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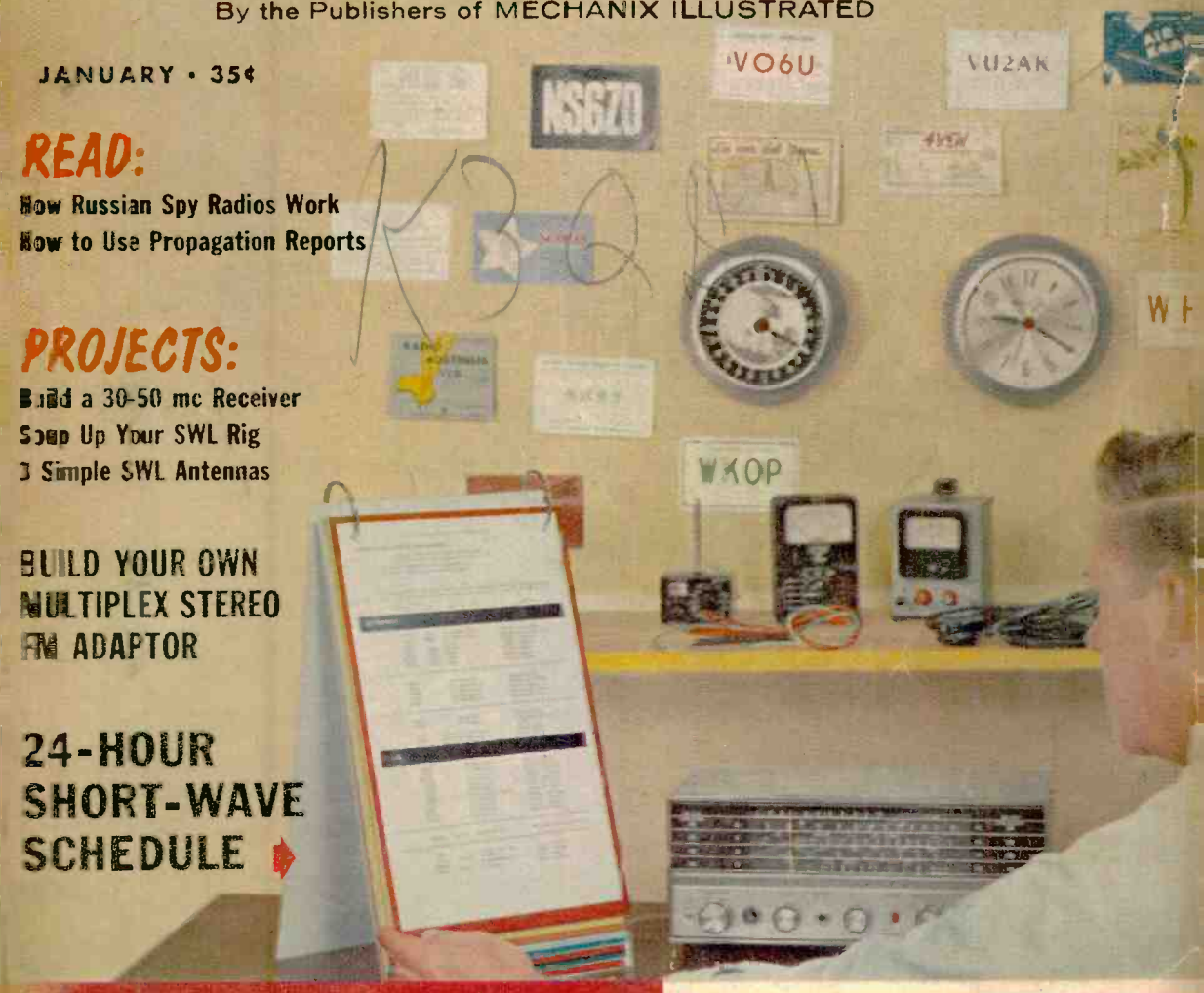

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In This Issue:

SWL Features & Projects

Special Features

Special Projects

Regular Departments

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—JOHN D. PETTIS,
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FEEDBACK from our readers

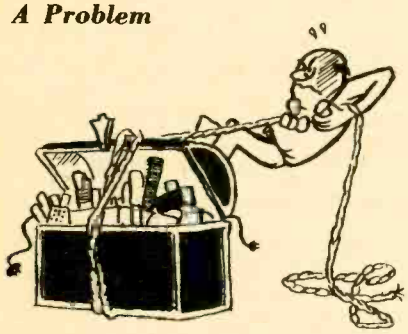
Write to: Letters Editor, Electronics Illustrated, 67 West 44th St., New York 36, N. Y.

