, you needn't wait up till the early hours for a standard test pattern to come on.

In addition, the patterner produces a tone-modulated RF signal which is useful in troubleshooting sound circuits in TV sets or FM tuners.

Using only two transistors, the circuit is powered by a 9-volt battery. Construction and use are simple and you don't have to make a direct connection to the antenna terminals on the TV set.

Construction

The author built his patterner on a piece of perforated phenolic board cut to about 3½x1½ inches. You may find construction easier with a larger board. Brass eyelets were used as tie points. Flea clips would work as well. Because of the high frequency at which the RF portion of circuit operates, point-to-point wiring as direct as possible is important.

The most critical component is coil L1. It has six turns of No. 18 solid, tinned, copper wire. The inside diameter is ⅜ inch and the length is $\frac{7}{16}$ inch. Snip the ends short and solder directly to C3's lugs. C3 is mounted in a ¼-inch hole in the perforated board.

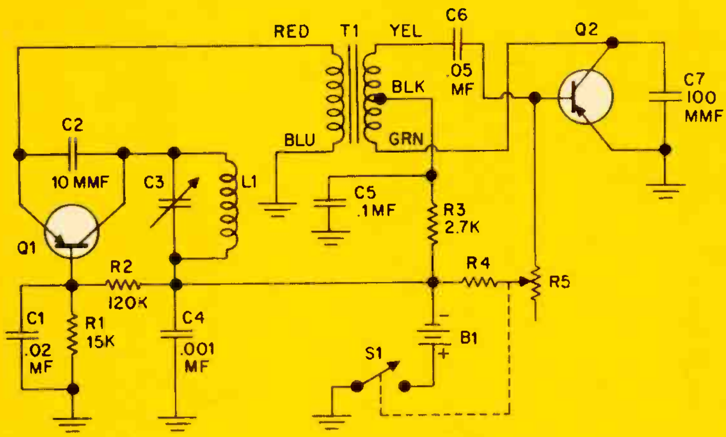
The patterner can be housed in a small plastic box. But if you choose a metal enclosure, be sure L1 is at least ½ inch away from the box.

How to Use It

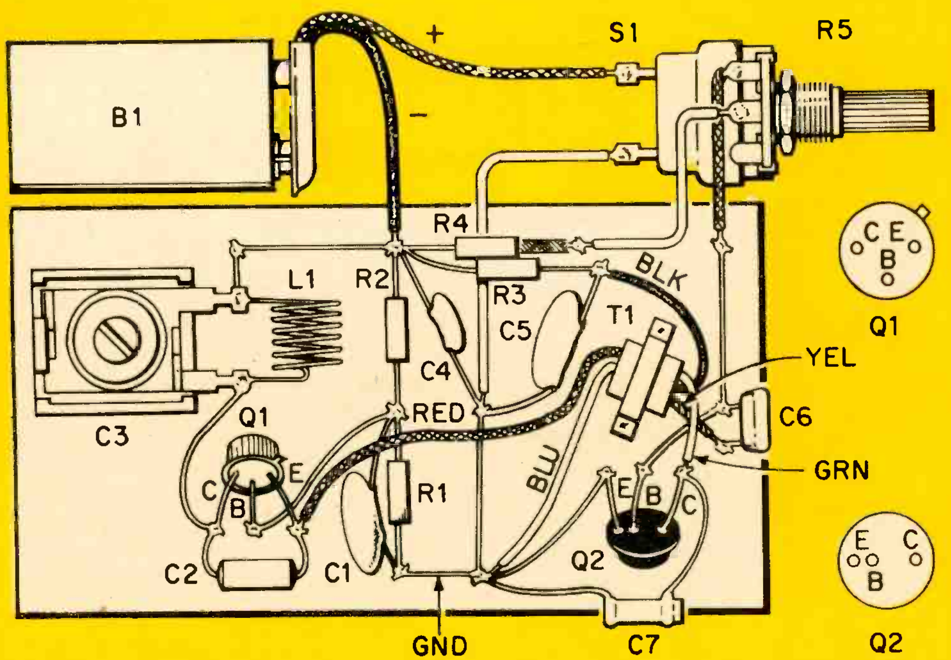
After you've soldered the last connection, check for wiring errors and shorts, and then turn on the

PARTS LIST

Resistors: ½ watt, 10%
R1—15,000 ohms
R2—120,000 ohms
R3—2,700 ohms
R4—150,000 ohms
R5—250,000-ohm, linear-taper potentiometer
Capacitors: Low-voltage disc ceramic unless otherwise noted
C1—.02 mf
C2—10 mmf
C3—15-130 mmf padder
C4—.001 mf
C5—.1 mf
C6—.05 mf
C7—100 mmf
Q1—HF50M transistor (available for $2.95 from Semitronics Co., 265 Canal Street, New York 13, N. Y.)
Q2—2N107 transistor
L1—Oscillator coil (See text)
T1—Transistor driver transformer: 10,000-ohm primary, 2,000-ohm, center-tapped secondary (Lafayette TR-98 or equiv.)
B1—9-volt battery
S1—SPST switch on R5



Patterner schematic. If output doesn't fall within channels 2 or 3, spread or compress L1. Q2, the AF pulse modulator, is used as modified blocking oscillator.



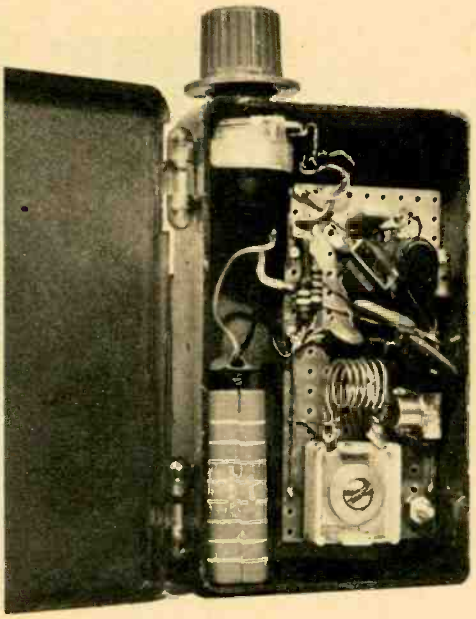
Keep RF-section wiring around Q1, L1 and C2 short. Bushing on C3 mounts through circuit board.

power. Tune your TV set to channel 2 or 3 and bring the patterner to within a foot or less of the antenna terminals. Adjust C3 until one or more horizontal bars appear on the screen. In the author's model this point was near maximum capacitance of C3 (when the screw was tight). Adjusting R5 changes the number of horizontal lines. Use whatever number you want as long as they clearly show up differences in bar spacing from top to bottom.

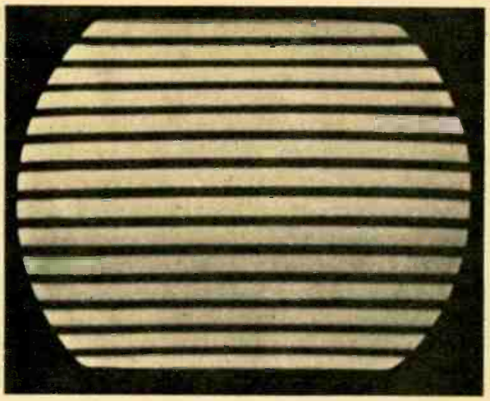
Now adjust the vertical height and linearity controls on your TV set until the spacing between bars on the top and bottom of the picture is the same and looks like our photo. Since the vertical height and linearity controls interact they must be adjusted together.

If you build the patterner in a metal box, make final tuning adjustments after mounting the chassis board in the case, or you may detune the RF oscillator.

C3 can be adjusted so one or more harmonics of the RF output will fall within the FM band. Set your FM receiver's dial at the low end and adjust C3 until you hear a buzzing.



Author's model in plastic box. Metal box will detune RF oscillator if any side is too near L1.



Pattern of equally spaced bars produced by correctly adjusted height and linearity controls.

How it Works

The patterner consists of an RF oscillator and an audio-frequency pulse modulator. The RF oscillator portion consists of Q1, L1, C1-C4, R1 and R2. The values of L1 and C1 were chosen so the output frequency would fall within TV channels 2 and 3. C2 feeds a small amount of RF from Q1's collector to its emitter to maintain oscillation. Base bias is supplied to Q1 by the voltage divider consisting of R1 and R2.

Q1 is emitter-modulated by returning its emitter to ground through the primary (used as a secondary in this circuit) of AF pulse-modulator transformer T1.

The secondary of T1 (used as a primary in this circuit), in conjunction with Q2, C5, C6, C7, R4 and R5, form the pulse-modulator oscillator. R5, by changing the base bias applied to Q2, varies the oscillator frequency and hence the number of horizontal lines that appear on the TV screen. If the oscillator frequency is 120 cps, two horizontal lines will appear. A frequency of 180 cps will produce three lines and 240 cps will produce four lines. If you want more lines than can be produced by R5, reduce the value of C5 to .05 mf.

R3 and C5 sharpen the pulses generated by Q2 to add definition to the horizontal bars. Though a 2N107 was specified for Q2, any inexpensive general-purpose, small-signal audio transistor will work.

HI-FI RECORD GUIDE

by Warren DeMotte

ONE of the marvels of our electronic age is the current interest in old music, Renaissance and Baroque. A few years ago even the most erudite musicians were familiar with only a sampling of Renaissance composers and compositions, and those by reputation rather than contact with the music. Today that period is being mined enthusiastically for its rich musical treasures, which are performed widely in concerts and recordings.

Some of the liveliest and most vital instrumental pieces of that era appear in Renaissance Festival Music (see cut), a program of Flemish dances and Venetian ceremonial compositions played on the instruments of that time by the New York Pro Musica and directed by Noah Greenberg. Cornetts, sackbuts, shawms, recorders, viols and their fellows combine in colorful, unusual timbres and harmonies, vividly recorded.

In Restoration England and a few years beyond, Henry Purcell wrote great music for the rulers of the realm. The finest of the Odes he composed for the birthday celebrations of Queen Mary is the 1694 Come Ye Sons of Art. Countertenor Alfred Deller sings and leads an ensemble of vocalists and instrumentalists in a delightful performance, engineered with sparkling clarity.

It was in those bygone days that many of the popular folksongs of today have their roots. The Greensleeves that Barbara Dane sings so charmingly in her When I Was a Young Girl album antedates Purcell, and it probably had a bawdy origin to boot. It is not a bawdy song now. Neither are her other numbers. But they're still winners.

Times have changed and words have changed but the beauty of the olden songs does not, a truth that Burl Ives always makes evident in his refreshing performances. Jimmie Rodgers has also found gold in the old lode, and he presents his discoveries with gratifying unostentation in a recording of one of his concert appearances.

Although innumerable recordings of Beethoven's Fifth Symphony are available, few are satisfactory. A new one, by Antal Dorati and the London Symphony, definitely is. It is assertive and powerful, lithe and eloquent, and well recorded. Overside, two magnificent Beethoven Overtures.

Haydn's Lord Nelson Mass is a virile expression of faith, worthy of its subject and its heroic namesake. The rendition by a brilliant group of soloists, a skilled chorus and the London Symphony Orchestra, with confident leadership by David Willcocks, is forthright and convincing. The recorded sound is spacious and full.

As a play, Rosamunde lasted just two performances and disappeared forever but the Incidental Music that Franz Schubert wrote for it has achieved immortality. Spirited and charming, its magic is effectively projected by Netania Davrath, the University of Utah Chorus and the Utah Symphony Orchestra with Maurice Abravanel wielding a sympathetic baton.

There is nothing quite so British as a [*Continued on page* 106]

Why Don't You Try CW DX?

By C. M. Stanbury II

Whether you read code or not, you can bag those didah stations!

TWO-THIRDS of the world's short-wave radio stations transmit only in Morse code. If you're a serious DXer (or a bored SWL looking for something new) you must, sooner or later, go after the didah boys. If you do, you'll bag such rare locations as Tahiti, New Guinea, Iceland and the Madeira Islands. All these prime targets send code on the upper SW bands and can be heard anywhere on earth.

But you don't read code? You don't *have* to. The secret is catching the code stations during marker periods. Markers are transmitted by CW stations between messages so other stations can determine which bands are open and to permit their signals to be tuned in accurately (also to keep possession of the frequency). A marker usually is sent slower than messages and always more evenly—usually via tape. The simplest type consists of a series of dots (dits), the letters DE and then the call sign of the station two or three times. This series is repeated for periods of a few minutes to hours at a time. It is easily recognized because of the uniform spacing and repetition.

To decode a marker, sit down with our code list at upper right, which is given in a form that approximates the actual sounds of the coded characters. When you tune in a code station keep listening until, with the help of the code list, you are able to make out the DE (dahdidit dit). Then listen for the first call letter. Concentrate until you can decode it. After that, move on to the other letters and/or numbers until you have the complete call.

It's a fairly simple procedure, although at first you can expect to spend about ten minutes decoding each call sign. But the prize is a good one and, despite your intentions, you're going to learn some code.

Not all markers consist of dots. Often the letter V is substituted, and most marine stations use CQ. Try at first for strong, interference-free signals, adjusting your BFO to the most comfortable level.

With this article we present a list of the busier CW stations. The U.S. transmitters at the top are the easiest to pick up, of course. Each one uses a great many different frequencies—so many that we haven't attempted to list them. The Latin American stations also are fairly easy to bag. The others represent more difficult DX. The term *government* in our list refers, of course, to the local government.