● *Fourth for Bridge?*

Your article last spring about teaching machines was very interesting. After reading it I bought a machine course on contract bridge and was amply rewarded.

Robert W. Owen
Marion, Va.

● *A Problem*



I have just one question which I and probably other EI readers ask themselves: what do you do with the equipment that you build?

Please keep up the good magazine.

Erik Andersen, WA2SAN
Keyport, N. J.

We usually try to use it, Erik. Of course, there's always the junk box, the hall closet or the attic.

● *Friends*

I have noticed a big change in your magazine. I'm all for the FEEDBACK column. In my view, your SWL and DX coverage is tops.

Wayne Pierce
Vestal, N. Y.

I was very interested in your column, THE LISTENER. Most of the SW columns you see are just dull lists, but not yours. I don't know whether you're going to print reports or not, but I advise against it. How about something for ARM's? That is a term invented by *me* for the small group of Amateur Radio Monitors in various countries.

Thomas W. Duignan
Fairfield, Conn.

Thanks, fellows. We are not going to print reports in THE LISTENER, and are any other ARM's interested?

● *Big Bugs*

Can you tell me how to increase the jolt in your ELECTRONIC INSECT KILLER (July '61 EI)? I built the unit but all it does is stun most of the bugs. Our California insects are rugged!

William McArthur
Redwood City, Calif.

Obviously, Bill, you have superior bugs in California. They'd have to be to stand up (on all six legs) to 800 volts. Our solution: just connect another capacitor (.02 mf @ 1,600 v.) in parallel with C3. That would approximately quadruple the unit's flash output.

● *Second War*

Just finished reading the article, OUR SECOND WAR WITH JAPAN (Sept. '61 EI). I wish other publications had the gumption to publish similar articles. The facts you talk about came home a year ago to our little grassland community of 4,700. A large clothing manufacturer canceled plans to put in a plant employing 250 because of the large import of blue jeans from Japan.

J. J. Jennings, K5QNX
Sulphur, Okla.

[*Continued on page* 114]

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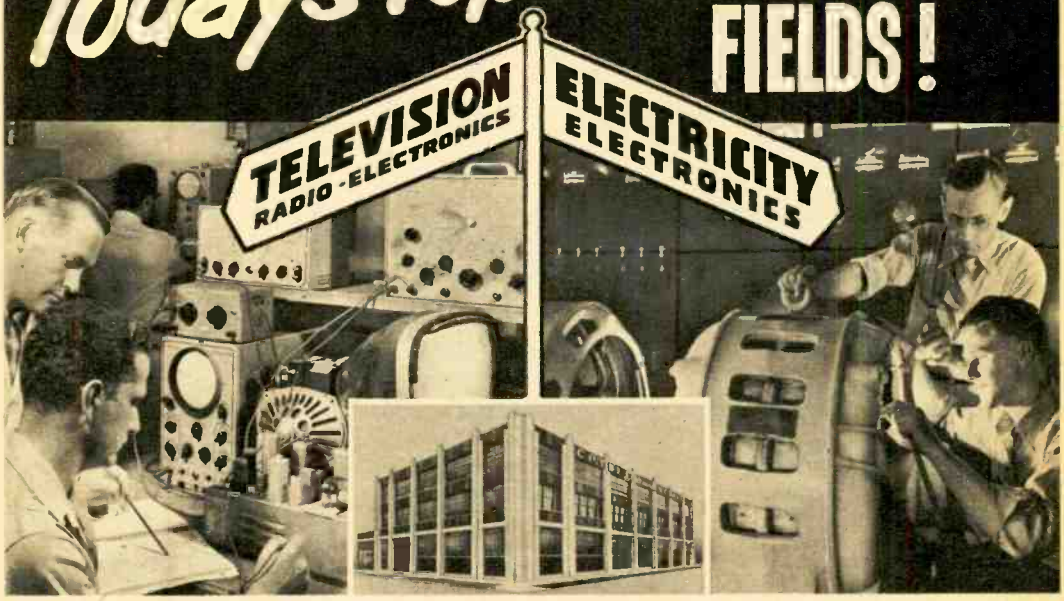

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. . . electronics in the news

PEEKABOO-BOO . . . That toothsome gal in the photo, being the shy type, is trying to hide behind a 21-inch steel disc. But obviously she picked up the wrong one because we can see her right though it! The secret? It's pretty thin steel (.006 inches) and also full of holes —441,222 of them, all perfectly round and evenly spaced. Would you care to count 'em?

The disc actually is a shadow mask made for a color TV tube by Buckbee Mears of St. Paul.

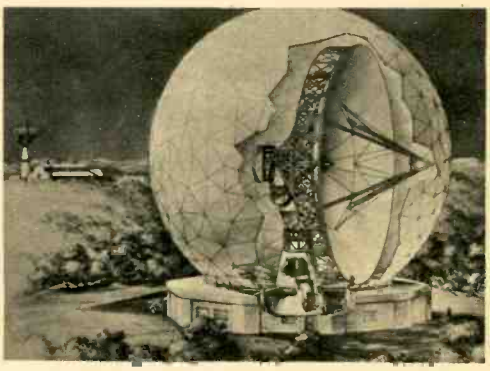
—o—

Getting Tough . . . Under Chairman Newton D. Minow the FCC is showing more gumption than it has in many years. For example, it has started proceedings against a couple of TV receiver owners in Maysville, Va., who have refused to do a thing about the interference their sets were creating in the neighborhood.

In its action, the FCC is sticking close to Section 15.69 of the Rules and Regulations: "The operator of a radio receiver, regardless of tuning range, date of manufacture, or of certification, which causes harmful interference shall promptly take steps to eliminate [it]."

—o—

Needle in a Haystack . . . In World War II our radar could pick up a battleship 20 or 30 miles away. Today, on Haystack Hill in Tyngsboro, Mass., the Air Force is completing Project Haystack, a radar system with a pinpoint beam that can see a metallic golf ball at 1,000 miles or a needle in a haystack several football fields away. Unique 100-KW plug-in transmitters fit in a cab on the back of the 120-foot parabolic antenna and ride along with it.



Haystack's narrow beam (.06-degree) is made possible by the big dish plus a high operating frequency—8,000 mc. Later, .05-degree will be achieved at 10,000 mc. The rig can throw a 500-mile-wide spot on the moon and make other spatial explorations (see Newest Celestial Art: RADAR ASTRONOMY, Septemper '61 EI). It also will be used to probe the ionosphere and troposphere and may play a part in our communications satellite program. Radiation, Inc., is the builder. The whole setup will be enclosed in a huge radome. Nearby is the famed Millstone Hill radar (see photo).

—o—

Universal Transistor? . . . The ubiquitous transistor unquestionably has revolutionized electronics but the fact that there now are some 2,000 different types, a great many not interchangeable, causes much confusion. RCA promises a way out of the fog with a new silicon model, the 2N2102, which is supposed to be

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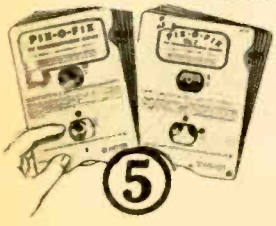

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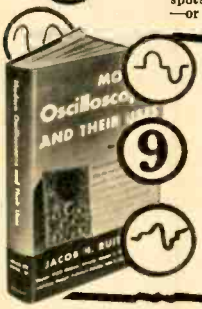

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Made by RCA's semiconductor plant at Somerville, N. J.

—o—

CB in Canada . . . The Canadian version of Citizens Band is scheduled to open April 1, 1962, under the name of General Radio Service. Canadian CB apparently will be considerably different from its south-of-the-border counterpart. The controlling Department of Transport, perhaps profiting from U. S. mistakes, has written stiff regulations. All super-regenerative circuits are banned and apparently anyone who puts a kit together must submit it for approval, which pretty well kills kits for Canadians. In another departure, the DOT has decided to allow modulation of either type—AM or FM.