In your report, always provide a complete description of the marker—length of the complete cycle in seconds, number of dots or V's or CQ's, how many times the call sign is repeated in each cycle, etc. Most stations will verify marker reception, sometimes via letter. But more often than not a DXer must make up his own card, which the station signs and returns. (The TGZ and HRB9 cards we show here are homemade.)

A good DX club can be of help if you take up CW DX seriously. For instance, the Newark News Radio Club's bulletin carries a utility section. The International Telecommunications Union (Geneva, Switzerland) publishes complete lists of CW stations.

THE MORSE CODE

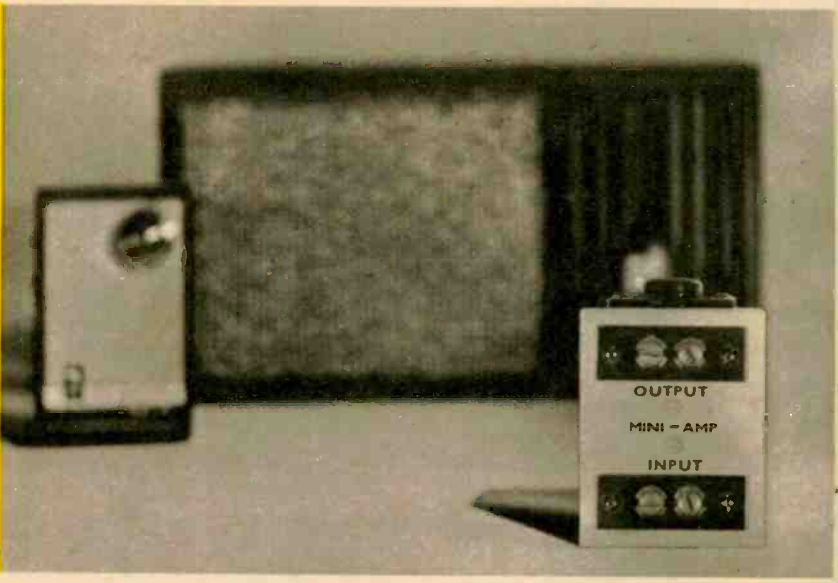
A	di dah	S	di di dit
B	dah di di dit	T	dah
C	dah di dah dit	U	di di dah
D	dah di dit	V	di di di dah
E	dit	W	di dah dah
F	di di dah dit	X	dah di di dah
G	dah dah dit	Y	dah di dah dah
H	di di di dit	Z	dah dah di dit
I	di dit	1	di dah dah dah dah
J	di dah dah dah	2	di di dah dah dah
K	dah di dah	3	di di di dah dah
L	di dah di dit	4	di di di di dah
M	dah dah	5	di di di di dit
N	dah dit	6	dah di di di dit
O	dah dah dah	7	dah dah di di dit
P	di dah dah dit	8	dah dah dah di dit
Q	dah dah di dah	9	dah dah dah dah dit
R	di dah dit	ø	dah dah dah dah dah

DX GUIDE TO CW STATIONS

STATION OPERATOR	CALL	KC	LOCATION
Mobileradio	WLO	many	Mobile, Ala.
Radiomarine Corp.	KPH	many	Bolinas, Calif.
Globe Wireless	KTK	many	Mussel Rock, Calif.
MacKay Radio	KFS	many	Palo Alto, Calif.
MacKay Radio	KOK	many	Paramount, Calif.
Radiomarine Corp.	WOE	many	Lantana, Fla.
Tropical Radio Telegraph	WAX	many	Ojus, Fla.
Tropical Radio Telegraph	WNU	many	Slidell, La.
Radiomarine Corp.	WCC	many	S. Chatham, Mass.
MacKay Radio	WSL	many	Amagansett, N. Y.
Radiomarine Corp.	WNY	many	New York, N. Y.
MacKay Radio	KLC	many	Galveston, Tex.
MacKay Radio	KLB	many	Kent, Wash.
U.S. Navy	NBW	2158	Guantanamo Bay, Cuba
U.S. Navy	NKA	4515	Asmara, Eritrea
Government	ETA91	23005	Addis Ababa, Ethiopia
Government	VPO4	8107.5	Port Stanley, Falkland Is.
U.S. Navy	NPN	22430	Guam
Tropical Radio Telegraph	TGB	11580	Guatemala, Guatemala
Tropical Radio Telegraph	TGZ	9720	Guatemala, Guatemala
Tropical Radio Telegraph	HRE	5130	La Lima, Honduras
Tropical Radio Telegraph	HRB9	2780	Tegucigalpa, Honduras
Government	TFK65	12165	Reykjavik, Iceland
Government	IQX	8502	Trieste, Italy
R. Marconi	CUB	8730	Funchal, Madeira Is.
Netherlands Navy	PJK5	8540	Suffisant, Curacao, Neth. Antilles
Government	FZN	10700	Noumea, New Caledonia
Government	JZK5	12800	Biak, Dut. New Guinea
Government	VJO25	19195	Port Moresby, New Guinea
Tropical Radio Telegraph	YND5	11650	Managua, Nicaragua
U.S. Navy	NST	8705	Londonderry, N. Ireland
Government	FZP	20090	Papeete, Tahiti

The Mini Amp

By John Sheldon



Two extra watts can give you big sound from small portables.

THE MINI-AMP delivers 2 watts of clean audio, yet it isn't much larger than a pack of cigarettes and has no transformers. Although the circuit is extremely simple, the Mini-Amp has reasonable frequency response and provides its 2 watts with an input of only 10 millivolts from a 12-volt battery.

The little rig may be used as a booster amplifier for those shirt-pocket transistor radios with either earphone or speaker output or for battery-operated phonographs. It is designed to drive an 8-ohm speaker, though satisfactory performance may be obtained with a 4-ohm model. In conjunction with a public-address trumpet, the Mini-Amp makes a useful electronic megaphone. And it also can be used as a modulator for a 5-watt Citizens Band transmitter.

The Mini-Amp requires 12 volts DC and can run off any type power supply with low-ripple output (such as a battery eliminator), an automobile storage battery or two 6-volt lantern or hot-shot batteries. Its components are standard and easily obtained, and the unit can be built in a few hours.

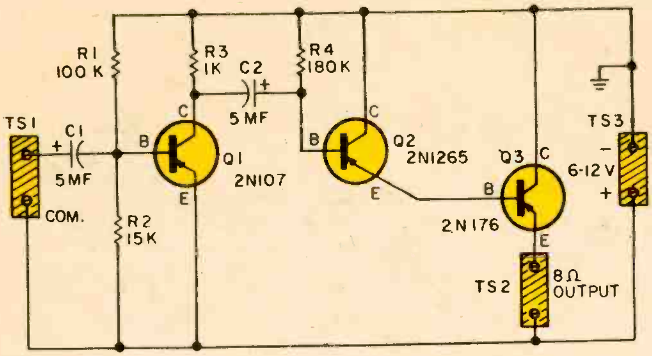
Construction

The author's Mini-Amp is built in a 1⅝x2¾x2⅛-inch Minibox. Power transistor Q3 was bolted to one end of the case. Because of the circuit design, it is essential that Q3's case, representing its collector lead, make good contact with the cabinet. Connections are made to Q3's base and emitter pins by using the contacts removed from a 7- or 9-pin tube socket. Make sure Q3's pin holes in the Minibox are large enough to prevent shorting to the cabinet. A ⅛-inch diameter hole should do it.

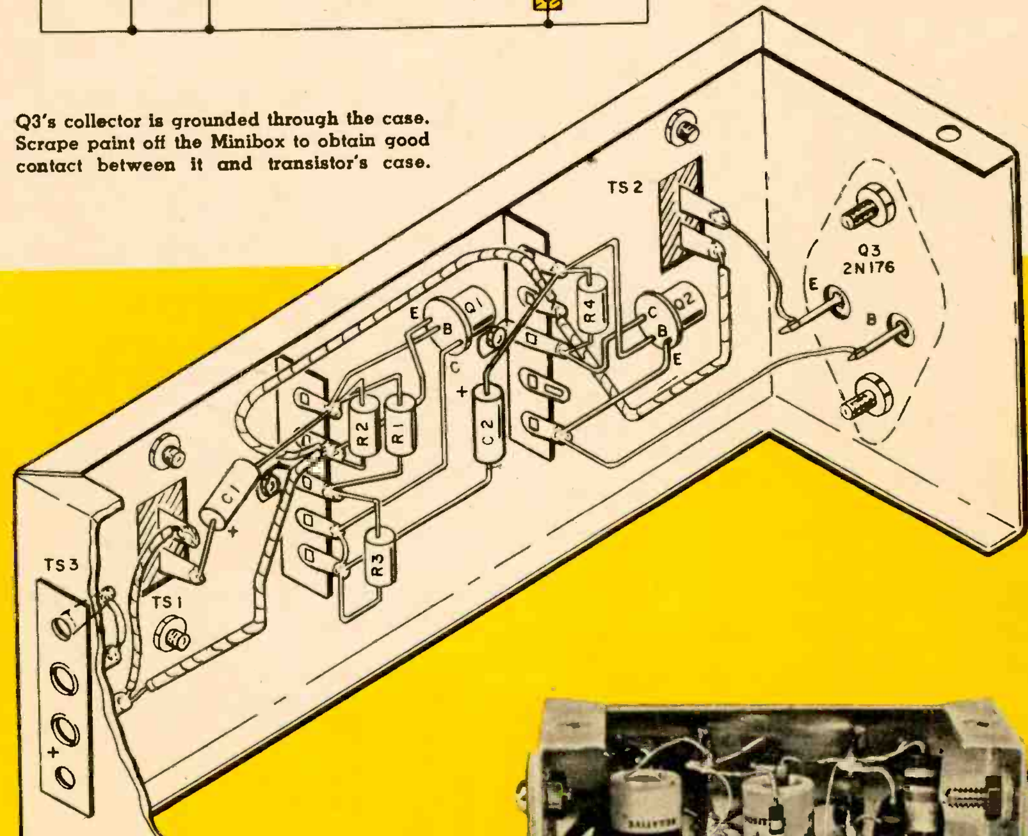
Terminal strips with two terminals and insulated screws are used for the input, output and battery connections. However, you may use any other type. Note that the input terminal at ground potential is not grounded to the case; it is connected to the B+ buss, the bottom line in the schematic.

Although the author mounted Q1 and Q2 on tie-point strips, you can use transistor sockets if you have the room in a larger box. Take the usual care to prevent overheating the transistors when you solder the leads by holding each with a pair of long-nose pliers.

The negative terminal of the power supply is connected to Q3's case so this transistor may be bolted directly to the Minibox without a mica insulating washer. The box is an adequate heat-



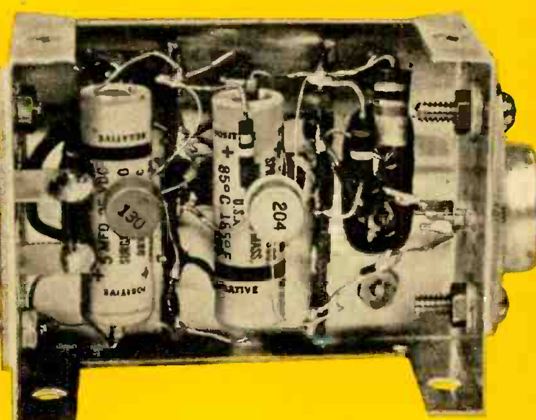
Direct coupling of Q2 and Q3 eliminates transformer. Be sure the battery polarity is correct, and don't short the output terminals or you'll destroy Q3. A four-ohm speaker may be used at a sacrifice in performance and an operating-current increase.



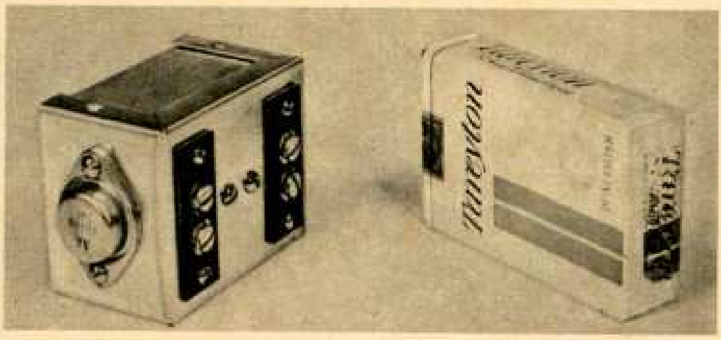
Q3's collector is grounded through the case. Scrape paint off the Minibox to obtain good contact between it and transistor's case.

PARTS LIST

Resistors: ½-watt, 10%
R1—100,000 ohms
R2—15,000 ohms
R3—1,000 ohms
R4—180,000 ohms
C1,C2—5 mf, 25 V electrolytic capacitor
Q1—2N107 transistor
Q2—2N1265 transistor
Q3—2N176 transistor
Misc.—Minibox, terminal strips, tie-point strips



Author's model. Grip leads of Q1 and Q2 with pliers when soldering them in place.



Note small size compared to a pack of cigarettes. Q3 is mounted at end of box. Output terminal strip is next to it. The input is mounted at the other end.

sink since Q3 is operated below its maximum rating.

Operation

When you hook up the power supply make sure that the polarity is correct. Reversing the leads will ruin the transistors. Needless to say, the Mini-Amp can't be powered by a handful of flashlight batteries (unless they are alkaline energizers) if you expect reasonable operating life. Current consumption with the Mini-Amp delivering full power is almost 500 ma. Flashlight cells would die a quick death.