In Britain, meanwhile, no one seems to be very interested in having CB.

—o—

Heart Time . . . Missiles and space men at Lockheed Aircraft have come down to earth long enough to develop an ingenious Heart Beat Totalizer that is carried around by the patient. The gadget consists of a pair of lead foil electrodes taped to the chest, a transistor amplifier the size of a pack of chewing gum and an inexpensive wristwatch rebuilt to run on the power of the heart's pulse. It takes 150 heartbeats to move the second hand a full circle and 9,000

to send the minute hand around once. The result is a total heartbeat count over a certain period of time—during which the subject carries out his normal activities. The Totalizer is being used for medical research, and build-it plans are not available.

—o—

Watery Wireless . . . Sonar and radio are combined to form a wireless undersea communications system in a project being carried out by Bendix. The rig works just like radio, except the waves are ultrasonic sound rather than electromagnetic. Bendix has transmitted not only voice messages via sonar but also has multiplexed ten telemetry channels into the same signal. A transducer at the receiving end converts the modulated ultrasound into electrical energy and the modulation is recovered. Bendix sees talking sonar as useful in underwater exploration, control of unmanned underwater vehicles and perhaps sub-to-sub talk. Range of about five miles might be increased by using buoy relays—which also could receive sonar signals from underwater and transmit them via radio to ship or shore stations.

—o—

Down on the Farm . . . In Britain and several other countries farmers, builders and such on-the-move workers are making use of a high-quality portable transceiver sold by Pye Ltd., Eng.

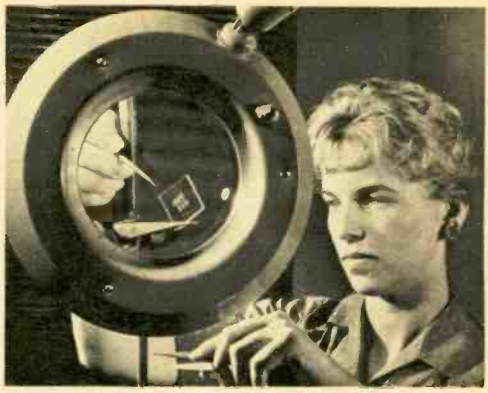
. . . News

(See photo of a farm foreman using the set.) The Handi-Ranger has a wide frequency range from 25 to 174 mc, weighs

about 20 pounds, reaches out 20 miles and contains ten tubes and 11 transistors. Price is $400 to $500.

—o—

Disappearing Act . . . Transistors started out the size of a pencil eraser and shrank so much you could balance one on the head of a pin. Now RCA is turning out experimental transistors so



tiny that 20,000 of them fit on a postage stamp. They are made by depositing thin films of semiconductor material on a glass base.

The RCA dreamers now envision a complete three-stage amplifier built on a surface only twice as wide as a human hair.

In the photo above three of the tiny transistors are shown spread out on a square of ordinary glass.

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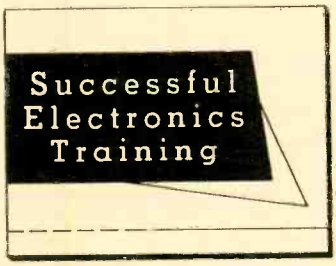

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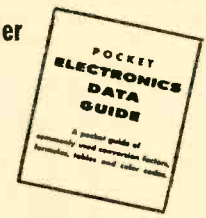

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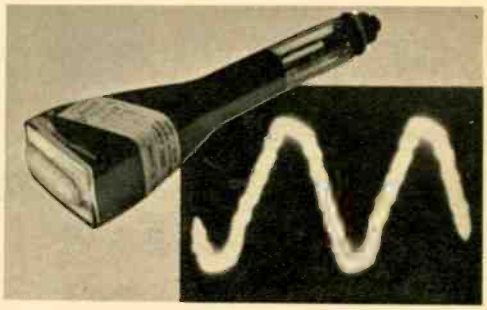
EI-37

. . .News

Going Up! . . . The success of Echo I, the 100-foot balloon now orbiting the earth as a passive reflector for short-wave signals, is spurring research on better and lighter materials for still larger satellites. Alcoa has come up with

a new "skin" consisting of foil and a plastic laminate. Chemically etched openings in the thin foil reduce the weight without affecting structural rigidity. A model balloon is shown.

Fiber-Optics Printer . . . A cathode ray printing tube with a faceplate of glass fibers has been developed by Sylvania and the American Optical Co. CRT printers usually have a lens system between faceplate and film. In this tube the film runs right in front of the plate.



Images created by the beam inside are transferred directly to the film by the quarter-inch-long glass fibers in the faceplate. Lower photo shows trace made by the tube beam on film. The tube is capable of reproducing charts, photographs, numbers and words at the rate of 10,000 lines per minute.

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Marion Woolsey, 3246 Warwick, Kansas City, Mo.	1st	12
Harold W. Johnson, 5070 Hermosa Ave., Los Angeles, Calif.	1st	15
Ralph Frederick Beisner, 2126 Grand, Joplin, Mo.	1st	12
N. B. Mills, II, 110 So. Race St., Statesville, N. C.	1st	12
Dean A. Darling, 403 S. Chase Ave., Columbus 4, Ohio	1st	12
Gerald L. Chopp, 518 Audubon Road, Kohler, Wisc.	1st	12

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28-A

. . . News

Lifesaver . . . A man in a small town comes down with a heart attack and is taken to a local hospital. The nearest heart specialist is hundreds of miles away and time is critical. How can the specialist give intelligent advice? Bell Telephone has devised a method of transmitting live electrocardiographs from the patient's bedside to the doctor via its Data-Phone system. Electrodes

are attached to the arm and chest of the patient and the nurse dials the specialist's number (top photo). Cardiac data then flow through the transmitting Data-Phone to an identical unit on the doctor's desk, coming out as a graph (bottom photo). Transmission of X-rays and other medical data via telephone lines is under study.

Electronic Marketplace

BOW-TIE ANTENNA . . . The Mite-Site is a TV antenna that is thin and flat enough to be kept out of sight behind draperies or under the rug, or, if

you like its lines, you can just pin it on the wall. It has a wingspread of five feet, is composed of silver printed circuit elements on Koroseal vinyl. About $3. RF Industries, Inc., Summit, N. J.

—o—

Instant TV . . . Do you get annoyed when you miss the first three murders on your favorite TV program because it took your set so long to warm up? Westinghouse has the answer for you with an Instant-On feature on their 1962 TV line. A portion of the circuit is designed to remain alive on reduced power at all times (as long as the line cord is plugged in). When you turn on

Marketplace

the switch, both picture and sound come in almost immediately. The stand-by circuitry consumes little power and protects the tubes from the damaging power surges of frequent on-off cycles. Westinghouse Electric Corp., 40 Wall St., New York 5, N. Y.

—o—

Double Stereo . . . Now you can—if you care to—control two pairs of stereo speakers in different parts of the house

from one location with Switchcraft's No. 670 Selector. Either pair of speakers can be cut in singly, or you can blast away with both pairs at the same time. $6.25. Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill.

—o—

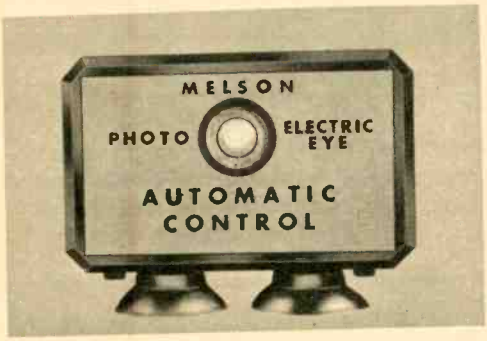
Deluxe CB . . . The Model 770 series in EICO's line of CB units is a group of high-grade transceivers featuring four-channel operation, optional crystal receiving, push-to-talk and full superheterodyne receiving circuit with adjustable squelch and series-gate noise

Marketplace

limiter. Model 770 is for AC fixed station use only; Models 771 and 772 also have 6- and 12-volt power supplies, respectively, for mobile operation. Prices for kits, about $70 and $80; for wired jobs, $100 and $110. EICO, Long Island City 1, N. Y.