To use the Mini-Amp as a modulator for a five-watt Citizens Band transmitter, connect the 8-ohm secondary of a small audio-output transformer with a 5,000-8,000-ohm primary (Stancor A3849 or equivalent) to the Mini-Amp's output terminals. Hook the transformer's primary winding in series with the B+ lead to the plate of the transmitter's final RF stage as shown in the schematic.

How it Works

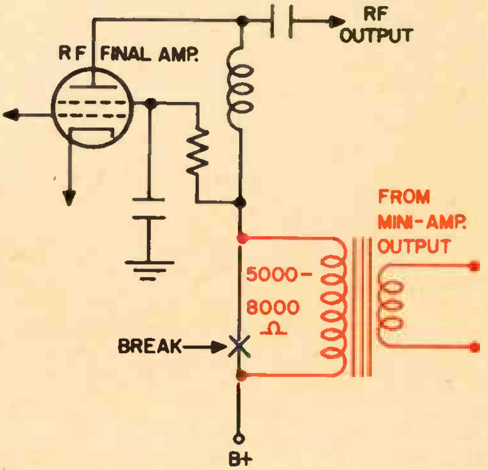
The Mini-Amp owes its simplicity to what is called a cascaded, emitter-follower circuit (also known as a Darlington circuit). Although used extensively in industrial and commercial applications, this circuit is little known in hobby electronics.

The emitter-follower configuration is similar to its vacuum-tube cousin—the cathode-follower. It has the same characteristics—a relatively high input impedance and a low output impedance. So low, in fact, that it can drive an 8-ohm speaker directly.

The considerably higher input impedance of an emitter follower compared with the more conventional common-emitter configuration allows Q3 to be driven directly by Q2 without an interstage matching transformer.

Take a look at the schematic. An audio signal applied to the hot input terminal is coupled by C1 to the base of Q1, which is connected as a common-emitter amplifier. Stable bias is provided for Q1 by the voltage divider consisting of R1 and R2. The amplified signal appearing at Q1's collector is coupled by C2 to the base of Q2, which is operated as an emitter-follower. Q2's emitter is direct-coupled to the base of Q3, the second emitter-follower.

Q2's and Q3's collectors are connected directly to B—◆—



Schematic shows connection of the Mini-Amp if it is to be used as a transmitter modulator.

Add STROBE BARS to Your Turntable

By Charles L. Hern

Widely spaced bars will show up small speed variations.

STROBE bars on the circumference of your turntable or record changer will give you a much more accurate indication of speed than will a standard strobe disc. Since the bars are farther apart than they are on a small disc, they tend to magnify speed variations. Fortunately, the pilot light on many turntables is located so that it can be used to illuminate the bars.

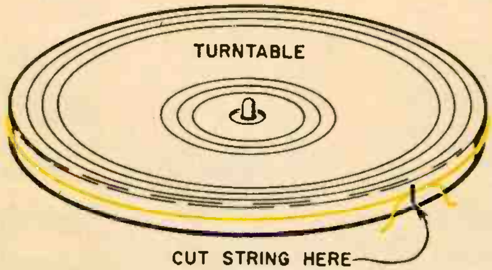
By using a tape called Labelon, which is sold by photo-supply, stationery and radio-parts stores, it is possible to do the job easily and yet give your equipment a professional look. The tape is available with a black, blue or red bottom layer. The top layer is white. When you write on it with a hard pencil or ball-point pen the marks are readily visible.

First, count the number of bars on your standard 60-cycle strobe disc for the speed you are interested in. There will be 215 bars for 33⅓ rpm. Next, wrap a piece of fine, flexible wire, string or thread (that won't stretch) around the turntable. At the point where the string or wire overlaps, cut both strands evenly. You then have a piece exactly equal to the circumference.

On top of a smooth surface, such as a sheet of glass or a highly-finished table, put a piece of the Labelon tape, taking care to make it straight and flat. Cut the tape to the exact length of the string. The ends must be cut at right angles so they fit together without overlap or a gap when the tape is later put on the rim of the turntable.

Divide the tape into five parts and draw five partition lines. (Five sections were chosen because 215 can be divided by 5 an even number of times.) Into each of these five sections draw 42 equally-spaced lines using a ball-point pen and a triangle. Take great care not to make a mistake. Once a mark has been put on the tape it can't be removed. For best results, the ball-point pen should be the same color as the tape backing. For better contrast with the white layer, choose a dark-colored tape.

The bars should be about $\frac{3}{16}$ of an inch wide and, of course, at right



Use string to determine circumference, or measure diameter accurately and multiply by 3.141.

For constant indication of turntable speed, connect a neon lamp to AC line, install near rim.

angles to both of the tape's edges.

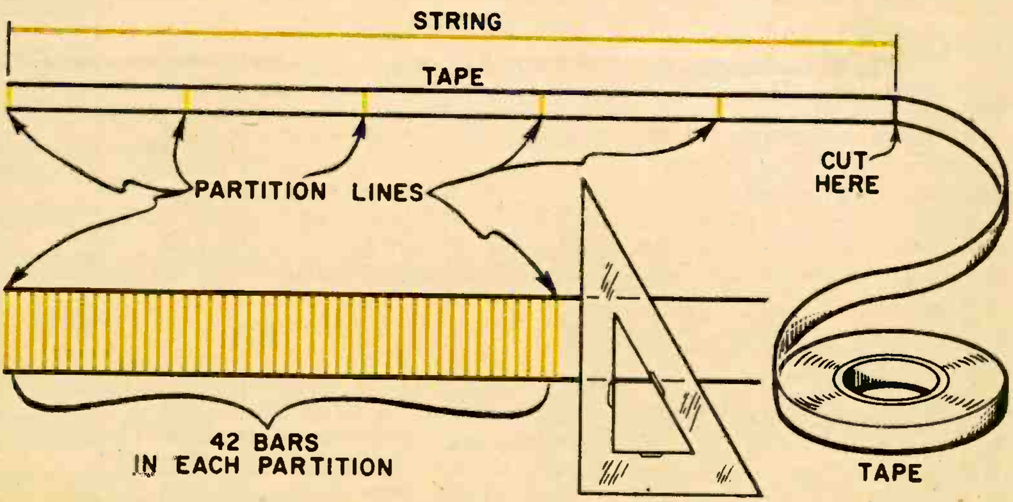
The first bar should be right on one end of the tape and the last bar should be one space from the other end. Count the bars once more to make sure there are exactly 215.

If you have a three-speed turntable or want to make up a set of bars for another speed, use the same procedure. For 45 rpm, there must be 160 bars. Again divide the tape into five partitions, but this time rule 31 lines in each. For 78 rpm, draw four partition lines and rule 22 lines in each. And for the most tedious job of all, 16⅔ rpm, draw 10 partition lines and rule 42 lines in each.

After all the lines have been drawn, separate the tape from the glass or table top and wrap it carefully around the edge of the turntable. This may require the help of a friend, since you must handle a rather long piece of tape and a free-wheeling turntable simultaneously. The two ends of the tape must meet exactly and one tape edge must be flush with the turntable edge.

If the turntable speed is correct, the bars will appear to stand still when illuminated by a 60-cycle neon or fluorescent light. If the bars move to the left the speed is too fast. If they move to the right the speed is too slow. The speed control will permit you to adjust for exactly the right rpm.

Exact speed is especially important if you have a sense of absolute pitch. If you play the piano in accompaniment to a recording, a slight error in the turntable's speed will cause a dissonance that might make you place an urgent call for a piano tuner.



For 33⅓-rpm speed there must be exactly 42 equally spaced bars in each of the five partitions.

THE LISTENER

SWL-DX NOTES

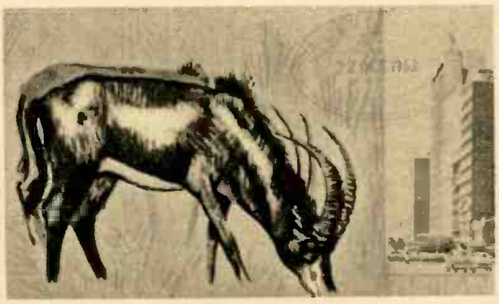
BY C. M. STANBURY II

BUBBLING POT . . . The Central African Federation, known also as the Federation of Rhodesia and Nyasaland, is a murky area in the world of DX. Some people count the federation as one country, others split it into its three parts of Nyasaland, Northern Rhodesia and Southern Rhodesia. The unresolved question now appears due for solution in dramatic fashion. The federation, created in 1953, is boiling politically at this writing and seems certain to split into three separate countries, resolving the DX quandary as a by-product of the explosion.

The Federal Broadcasting Corp. (FBC) now controls all broadcasting in the federation. Although no cinch for the DXer, the transmitter most easily heard in North America is at Lusaka, Northern Rhodesia. It operates on 4828 kc, with sign-on and news in English at 2300 EST. On Sunday evenings at about the same time—when Emisoras Gran Colombia at Quito, Ecuador, is off the air—Lusaka also can be logged at 4911 kc.

Southern Rhodesia, although the most developed of the three territories, has only one station that is reported consistently in North America. This transmitter is at Salisbury, capital of Southern Rhodesia. The frequency is 3396 kc.

The Rhodesias may be difficult to monitor but Nyasaland is nigh on to impossible. The lone transmitter is at Zomba, operating on 3955 kc with a limited schedule at midday EST. The split-up may lead to expansion of the Zomba facilities—and a brand-new name in the countries list. Early this year Nyasaland became a self-governing protectorate of the United Kingdom and the land's first prime minister, Dr. Hastings Banda, proclaimed it a new state with the name of Malawi.



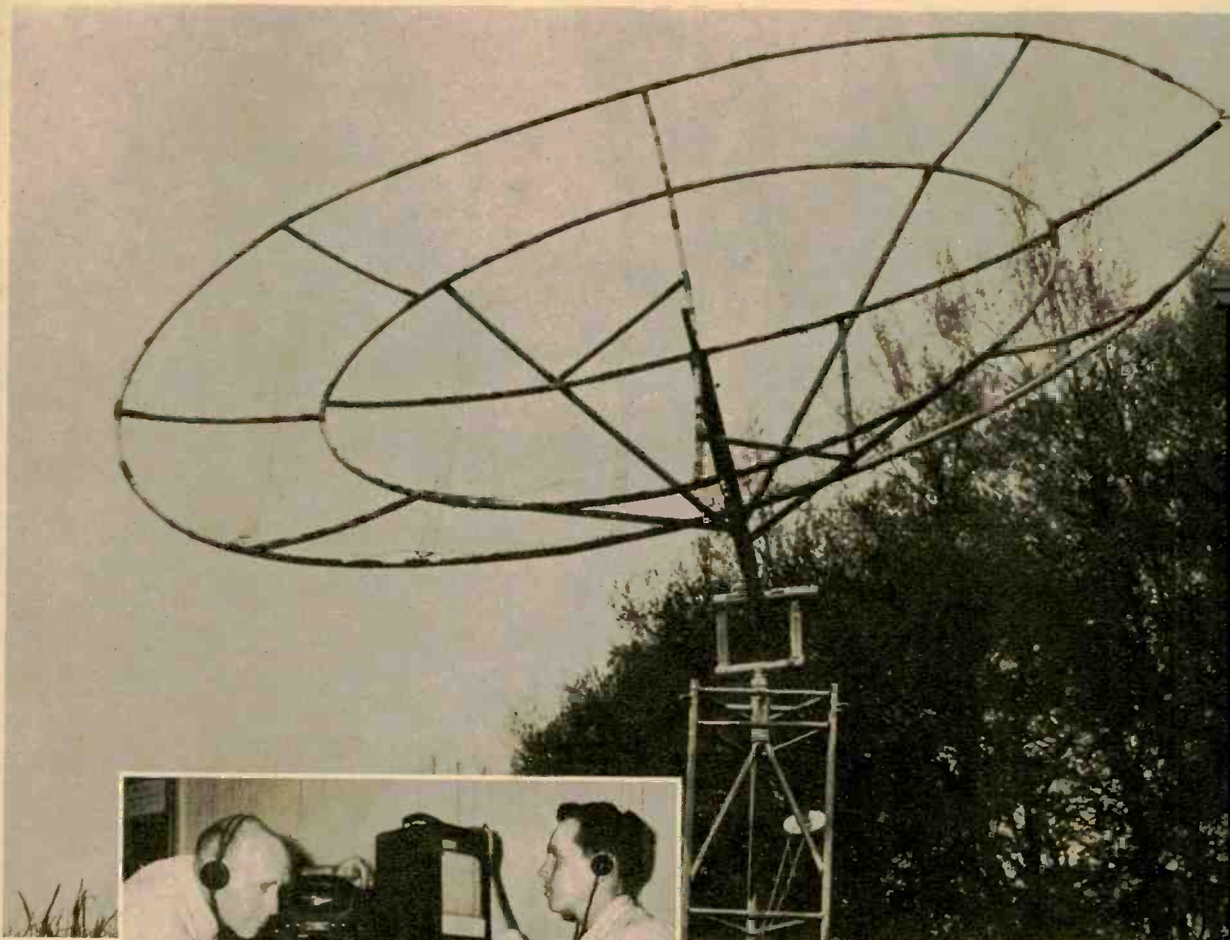
African animals grace the attractive QSL card of the Federal Broadcasting Corp. of Central Africa.

Northern Rhodesia presently is a partly self-governing British protectorate and Southern Rhodesia is a self-governing colony. In due course all three lands seem destined for complete independence after more than half a century of British rule. Just what will happen to the Federal Broadcasting Corp., which has taken little or no part in the political wars, is a moot point.

As independent countries, the three lands may have a varied political picture. Dr. Banda, who talks of a "black man's continent," heads a nationalist government. Northern Rhodesia apparently is headed the same way, while Southern Rhodesia recently put white conservatives in power.

Argument . . . In the March EI the chairman of the Canadian DX Club, who confessed to being neither pro-American nor pro-Russian, complained that both countries were "bad at cluttering" the 40-meter amateur band with their international broadcasts. That may be true, but I'd certainly have to argue that *only* the Communist stations *beam* their propaganda broadcasts into ham territory. Some interference was expected, naturally, when the regional split of 40 meters between BC and the hams was decided on. But the excessive QRM now rampant makes it look like a bad bargain

TELESCOPE



One of scope's two parabolic reflectors is shown above. Both were hand-crafted. At left teacher James Snyder and student Pete Eckenstierna with recorder, which sits on main equipment cabinet and control panel.

This high-stability signal generator is used as the local oscillator stage in the superheterodyne receiver. Its 27.005-mc signal beats with a 60-mc received signal from RF stages to produce a 33-mc IF signal.

Photographed for EI by Rudy Arnold

Without A Lens

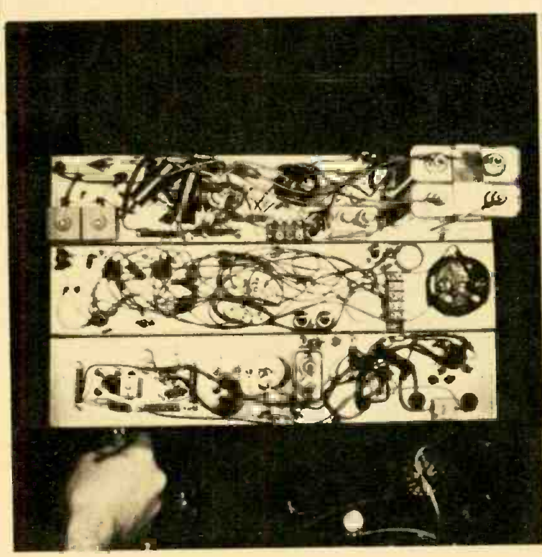
High school boys put together a radio telescope that rivals Cape Canaveral for complexity . . . and it works!

WHEN a few students in the Astronomical Society at Walt Whitman High School, South Huntington, N. Y., decided to build a radio telescope, you couldn't have got a bet that much would come of the project. But the teen-age boys, aided by Science Department coordinator James Snyder, had the last laugh. In an incredibly few months they had put together an instrument so complicated that its operation could be understood only by those intimately acquainted with the field.

Just as surprising, perhaps, was the fact that the telescope worked, and well. Various improvements were made and different pickup arrangements were tried. The most successful over the last couple of years of operation has been a set of twin parabolic-reflector antennas which, set 150 feet apart, represent an interferometer system.

The sophisticated superheterodyne receiver (see block diagram) is tuned to about 60 mc to receive radio signals emanating from the stars. Picking up such electromagnetic energy is not difficult, but the heavens are notoriously noisy so the problem becomes one of fishing the signals from a particular star out of this background roar. The Walt Whitman instrument employs two well-regulated power supplies, five RF stages and four IF stages to achieve stable operation and maximum gain. Star and background noise signals are read out in a variety of ways. They can be monitored on a speaker, viewed on an oscilloscope, or recorded on magnetic tape or graph paper.

At left below are three stages of the radio telescope (top to bottom): low-speed chopper, DC amplifier and cascode RF stage. At the right is student Steve Terney with magnetic tape recorder. On top of the main equipment cabinet sit the graphic recorder and high-stability signal generator. The generator is sitting atop a hooded oscilloscope.

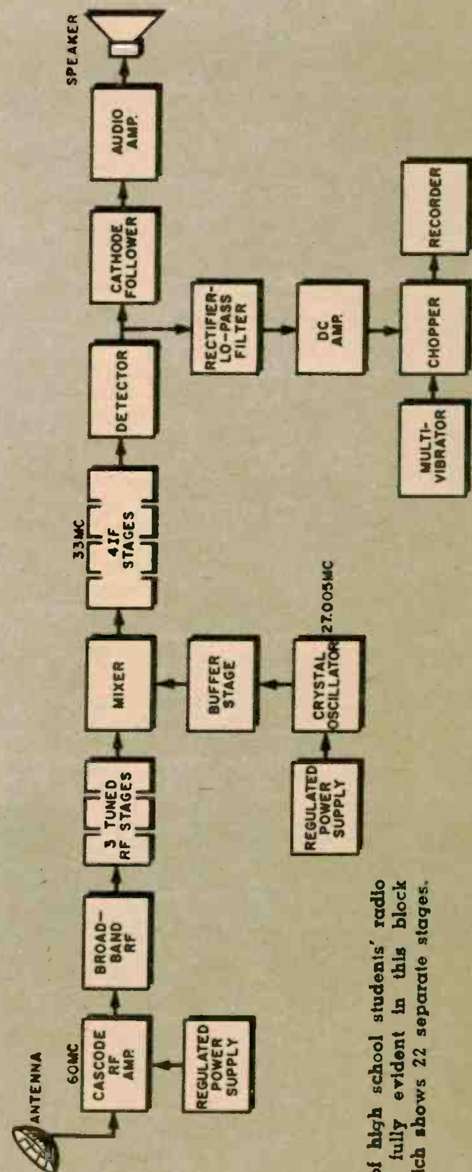


Continued on next page

Student Richard Henry peers into a hooded oscilloscope on top of main cabinet. It is one of several readout devices of rig.

Telescope's time switch being adjusted by student. After 15-minute warmup, the set exhibits under 1 per cent drift at output.

Graphic recorder is most valuable of all readout devices, for its permanent record can be examined in detail and at any time.



Complexity of high school students' radio telescope is fully evident in this block diagram, which shows 22 separate stages.

GOOD READING

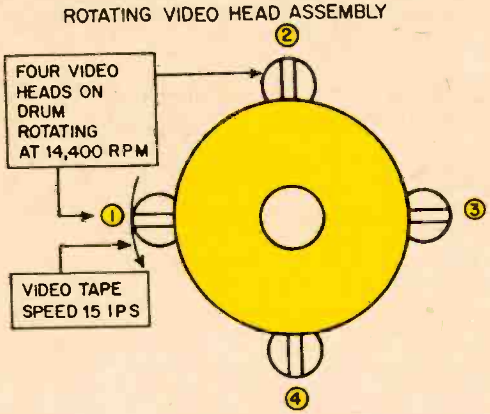
By John Milder

This corner usually leads off with fairly general electronic books. But so many good volumes on specialized subjects have been coming our way lately that we want to review them while they are still current.

TELEVISION TAPE FUNDAMENTALS. By Harold E. Ennes. Howard W. Sams & Bobbs-Merrill, New York & Indianapolis. 256 pages. $5.95

This is the first book I've seen on the ins and outs of TV tape which, so far as I'm concerned, is a more fascinating

ROTATING VIDEO HEAD ASSEMBLY



subject than what's on the screen. Tape has quietly revolutionized the television industry of late, but little material has been available on the subject. This volume explains both the basic workings of tape and how it is used in network programming. It is intended for the engineer but can be understood by anyone with a general electronics background. The book covers everything from cueing procedures to the strange TV tape head assemblies. To increase *apparent* tape speed, four small video heads (see cut) rotate on a drum at 14,400 rpm while the tape itself moves past the head assembly at a conventional 15 ips. Apparent tape speed becomes 1,500 ips.

HOW TO SOLVE PROBLEMS IN ELECTRICITY AND ELECTRONICS. By Henry Jacobowitz. John F. Rider, New York. 185 pages. $3.50

Everyone from shop electrician to design engineer runs into problems needing a formula for solution. Only he's forgotten the formula. When you're in that kind of corner, this is a handy reference to have around. It's not exactly sprightly reading but it does have all the rules, tables and equations.

MEDICAL ELECTRONICS EQUIPMENT HANDBOOK. By Donald A. Smith. Howard W. Sams & Bobbs-Merrill, New York & Indianapolis. 252 pages. $6.95

Whether for good or bad, medicine has become heavily dependent on electronic equipment. This book is a good general survey of the kind of equipment now relied on for diagnosis, treatment and analysis, and as such should be valuable both to service technicians and the limited number of doctors and therapists who have some background in electronics. It is not for the layman who would like to keep up with breakthroughs in the field, but it is full of information for those who use and rely on such equipment. Someday I'm going to find out how the publisher got the book's binding to smell of hospitals.

RADIO REGISTRY. Compiled by the staff of Communication Engineering. Radio Magazines, Inc., Mineola, N. Y. $20 annual subscription

For those who haven't come across it, this Radio Registry (published four times a year) lists all public-safety radio facilities operated by state and municipal governments. Since there is only so much space on our airwaves, it provides knowledge of who is—or may be—interfering with whom, and its listings (both by area and frequency) are more specific than the FCC's.

[Continued on page 106]

CB CORNER

BY LEN BUCKWALTER KBA4480

THE BIG BANG

BEWARE. . . With the federal highway program in full swing, you're likely to enter a blasting area at any time, coming face to face with a sign that tells you to lay off transmitting on your Citizens Band equipment (see photo). Heed its warning—or your mike button could detonate a large charge of dynamite at an inappropriate moment.

It's entirely possible for a CB transmitter to fire the blasting cap that sets off the big bangs on road construction jobs. The problem is not due to any mix-up in radio signals, since the caps

are triggered through wires. It results from an induction effect. Radio-frequency energy from the mobile antenna might enter the control wires and create enough of a current flow to take over the plunger's job.

Though the low power of CB rigs reduces the possibility of such a mishap, this is only part of the story. When the distance between your car and the blasting cap is less than 100 feet, there *is* real danger of an accidental detonation.

If you take a close look at the photo, you'll note an interesting detail. Apart from the DANGER sign, there's no evidence of a road construction job in progress—no bulldozers, no cement mixers and so on. The reason, in this instance, is that the construction site is under a bridge about 500 feet beyond the sign. In crossing the bridge, that car at the left might come within the 100-foot circle. So play it safe and keep your finger off the mike button when you see one of these signs. It usually has a red background.

Free . . . a packaged program to schedule at a CB club meeting. Sonar has prepared an interesting color movie on how CB equipment is made and used. You need no projector for this one. They will send projector, film and a technician to clubs anywhere in the U. S. After the showing, the technician answers questions on CB radio. For further details, have a club officer drop a line to: Mr. J. Liebman, Sonar Radio Corp., 73 Wortman St., Brooklyn 7, N. Y.

Fine News . . . from FCC. You may recall that several months ago the Commission received the power to levy small cash fines against violators of CB regulations. Here are the even dozen law-busters singled out by the FCC.

Operating: by an unauthorized person, without required identification, on an unauthorized frequency, with excess power, with unauthorized emission or transmitting equipment.

Transmitting: a false call sign or false distress call, unauthorized communications, interference to any distress call or distress communication, an unauthorized communication service.

Failing: to attenuate spurious emis-
[*Continued on page* 100]

KEY-CLICK FILTER

WHEN you key your transmitter you may be throwing a ragged picket fence of RF spikes across the RF spectrum. Key-clicks they're called, and they may show up all over an amateur band hundreds of miles away. Such spikes also can cause TV pictures to jump and roll.

The remedy is a simple key-click filter, built in a 35mm film can and mounted right at the key. All you need is a .001 mf, 1,000 V disc capacitor and a 2.5 mh RF choke. The capacitor goes across the key leads and the choke is connected in series with the hot keying lead. RG58/U or RG59/U coaxial cable must be used from the key to the filter and the filter to the transmitter.

First, drill a ⅛-inch hole in one side of the film can and a ¼-inch hole directly opposite. Scrape the paint from both sides of the can around the ⅛-inch hole. Drill ¼-inch holes in the can's top and bottom.

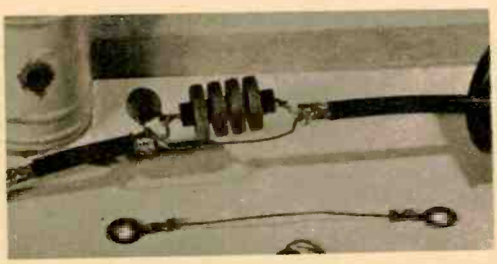
Put a wood screw through the ¼-inch hole in the side of the can, the ⅛-inch hole, and through a lug to which is attached a short length of wire. Tighten the screw into the wood base.

In stubborn interference cases, add a second capacitor of the same value from the center conductor of the coax to ground at the *transmitter* side of the choke. If your main trouble is TVI, use a 7-microhenry choke (Ohmite Z-50) instead of a 2.5 mh choke.

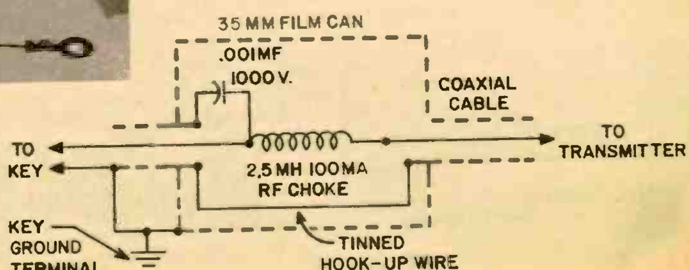
Slip the filter in the can and connect it to the key. The lead from under the can goes to the key's ground terminal. Scrape the paint from the can threads and screw the cap in place.

Even if your transmitter draws more than 100 ma through the keying circuit, L1 won't overheat because it handles the current only intermittently. When operating phone, pull the key plug unless there is a phone-CW switch on the transmitter which can be set to CW.

—*Nicholas Rosa*, W1NOA



One end of coax goes to key terminals. Solder capacitor between the coax braid and the inner conductor. Solder choke between two inner conductors. A jumper of copper wire runs between the two coax braids.



KIT
EI
REPORT

ONCE you become accustomed to the advantages of FM radio on your hi-fi system it is a trial to put up with the typical small AM portable when you're on vacation, camping . . . or perhaps trudging along on one of those popular 50-mile hikes. Now you won't have to make the jarring transition from FM to AM. The new FM portables—of which the Heath GR-61 is the first offered in kit form—permit you to enjoy good fidelity almost anywhere.

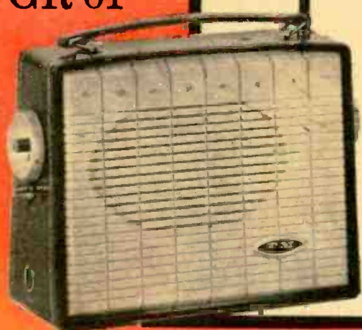
The GR-61's price is $47.95, somewhat higher than prices of comparable-size AM portables. But remember that high-frequency transistors are expensive. More importantly, you get a lot of radio (ten transistors) for the money.

While FM portables aren't exactly new, not much has been said about their performance and how they stack up against conventional FM tuners. We checked the completed kit in our lab and this is what we found: sensitivity at 88 mc was 5 microvolts for 30db quieting (1.6 microvolts for 20db quieting; Heath claims 3 microvolts for 20db quieting). At 106 mc the sensitivity was 8 microvolts for 30db quieting.

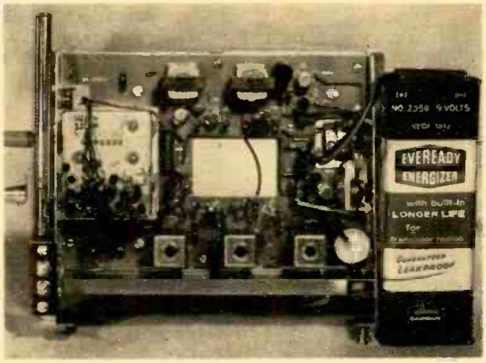
Considering the GR-61's size (9½x7½x4 inches) its audio quality is excellent. Its other features are a preassembled and prealigned front-end, prealigned IF's, AFC, 4x6-inch speaker, tuned RF stage, heavy-duty battery (note its size in the photo) and a 250-milliwatt push-pull output stage. It also has a vernier fine-tuning knob for precise tuning, tone control, earphone jack and a provision on the circuit board for making a connection to your hi-fi system.

Even if this is your first kit, construction won't be difficult. The manual includes sketches of all parts for easy identification. This simplifies things, since most parts are packed together in bags and envelopes. There are three large, fold-out pictorials. Two cover 30 steps each; the third takes care of wiring to the printed-circuit board. Around the perimeter of the large pictorials are boxed descriptions of the part to be installed. This will save you the time of reading lengthy individual steps. Lines run from the boxes to the pic-

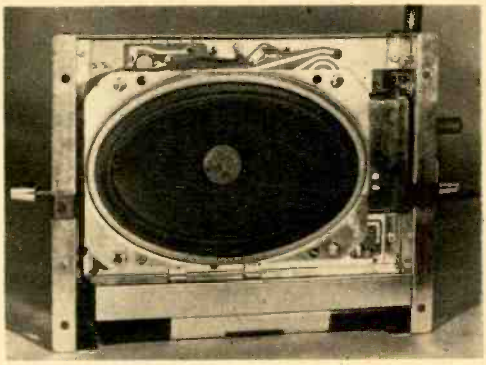
HEATH
GR-61



FM PORTABLE RADIO



Front-end is at left side, center, of circuit board. The heavy-duty battery assures long operating life.



Sizable speaker produces excellent tone. Battery fits in compartment underneath the circuit board.

torial to show exact part location. Follow the lines carefully; your eyes can wander easily from one to the other.

Final steps are installation of the IF, ratio detector, audio transformers, front-end, mechanical parts and speaker. The last step tells you to position the leather case carefully over the radio. Save your patience for this one. We had to do a lot of pulling and prying before the last screw was tightened.

Under the pressure of time we built the kit in about three and a half hours but it's likely to take the average builder a little more than six. The set played when first turned on and it was not necessary to touch up the alignment of the ratio detector as the manual suggests might have to be done. However, if the sound is distorted, the ratio-detector secondary should be aligned by ear, we read, for the "clearest, loudest sound." That's all there is to it. Instrument alignment improved performance somewhat but not enough for us to hear the difference. (A five-step, instrument-alignment procedure, requiring a sweep and marker generator and scope is described in the manual.)

With its 34-inch telescoping antenna extended, the GR-61 was hot in the metropolitan New York area. All the stations we regularly receive on an FM tuner came through clearly on the portable.

And speaking of hot, we realized that a portable is likely to be left in the summer sun so we subjected it to a heat test. We started at 84°F with the AFC on. At 99° the audio fell 5.5db and drift was about 83 kc. At 117° the audio fell about 10db and drift was 220 kc. At 120° the audio was down 30db and drift was 715 kc. And at 120° the audio-output transistors went into thermal runaway and there was no sound at all. Fortunately, the transistors weren't damaged and could still be used after they cooled. So remember: keep this portable in the shade! It doesn't take long for summer sun to run up the temperature of a set left out in the open.

If you use the portable with your hi-fi system, the portable's speaker must be disabled. A miniature phone plug with a 4-ohm resistor across its terminals will do the job when plugged into the phone jack. The volume control still sets the audio output level but the portable will be silenced.

No corners were cut in the circuit design. The front-end is comprised of a tuned RF stage (three-gang tuning capacitor) and separate mixer and oscillator transistors. Following are three IF/limiter stages. The signal from the last IF stage goes to a ratio detector. Most of the detector-stage components are in a packaged electronic circuit. Two audio stages follow. The first, the driver amplifier, is transformer-coupled to the push-pull output transistors.

To sum up, while the GR-61 won't bring true hi-fi to the lakeside, it certainly will add new pleasure and experiences to outdoor radio listening.

EI AT LARGE

Hi-Fi Jazz

WHAT has the Institute of High Fidelity done for *you?* Lately, we mean.

Unless you're a manufacturer of hi-fi equipment, or a real addict, your answer might be: "The *what?*"

One way to approach IHF is to tell what it used to be: the Institute of High Fidelity *Manufacturers*. That last word

told who paid the dues, at least. It was companies manufacturing hi-fi gear—of a specific type. It had to be *component* equipment. Those who turned out packaged radio-phonos and regular phonographs were excluded as being outside the true hi-fi field. For them, getting into IHFM was akin to a horse-doper trying for the AMA.

The *Manufacturers* now has been dropped and the IHF includes many kinds of firms in and on the fringes of high fidelity. EI is an associate member, since hi-fi is one of our interests.

All of which brings us to a meeting the other evening of the IHF Publishers Committee at the New Yorker Hotel, hard by Penn Station in midtown Manhattan. The committee acts as an IHF advisory group in its special area of skill. Being in the publishing business, we automatically qualified for membership, without benefit of campaign speeches or voting. Ray Pepe, IHF's live-wire president, came on from Los Angeles for the get-together. The business at hand was a project to put together and publish a booklet that would explain the hi-fi concept to beginners and give useful advice to hobbyists on

[*Continued on page* 108]

CB Corner

Continued from page 95

sions or respond to written official communications from the Commission.

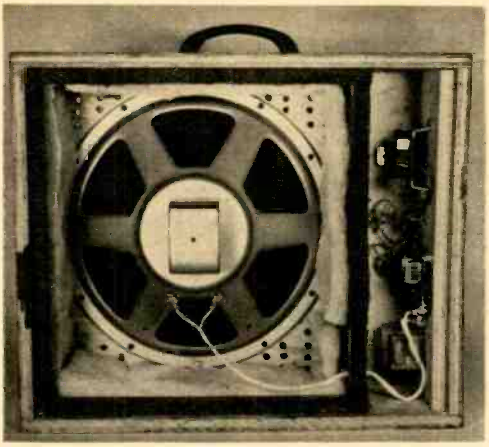
Those little items will get you fined, but don't forget the others that merely get you in trouble.

Playing Checkers . . . with CB units. This was the novel phrase coined recently by a Civil Defense official as he described how CB mobiles can be used in an emergency situation. Peter Winters, an area CB coordinator, visualizes any disaster area as mapped out in the manner of a checkerboard. Spotted throughout are CB mobiles, dispatched into position by local CD headquarters. "Your eyes and voice," said Winters in a talk to a CB club, "will enable us to play checkers." He went on to explain that information funnelled to headquarters by roving mobiles would help officials to piece together a big picture of conditions throughout an area. As events change, units are shifted to new locations.

Reader Asks . . . about field-strength meters: "What's the difference between instruments which need no batteries and the transistor types which do?" If you want really accurate results in tuning your rig to an antenna, the transistor-type is far superior. This is not due to sensitivity alone. If you use a battery-less type, it must be held within a few feet of the antenna to get ample RF pickup. Trouble is, the field-strength meter becomes part of the antenna system and readings are inaccurate. Another important limitation: when the meter is close in to the antenna it may respond to the strong *electromagnetic* field being radiated. (This field travels just a few feet; it's the *electrostatic* field that carries RF ten or 20 miles.) With the sensitive transistor-type meter, you can stand more than 8 or 10 feet from the antenna and suffer no such error. Also, its greater pickup range is handy for tuning a base-station antenna which may be mounted on a peaked roof and is difficult to measure with a short-range instrument

The Super Portable

Text continued from page 60

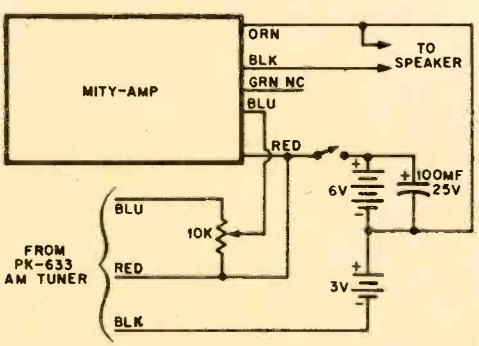


Inside view. To save space, remove speaker magnet cover. Tuner, amp and battery are at right.

both leads of a 1,000-ohm, ½-watt resistor to a length of ⅛-inch. Push one lead through the hole in the board that the emitter lead was in and solder. Now solder the emitter lead of TR-1 to the other side of the resistor.

Connect a 47,000-ohm, ½-watt resistor and a .03 mf capacitor in series. Put the capacitor lead through an unused hole in the board, next to the hole C6's lead formerly came through. Solder it in place. Connect the lead of the 47,000-ohm resistor to the black speaker-lead lug.

On the underside of the board solder a jumper from the gray speaker-lead lug



Mity-Amp connections. Amplifier requires large 6-volt battery, and extra 100 mf, 25 V capacitor.

to ground. Ground is the ⅛-inch wide foil strip just next to the lug. This completes the amplifier modification.

The tuning capacitor shaft must be extended about an inch to fit through the cabinet. The author used a 1⅛x¼-inch diameter-metal spacer and a 1¼-inch machine screw with the same thread as in the tuning-capacitor shaft. File the ends of the spacer to fit the tuning shaft as shown on the pictorial.

Mount the tuner and amplifier on a 5¼x13-inch piece of ½-inch plywood or pressed board. Use ¼-inch spacers under the amplifier. An aluminum bracket holds the battery in place. Wire the amplifier, tuner and volume control as shown. Slide the board in place and secure it with wood screws through the side of the cabinet. Connect the speaker and put the back on with 1½-inch wood screws.

If you don't think the 360-milliwatt output of the PK-544 amplifier will be enough, use a 2-watt Mity-Amp amplifier instead. Because the Mity-Amp's current drain is much heavier, it will be necessary to use a 6-volt lantern cell and two penlight cells. This schematic shows the required connections.

Robot Gun-Slinger

Continued from page 43

does not pull in at all and the dummy's gun stays down. As a result, the dummy's eyes go out and the charging voltage is removed from C5 so that the timing of the interval between draw-and-fire signal and a hit is still indicated.

Reset Action. Pushbutton S2 (*reset*) has one normally closed and one normally open set of contacts. After timing has been noted, step off the mat-switch and press S2 to reset the circuits. When the NO contacts on S2 are closed, C5 discharges through R7, restoring the plate current of V3 and causing M1 to deflect to the right.

When the NC contacts of S2 open, the *AC common* buss is opened momentarily, allowing V5 to de-ionize and to release RY3. The clock timer, if used, will have to be manually reset with its own lever.

Continued from page 54

F-M Communicators
1372 12th Ave. N.
Fargo, N. D.

Tri-Co. Citizens Radio League
Box 1301
Akron 9, Ohio

Logan Co. CB Club
525 Hamilton St.
Bellefontaine, Ohio

Butler Co. CB Assoc.
c/o Fred McKenzie
10839 Colerain Rd.
Cincinnati, Ohio

Northern Hills CB Club
9100 Long Ave.
Cincinnati 31, Ohio

CB Club
c/o Mader Funeral Home
Circleville, Ohio

Scioto Valley CB Club
c/o Garry George
Route 3
Circleville, Ohio

Cleveland 10-4s
11401 Kinsman
Cleveland, Ohio

Hillcrest Citi-Band Club
1040 Lander Rd.
Cleveland, Ohio

Lake Erie CB Assoc.
2497 110th St.
Cleveland, Ohio

PBU CB Club
Box 193
College Corner, Ohio

Central Ohio CB Assoc.
Box 92
Columbus 16, Ohio

The Nineteeners
612 Loomis Ave.
Cuyahoga Falls, Ohio

Dayton Citizens Radio Assoc.
2500 Woodway Ave.
Dayton 6, Ohio

Northwest Space Spanners
c/o Don Echler
Delta, Ohio

Lakeland Radio Club
23630 Chadsey Drive
Euclid 23, Ohio

Bowfin CB Club
c/o Jones TV Service
Findlay, Ohio

Butler County CB Club
121 N. "C" St.
Hamilton, Ohio

Allen Co. CB Radio Club
1226 E. Market St.
Lima, Ohio

South-Lynd Radio Club
Lyndhurst City Hall
5301 Mayfield Rd.
Lyndhurst 24, Ohio

Richland Co. CB Club
c/o Dutch Davis Service
61 Cameron Ave.
Mansfield, Ohio

27 Meggers Club
1553 Algiers Dr.
Mayfield Heights, Ohio

Pomeroy Bend Citizens Radio Club
831 Ash St.
Middleport, Ohio

Williams Co. CBers
c/o George Yarger
Rural Route
Montpelier, Ohio

Knox Co. 5 Watters
c/o Cliff Durbin
Route 3
Mount Vernon, Ohio

Citizens Radio League
8161 Gregory St., SW
Navarre, Ohio

10-4 Radio Club
51 E. Columbus St.
Nelsonville, Ohio

Carrol County CB Club
c/o Bud Maley
Route 171
New Harrisburg, Ohio

5 Watters of Lake Co.
103 Bellemeadow Rd.
Painesville, Ohio

Pomeroy Bend Citizens Radio Club
c/o Carl S. Hysell
Main St.
Rutland, Ohio

Springfield Area Citizen Radio Assoc.
151 Kensington Pl., N.
Springfield, Ohio

CBers Emer. Service
3157 Muirfield
Toledo, Ohio

11-OM Club
Box 111
Toledo 1, Ohio

Inter-State CB Club
333 S. Harrison
Van Wert, Ohio

Euclid 11 Meter Radio Club
28766 Alton Rd.
Wickliffe, Ohio

Muskogee CB Radio League
430 S. 12th
Muskogee, Okla.

The Heterodynes
Box 9812
Oklahoma City, Okla.

Cherokee Co. Radio Operators
City Airport
Tahlequah, Okla.

CB League of Tulsa
Box 66, Admiral Sta.
Tulsa, Okla.

Oregon CB Emer. Corps
Box 173
Depoe Bay, Ore.

Curry CB Radio Assoc.
Box 8
Gold Beach, Ore.

Oregon Grapevine
Box 4261
Portland 8, Ore.

Douglas CB Radio Assoc.
Box 991
Roseburg, Ore.

Columbia Basin Emer. Net
c/o Webster Zimmerman
Route 1, Box 147 A
West Lynn 6, Ore.

Lehigh Valley CB Assoc.
12th & Sumner Ave.
Allentown, Pa.

CB Rangers
Box 284
Butler, Pa.

Chester City CB Assoc.
c/o Elmer Fredd
Dtn. Rd.
Downingtown, Pa.

Del. Co. Citizens Radio League
212 Blanchard Rd.
Drexel Hill, Pa.

Erie CB Radio Assoc.
2223 Parade St.
Erie, Pa.

Abington CBRC
41 Highland Ave.
Factoryville, Pa.

Susquehannah Co. CB Club
c/o Herb Walker
Hallstead, Pa.

Central Pa. CB Club
414 S. 13th St.
Harrisburg, Pa.

Fay-West Club
Box 346
Harrison City, Pa.

Tri-Co. Radio Assoc.
c/o Tom Cochrane
Wynfair House, Apt. A9
Hatboro, Pa.

Johnstown CBs
Box 852
Johnstown, Pa.

C-Banders Radio Club
c/o American Legion
White Oak
McKeesport, Pa.

Lycoming CB Radio Club
Box 247
Montoursville 4, Pa.

Lancaster Co. CB Club
Box 202
New Holland, Pa.

Allegheny-Kiski 5 Watters
1141 Sixth Ave.
New Kensington, Pa.

Tri-County Citizens Radio Assoc.
824 Regina St.
Philadelphia 16, Pa.

AVCR
Box 7819
Pittsburgh 15, Pa.

5-11 Radio Club
868 Glass Run Rd.
Pittsburgh 36, Pa.

Punxsutawaney CB Club
111 Lane Ave., Box 32
Punxsutawaney, Pa.

Qui-Co Citizens Radio League
112 N. 9th St.
Reading, Pa.

Keystone CB Club
413 N. Main Ave.
Scranton, Pa.

Bux-Mont Citizens Radio League
49 Ridge Ave.
Sellersville, Pa.

Mason-Dixon CB Club
c/o Grace L. Dubbs
Route 3
Shippensburg, Pa.

Williamsport CB Club
425 E. Mountain Ave.
South Williamsport, Pa.

Tri-Co. Citizens Radio League
167 Acorn Dr.
Warminster, Pa.

West Chester CBers
112 Leslie Lane
West Chester, Pa.

Penn-Jersey CB Club
Yardley Community Center
Yardley, Pa.

York CB Assistance Club
1880 W. Market St.
York, Pa.

Western Area CB Club
c/o Howard E. Jackson
Hazel St.
Zelienople, Pa.

Butler Co. CB Club
c/o Tony Avruda
58 Gould St.
Newport, R. I.

Narragansett Bay CB Radio Club
American Legion Bldg.
Spring St.
Newport, R. I.

R. I. Radio League
37 Elmwood Ave.
Providence, R. I.

Charleston CB Club
c/o Fire Station
Dorchester Rd.
Charleston Heights, S. C.

Pickens Co. CB Radio Club
City Hall
Easley, S. C.

CB CLUBS CB CLUBS CB CLUBS CB CLUBS CB

Citizens Radio Club
c/o Case Piano Co.
1613 Augusta Rd.
Greenville, S. C.

Grand Strand CB Club
c/o J. A. Merrel
Myrtle Beach, S. C.

Catawba CB Radio Club
c/o Vaughn C. Angel, Jr.
741 Colonial Dr.
Rock Hill, S. C.

Spartan CB 11 Club
2312 Avondale Dr.
Spartanburg, S. C.

CBers of Lower East Tenn.
c/o Franklin D. Grant
520 First St.
Athens, Tenn.

Volunteer State CB
Radio Club
1218 McCallie Ave.
Chattanooga, Tenn.

Johnson City CB Club
Box 3191
Carroll Reece Branch
Johnson City, Tenn.

CB Volunteers of
Knoxville
202 Westover Dr.
Knoxville 19, Tenn.

Volunteer CBs
2316 W. Ridge Rd.
Knoxville, Tenn.

Memphis CB Radio Club
3448 Clearpool Circle
Memphis, Tenn.

Memphis Radio CB Club
410 Malvern Place
Memphis, Tenn.

Nashville CB Radio Club
2313 Castlewood Dr.
Nashville 14, Tenn.

Roane Co. CB Club
Box 56
Rockwood, Tenn.

Middle Tenn. CB Club
c/o Isaac Williams
313 Jarrell St.
Shelbyville, Tenn.

Beaumont CB Club
745 Ave. E
Beaumont, Tex.

Greater Dallas CB Club
1318 Michigan Ave.
Dallas 16, Tex.

Skyline CB Emer. Radio Net
8709 Dyer St.
El Paso, Tex.

CB Radio Club
c/o M. Chapman
4224 Evans Ave.
Fort Worth, Tex.

CB Radio Club of
Fort Worth
Box 9697
Fort Worth 7, Tex.

Galveston Co. CB Assoc.
1015½ 45th St.
Galveston, Tex.

Hunt Co. CB Emer. Net
3107 Poplar St.
Greenville, Tex.

Lockhart Citizens Radio
105 E. Pecan St.
Lockhart, Tex.

Hub City Radio Club
1812 Ave. K
Lubbock, Tex.

Lubbock CB Radio Club
Box 5341
Lubbock, Tex.

Caddo Dist. CB Club
703 W. Houston
Marshall, Tex.

Bayshore Area C-Banders
c/o Pasadena Fire Sta. #2
Pasadena, Tex.

San Antonio CB Club
644 S. Main St., Bldg. 30
San Antonio, Tex.

Shamrock Two-Way Radio
Club
515 S. Madden
Shamrock, Tex.

Faith Village 5 Watters
1631 N. Sumner Terr.
Wichita Falls, Tex.

Twin State 5 Watters
c/o Fire Station
Windsor, Vt.

Virginia CB Radio Assoc.
Box 471
Annandale, Va.

Southwest Va. Radio Club
c/o Rainbow Restaurant
Chilhowie, Va.

5 Watt Mountaineers
CB Radio Club
1009 Hamilton Ave.
Clifton Forge, Va.

CB 5-W-Tri City Club
c/o John Cagle
1006 Elko St.
Colonial Heights, Va.

Radio Experiments
c/o John Childress
307 Norfolk Ave.
Colonial Heights, Va.

5 Watt Ridge Runners
c/o Herbert M. Loyd
Route 1
Crimora, Va.

Danville CB Club
1001 Riverside Dr.
Danville, Va.

Arfax CB Club
Box 551
Falls Church, Va.

Bedford CB Radio Club
c/o Lewis Nunn
Forest, Va.

Piedmont Citizens Radio
Assoc.
c/o Everson Hottle
Haymarket, Va.

Bath Co. 11 Meter CBers
Box 128
Hot Springs, Va.

Henry Co. CB Club
805 Parkview Ave.
Martinsville, Va.

CB 5 Watters of Va.
Court House
Newport News, Va.

Crystal Crackers CB Club
c/o Elbert Lemar
Pennington Gap, Va.

Va. State CB Radio Assoc.
2100 Manly Rd.
Richmond 29, Va.

Roanoke Valley CB Radio
Club
c/o McKnight Electronics
Shenandoah Ave.
Roanoke, Va.

Piedmont Citizen Radio
Assoc.
Box 101
Shadwell, Va.

Apple Valley CB Club
435 Fairmont Ave.
Winchester, Va.

Potomac & Rappahannock
Citizens Radio Assoc.
621 Sharp Dr.
Woodbridge, Va.

Evergreen Area CB Assoc.
9220 Holly Dr.
Everett, Wash.

Port Angeles CB Club
426 Seventh St.
Port Angeles, Wash.

CB Minutemen of Wash.
2403 Sixth Ave., W.
Seattle 99, Wash.

Evergreen Area CB Assoc.
519 N. 66th St.
Seattle 3, Wash.

14W Assoc. of Seattle
2116 Ferry Ave.
Seattle 16, Wash.

Racine CB Club
1019 Crabtree Lane
Racine, Wis.

Central H. S. Radio Club
2476 S. 75th St.
West Allis 19, Wis.

Electronic Tachometer

Continued from page 71

These low-voltage pulses are fed to the tach, and are reduced in amplitude by a voltage divider. The voltage divider feeds a pulse shaper (see CR-1 and CR-2 in schematic) which uniformly shapes incoming pulses and applies them to TR-1. R3 clips the peaks to prevent TR-1 from being overloaded. TR-1 amplifies and inverts the pulses. Zener diode CR-2 keeps the level of the pulses uniform while C-2 keeps the pulse width constant. The series (CR-4) and shunt (CR-3) diodes which drive the meter allow only the positive-going pulses to pass. Negative-going pulses are shunted to ground.

The meter indicates the average voltage of the pulses. When engine speed increases the points open and close faster, increasing the number of pulses to the meter and causing it to indicate a higher voltage. If you do a lot of driving for business or pleasure, the tach will pay for itself in no time.

Continued from page 57

you can use voltages and the *Voltage Ratio* column when determining ratios. However, the input and output impedances of the equipment you're checking *must be the same*. Now, notice in the table that 3db represents a *power* ratio of 1.99 but that 6db represents a *voltage* ratio of 1.99. We won't go into the math required to explain this but, when dealing with voltage or current, our early formula becomes $db = 20 \log E1/E2$, where E1 is the larger voltage and E2 is the smaller voltage. In the case of current the formula would be $db = 20 \log I1/I2$, where I1 is the larger current and I2 the smaller current. When you are working with voltage or current the answer will be twice as great as when dealing with power.

An example should make this clear. While driving your amplifier with a sine-wave signal, you measure the voltage across the speaker terminals and calculate the power to the speaker to be 10 watts. (To calculate the power you would use the formula $W = E^2/R$, where W is the power in watts, E is the measured voltage and R is the impedance of the speaker.) You change a tube in the amplifier and the voltage to the speaker doubles. This, then, would be a voltage ratio of 2. Under the *Voltage Ratio* column in the table you'll find that a voltage ratio of 2 (1.99, actually) is equivalent to 6db. Now notice that 6db represents a *power* ratio of 4 (actually 3.98). Therefore, when you doubled the output voltage the power was increased four times to 40 watts.

Microphones. If everything in electronics were rated in db with the same reference level, db problems would not be difficult. As a general rule, most equipment *is* rated in terms of the dbm reference level. The problem-children, however, are microphones, since their outputs may refer to different reference levels.

Some microphone output ratings are given in reference to 1 mw (0dbm). Some are rated in dbv (1 volt). And some are in reference to 1 millivolt. Some, judging from performance, have heaven-knows-what for a reference level. But, regardless of the reference level, the important thing to bear in mind is that since the db is just a ratio, it doesn't matter what reference is used as long as you consistently use the same one. If a microphone with a —57dbm rating driving an amplifier's output to 1 watt is replaced with another microphone with a —54dbm output level (a 3db difference or a power ratio of 2), the amplifier will now deliver 2 watts.

If a microphone having a —60*dbv* rating driving an amplifier to 10 watts is replaced with a microphone having a —57*dbv* rating (again a 3db difference), the amplifier will deliver 20 watts. In other words, the power ratio always will be the same, regardless of the reference used, so long as both microphones have the *same* reference.

Now that we have shown how to use the db in audio work, let's see how it's used in other places.

Amateur Radio. Most newcomers to amateur radio say the more power the better—if 100 watts output is good, 1 kilowatt is likely to be ten times better. This is not always true. For example, let's say the station you're listening to is running a "full gallon" (1 kilowatt) and you read him at 20db over S-9. (The S-meter reflects power, and each S unit nominally equals 6db.) In the table you find that 20db is equivalent to a power ratio of 100. Now, by dividing the original 1,000 watts by 100, you get 10 watts. Tell the other station to cut back his power to 10 watts. You will now receive him at S-9, still a powerful signal, with a considerable saving in power and tube life. That extra 20db was being wasted.

FM and TV Antennas. With few exceptions, antennas are rated in db gain —a figure which tells you in advance how the antenna should perform. But what is the reference? The dipole is the reference FM/TV antenna. It is said to have 0db gain. Its receiving pattern, shown in Fig. 2A, is bi-directional with maximum sensitivity at right angles to the element's axis. Notice the pattern of the yagi antenna in Fig. 2B. The rear and side sensitivity has been pressed into the forward direction. Typical gain for a yagi is 9db. Since 9db represents a power ratio of 8, the yagi will deliver eight times more signal when either transmitting or receiving than will a dipole mounted in the same position.

Citizens Band Antennas. CB antennas also are rated in db gain, a figure useful in indicating effective transmitted power. The CB reference antenna is the ground-plane and its gain is said to be 0db. It has a non-directional radiation pattern, as shown in Fig. 1A. The directional beam antenna has a gain of around 10db. The table tells us that 10db represents a power ratio of 10. Therefore, in the forward direction, the beam, when fed a 5-watt signal, will give the same performance as a 50-watt transmitter feeding a ground-plane antenna. Such a beam antenna will increase your 5-watt signal to 50 watts of effective power. Since the beam's pattern is essentially the same for receiving and transmitting, the beam also will produce a 10db gain in the forward direction when receiving.

Are Radio Waves a Threat?

Continued from page 79

sity of California has dealt with the longevity of mice to determine whether irradiation below "safe" levels would affect life span. Results are not yet in.

Other experiments have dealt with the permeability to ions of nerve membranes. The sciatic nerve of a frog was subjected to microwaves while an ionic solution was dropped on the nerve. The ion concentration in the nerve was then measured with ultraviolet spectroscopy.

Other experiments are planned to deal with the so-called free radicals as they are affected by RF energy. Free radicals are intermediate products in a chemical reaction. Presumably, they have an important function in the effects of medicines on our body functions. It is thought by medical researchers that free radicals are largely responsible for the benefits we derive from medicaments.

Research in athermal effects has just begun in earnest. Many medical therapists who did early work with diathermy commented on the possible beneficial effects of small dosages of irradiation, but it is difficult to predict where the research will lead and what it will mean to you and me.

The medical type research has dealt largely with *benefits* that might come from irradiation. What about the *hazards?* Will we be forced to limit radiation from transmitters and industrial generators in the same manner that we limited nuclear bomb testing because of possible contamination of the atmosphere? Such a step seems hardly likely.

But foregoing limitations does not mean there are no hazards. It seems entirely possible that some psychological effects in humans may be measurable in the vicinity of powerful transmitters. There is some concern about the matter but no research projects have been announced. The author, as a matter of fact, has tried for some time to interest researchers in such a project, but with no success.

It is entirely conceivable that drivers passing transmitting towers may suffer a measurable slowing of reaction time, as did scientist Gordon's dogs. This, of course, would represent a hazard to safety. Possibly, the effects may take place only at certain frequencies.

Before we install super-power transmitters to communicate with space vehicles and interplanetary explorers, it would be well to investigate all the possible effects on humans of strong *and* weak electromagnetic radiation, even if such effects are only temporary.

An Italian scientist named Cazzamalli, who has been much maligned, found that his subjects began to have hallucinations when subjected to strong RF fields for long enough periods. Can we say for certain that this has not happened to pilots, to automobile drivers, to train engineers at the moment of passing a transmitter? We certainly cannot attribute air disasters and car wrecks arbitrarily to radiation. But we can't be sure there was no connection.

This, then, is a new frontier for science. The challenge is to determine the precise effects of electromagnetic radiation on the human body.

Good Reading

Continued from page 95

THE ABC's OF SHORT-WAVE LISTENING. By Len Buckwalter. Howard W. Sams & Bobbs-Merrill, New York & Indianapolis. 96 pages. $1.95

A good many of those reading this column may already be SWL's—aren't you? If you are, you're no doubt trying to make converts of your brothers, friends, or even your wife or mother. This is just the book to give your victims. It's a fine, entertaining essay that explains the appeal of short-wave listening and tells the eager reader how to become an SWL himself.

SERVICING TRANSISTORIZED TWO-WAY RADIO. By Patrick Craney. Howard W. Sams & Bobbs-Merrill. New York & Indianapolis. 128 pages. $2.95

Everyone loves tubes (we can at least find out which one to blame when something goes wrong), but transistors keep coming along. With the advantages they offer for portable equipment they are making a logical place for themselves in two-way radio. For anyone concerned, this book is a good way to start learning to live with them.

And make note of . . .

HI-FI HANDBOOK. By Steven Hahn. Crowell. 216 pages. $4.95

MODERN INFRARED TECHNOLOGY. By Barron Kemp. Sams. 255 pages. $4.95

RCA TRANSMITTING TUBE MANUAL. 320 pages. $1

RADIO-TELEVISION-ELECTRONICS DICTIONARY. Rider. 190 pages. $3.50

RCA TRANSISTOR MANUAL. 304 pages. $1.50

TV SERVICING MADE EASY. By Wayne Lemons. Sams. 160 pages. $2.95

POCKET DICTIONARY OF COMPUTER TERMS. Sams. 96 pages. $1.50

TROUBLESHOOTING WITH THE VOM AND VTVM. By Robert G. Middleton. Sams. 160 pages. $2.50

Hi-Fi Record Guide

Continued from page 83

Gilbert and Sullivan caper. Ruddigore is not their most popular effusion but it is entirely typical, as an analysis of the title itself indicates. Red Blood, egad, and performed with vigor, understanding and style by the D'Oyly Carte company, the inaugural enactors of the G&S masterpieces. All's still right with the world.

Organ music is fine for testing your stereo or mono hi-fi rig and here's a new Bach series, with Carl Weinrich at the manuals, which provides great music and outstanding sonics. In Volume 2 there are only four compositions but each is monumental.

If Modern Jazz is sometimes disconcerting because its melodic base is unfamiliar, a corrective is offered in a series of records that features famous jazz artists playing songs by famous popular composers. In Great Jazz Artists Play Compositions of Harold Arlen, there are nine numbers, each played by a different group. As the tunes are familiar and often obdurately individual and the players include people like Wes Montgomery, Bill Evans, Herbie Manne and the Adderleys, here is ample opportunity for provocative—or frustrating—music-making.

Records discussed in this column, with monaural discs listed first and stereo versions following:

Renaissance Festival Music
Greenberg, New York Pro Musica — Decca DL-9419; DL-79419

Purcell: Come Ye Sons of Art
Deller, Choir, Orchestra — Vanguard BG-635; BGS-5047

When I Was a Young Girl *Barbara Dane* — Horizon WP-1602; WP-1602-S

Burl *Burl Ives* — Decca DL-4361; DL-74361

Jimmie Rodgers in Folk Concert — Dot DLP-3496; DLP-25496

Beethoven: Fifth Symphony
Dorati, London Sym. Orch. — Mercury MG-50317; SR-90317

Haydn: Lord Nelson Mass
Willcocks, Chorus, London Sym. Orch. — London 5731; OS-25731

Schubert: Music for Rosamunde
Abravanel, Davrath, Chorus, Utah Sym. Orch. — Vanguard VRS-1087; VSD-2114

Gilbert and Sullivan: Ruddigore
D'Oyly Carte Opera Co. — London A-4248; OSA-1248

Bach: Organ Music, Vol. 2 *Carl Weinrich* — RCA Victor LM-2649; LSC-2649

Compositions of Harold Arlen *Jazz Artists* — Riverside RM-3518; RS-93518

3 FOR 4-TRACK BY HEATHKIT

4-TRACK STEREO TAPE PLAYER*

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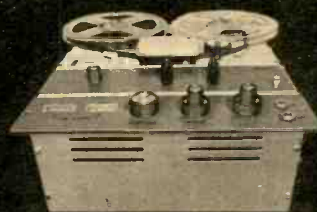

4-TRACK STEREO TAPE RECORDER*

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4-TRACK PORTABLE STEREO RECORDER*

• Includes all amplifiers & speakers • Records & plays 4-track stereo & mono tapes • 7½ & 3¾ ips • Bar-type level indicators • Mike & line inputs • Dual two-way speaker systems • Stereo headphone jack • Factory assembled case with lift-top lid and swing out detachable speaker wings. KIT AD-72, 43 lbs., no money dn., $19 mo. $198.00

*All mechanisms feature exclusive Heathkit version of Vega of California deck—rugged die-cast simplicity for long, dependable performance—beige & copper-tone color

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Prices & specifications subject to change without notice. Dealer & export prices slightly higher.

Continued from page 100

a slightly higher level.

Though great ideas don't always see the light of day, the outlook is fair to good in this case. Some time soon a hi-fi primer/first reader of about 60 pages is likely to be announced by IHF. It will be distributed by hi-fi dealers, probably at a quarter a copy, and offered by mail to readers of such magazines as EI.

We haven't seen a word of the copy to date but we unhesitatingly recommend the yet-unpublished tome to anyone with even a vague interest in having hi-fi at home or anyone who is looking for more advice before taking the plunge. On the committee are the top hi-fi publishing specialists (that's the word that lets us out) of the day, so the information offered up is certain to be authoritative and usable. It's seldom that one sees such a single agglomeration of high-fidelity brainpower.

In another activity, IHF is making a recommendation to the Federal Trade Commission about the use of the term *high fidelity*. As Ray Pepe said, "High fidelity is a term that belongs to any Tom, Dick or Harry who wants to use it." You see it applied to some mighty strange equipment here and there.

The IHF realizes that high fidelity can't be restricted by law to any one kind of equipment but it would like to see the FTC require those using the term to define it. A hi-fi ad, under a rule like that suggested, would have a footnote to give actual power and distortion figures for any equipment described.

That might lead to some eye-catching footnotes, considering the fact that we now have high-fidelity lipstick and high-fidelity brassieres, among other things.

IHF's major contribution to date probably is the set of standards it has given the audio industry. Where once specs didn't mean a thing because they had that brassy ring, you now get the silver tones of truth because you can make direct comparisons when the specs have a common basis.—*R.G.B.*

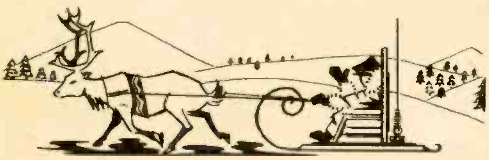
DXing CB In Sweden

ORNSKOLDSVIK, SWEDEN

IN radio circles here in Sweden we have heard only a few facts about the American Citizens Band. But one of the more interesting bits of information, in view of this report, is that CB stations are limited to 5 watts of power and are for short-range communications. I wonder if CBers ever wonder about how far their signals reach when conditions are right?

They might be surprised to learn that their communications come into my shack fairly regularly on peak-DX days. And that's quite a jump! My home is in a town of 7,000 people on the east coast of Sweden. I'm not far from the Arctic Circle and about 400 miles north of Stockholm. My antenna is a 590-foot V-beam and my receiver a Hallicrafters SX-71. My location is advantageous in that I am on a high hill.

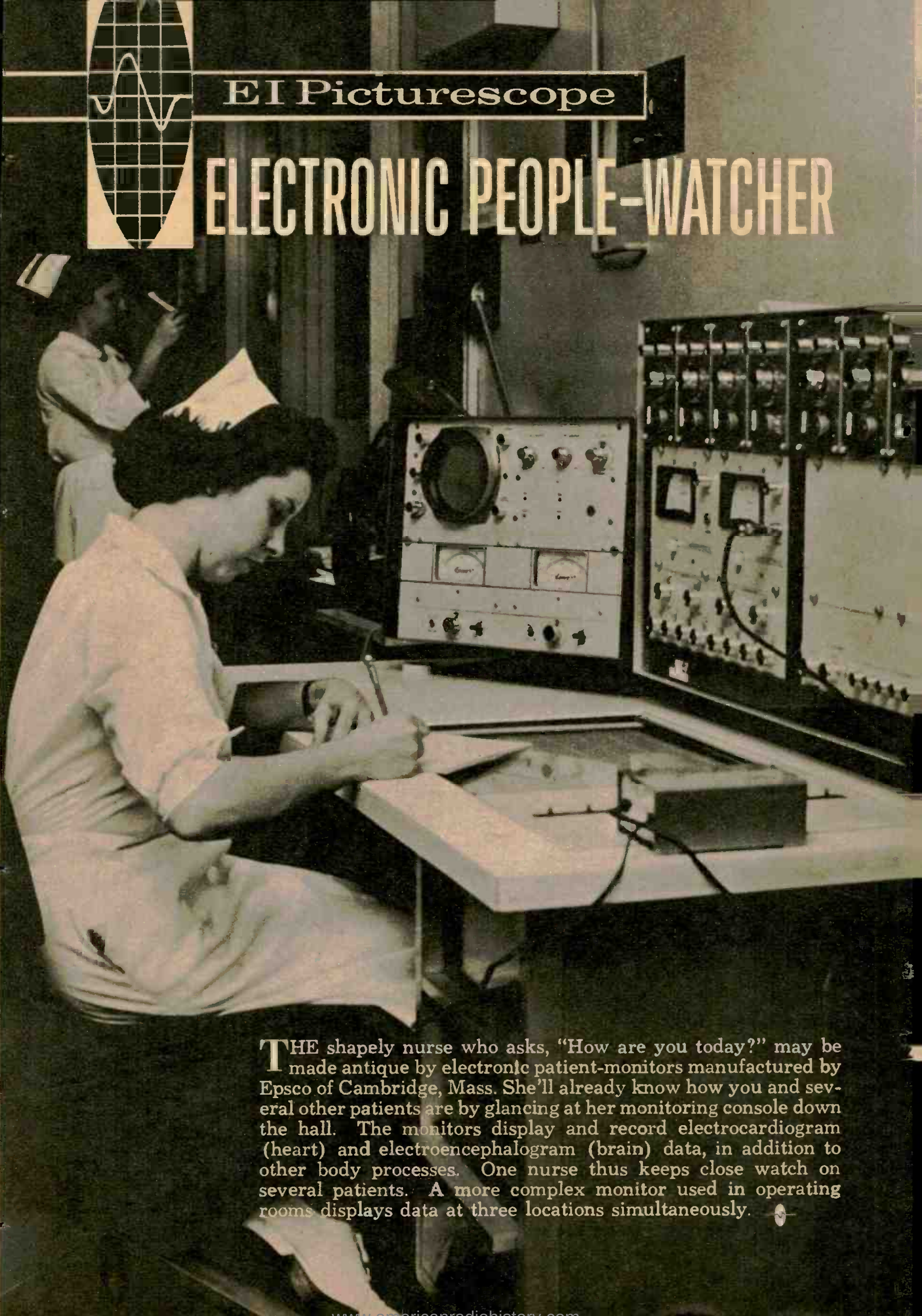
My greatest success in picking up 27-mc signals came on a February evening at 1718 GMT (6:18 p.m. local time



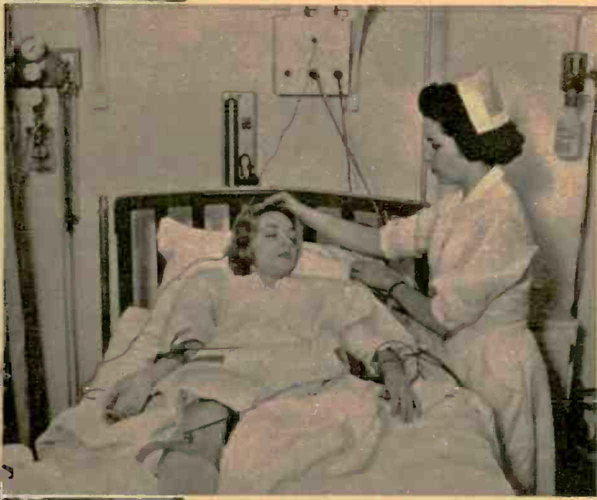
and 12:18 p.m. on America's East Coast). I had been having fair success tuning in the Citizens Band signals but was not able to read most of them. Suddenly I ran into a very strong one that read S-8 and was clear. His call letters were 1W1195. I heard him say he was located in West Haven, in Connecticut. Through a W1 ham friend in that city, I got 1W1195's name and address and, a few days later, sent him a reception report.

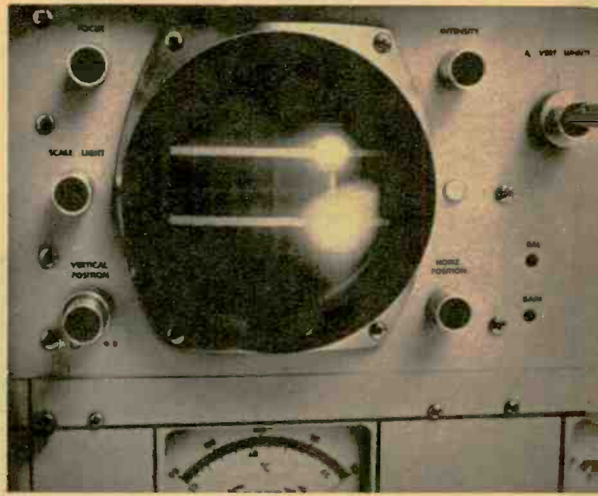
About a week afterward I received a QSL card from the station's owner, whose name was Charles. I was delighted with the card and I think Charles was quite a bit surprised by my report. His transmitter was rated at 5 watts, he used a converted BC-454 to receive and his antenna was a ground plane.—*Sven Elfving*

ELECTRONIC PEOPLE-WATCHER



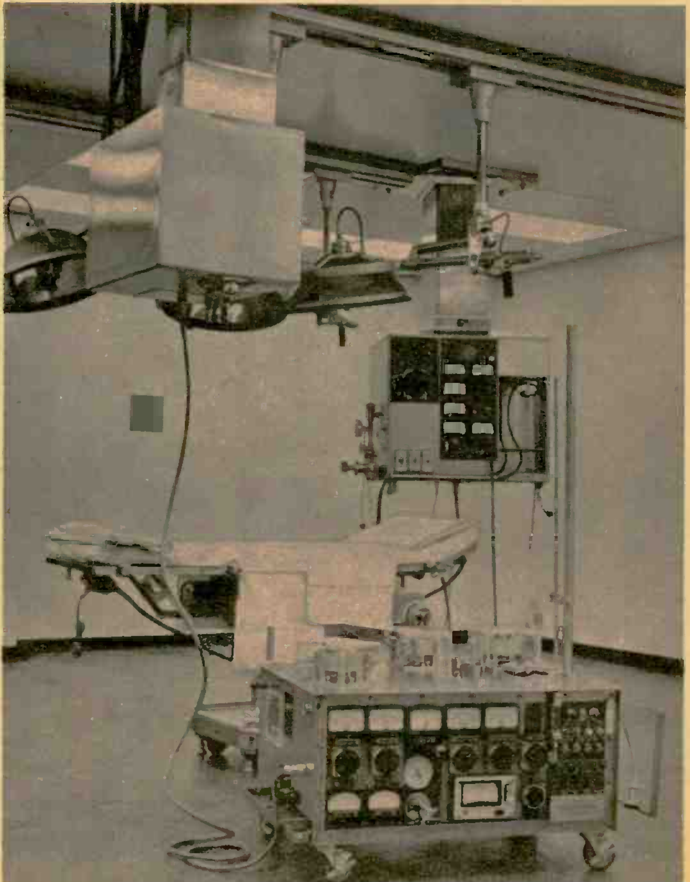
THE shapely nurse who asks, "How are you today?" may be made antique by electronic patient-monitors manufactured by Epsco of Cambridge, Mass. She'll already know how you and several other patients are by glancing at her monitoring console down the hall. The monitors display and record electrocardiogram (heart) and electroencephalogram (brain) data, in addition to other body processes. One nurse thus keeps close watch on several patients. A more complex monitor used in operating rooms displays data at three locations simultaneously.





In hospital room, electronic monitor's electrodes are strapped to leg and arms for heart activity (EKG) and to the head for brain's electrical activity (EEG). The two resulting traces appear simultaneously on cathode-ray tube face (right photo) at nurse's monitoring station. On the opposite page is a large hospital installation which can monitor eight patients at once.

An operating-room monitor displays patient data at three points (two are shown in center and bottom of photo at right). Five "modalities" are monitored: EKG, EEG, the arterial and venous blood pressures, and body temperature.



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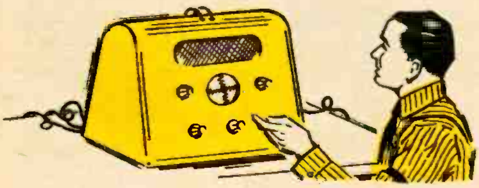
Transatlantic TV: 1930

THE idea of television programs flowing back and forth across the Atlantic between America and Europe via the Telstar and Relay satellites has caught the public's fancy in recent months. But transatlantic TV is much older than that—more than 30 years older, in fact.

In 1929 and 1930 the General Electric Co. in Schenectady, N. Y., built a pioneer television transmitter and at-



tempted to send video images to England, Germany and Australia. The tests were mildly successful to GE, but to one English radio hobbyist they were little short of astounding.

Douglas Walters, G5CV, was living at Godalming, Surrey, at the time and had worked as an engineer for the Baird Co., which ran daily 30-minute television transmission experiments for the BBC. Mr. Walters, as a hobby, put together a home-brew TV receiver which had a mechanical scanning disc containing 30 holes.

On September 16, 1930, Mr. Walters was tuning around 15 mc with a radio receiver when he bumped into a signal he recognized as video. Quickly switching in his television set, he saw on his screen the image of a man. A little later came a voice which announced that this had been an experimental television transmission from the GE station (W2XAF) in New York. The thrilled Briton sent off a cable to the company and two days later received a wire confirming his report. The message added that this was believed to be a distance record for amateurs.

Mr. Walters still has the original cable—written with pencil in longhand.

—*Thomas W. Duignan*

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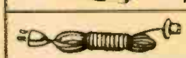

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1B3	.79	6AW8	.90	6SA7GT	.99	12CX6	.54
1DN5	.55	6AX4	.66	6SH7	1.02	12D4	.69
1G3	.79	6AX5	.74	6SJ7	.88	12DE8	.83
1J3	.79	6BA6	.50	6SK7GT	.95	12DL8	.88
1K3	.79	6BC5	.61	6SL7GT	.84	12DQ6	1.04
1R5	.77	6BC8	1.04	6SN7	.65	12DS7	.84
1S5	.75	6BE6	.55	6SQ7GT	.94	12DT5	.76
1T4	.72	6BF5	.90	6T4	.99	12DT7	.79
1U5	.65	6BF6	.44	6T8	.85	12DT8	.78
1X2B	.82	6BG6	1.70	6U8	.83	12DW8	.89
2AF4	.96	6BH8	.98	6V6GT	.54	12DZ6	.62
3AL5	.46	6BJ6	.65	6W4	.61	12ED5	.62
3AU6	.54	6BJ7	.79	6W6	.71	12EG6	.62
3AV6	.42	6BK7	.85	6X4	.41	12EK6	.62
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5CL8	.76	6DG6	.62	12AL8	.95	19BG6	1.39
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5J6	.72	6DQ6	1.10	12AU6	.51	25AX4	.70
5T8	.86	6DT5	.81	12AU7	.61	25C5	.53
5U4	.60	6DT6	.53	12AV6	.41	25CA5	.59
5U8	.84	6DT8	.94	12AV7	.82	25CD6	1.52
5V6	.56	6EA8	.79	12AX4	.67	25CU6	1.11
5X8	.82	6EB5	.73	12AX7	.63	25DN6	1.42
5Y3	.46	6EB8	.94	12AY7	1.44	25EH5	.55
6AB4	.46	6EM5	.77	12AZ7	.86	25L6	.57
6AC7	.96	6EM7	.82	12B4	.68	25W4	.68
6AF4	1.01	6EU8	.79	12BD6	.50	32ET5	.55
6AG5	.70	6EV5	.75	12BE6	.53	35C5	.51
6AH4	.81	6EW6	.57	12BF6	.60	35L6	.60
6AH6	1.10	6EY6	.75	12BH7	.77	35W4	.42
6AK5	.95	6FG7	.69	12BK5	1.00	35Z5	.60
6AL5	.47	6FV8	.79	12BL6	.56	36AM3	.36
6AM8	.78	6GH8	.80	12BQ6	1.16	50B5	.69
6AQ5	.53	6GK5	.61	12BR7	.74	50C5	.53
6AS5	.60	6GK6	.79	12BV7	.76	50EH5	.55
6AT6	.49	6GN8	.94	12BY7	.77	50L6	.61
6AT8	.86	6H6	.58	12BZ7	.86	70L7	.97
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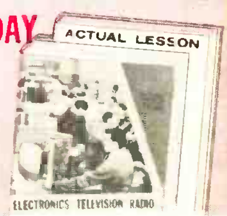

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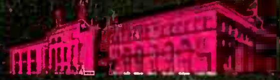

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