—o—

Private Eye . . . A simple way to discourage footpads and second-story men when you're away from home has been devised by East Coast Enterprises.



Their Melson photo-electric eye connects to any lamp or lighting system in the house and turns it on when darkness approaches. About $5. East Coast Enterprises, 1212 Granby St., Norfolk, Va.

—o—

Line Monitor . . . Realizing that exact AC line voltage is important in the ham shack, service shop, industrial or photo

Marketplace

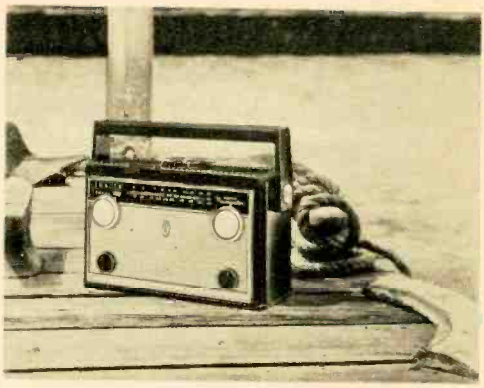
lab and other places, RCA has brought out an AC voltmeter or line monitor with an expanded and easily read scale calibrated from 100 to 140 volts. The needle action is sensitive and responds quickly to voltage fluctuations. About $15. RCA, Harrison, N. J.

—o—

Clean Clear Through . . . Minneapolis-Honeywell is marketing an electronic air purifier for use in home heating and cooling ducts (most similar equipment is for large industries). The M-H rejuvenator is a sort of open-end box measuring 8 x 22 x 22 inches. After a filter

strips out lint and large particles, the air passes a series of high-voltage DC plates which gives the remaining particles an electrical charge. A second group of plates then attracts and holds the particles having opposite polarity. A wall-mounted control panel in the living area is in handy reach of the cool owner. The M-H people claim their purifier can take out 95% of all airborne particles, including dust and pollen. The unit can be installed in a new house for approximately $350 and in an existing structure for around $400.

Three-Band Portable . . . Anyone who needs detailed weather news can use the new Zenith Royal 790. This three-band, all-transistor portable weighs 5½



pounds and works on six size C dry cells. It covers 150-400 kc, used by FAA and Canadian weather-navigation stations and radio beacons; 2-5 mc, where you can get ship-to-shore, amateur, Civil Air Patrol and Bureau of Standards time transmissions, and the broadcast band. Azimuth on top of the case gives approximate bearings of stations. Other features are a built-in Wavemagnet antenna—one for each band, and an optional earphone attachment. About $100. Zenith Sales Corp., Chicago, Ill.

—o—

Her Master's Voice . . . That's just a plain old set of Shakespeare and a little Utrillo masterpiece our blond friend is

Marketplace

eyeing. But guess what? She's hearing stereo—that's what! The books and painting hide a pair of speakers. They're designed for high-fashion decorators and homemakers who can't stand a speaker that looks like a speaker, and perhaps for those who want to keep their addiction a secret. When you tire of the Utrillo you can paint your own masterpiece right over it. Similar enclosures are being manufactured to house various other kinds of audio units. Priced from $15 to $35. Sears, Roebuck & Co., Chicago.

—o—

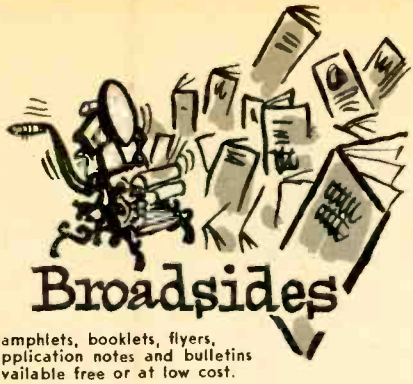
Portable With Punch . . . The Duo-Com 120 is a 28-ounce one-watt handi-talkie for Citizens Band operation. It provides far greater transmitting range than license-free 1/10-watt equipment. Using 11 transistors and two diodes, the unit works on a rechargeable battery good for 18 hours. It has squelch control, a telescoping antenna and jacks for earphone connection. The Duo-Com uses standard plug-in crystals (and comes with a channel 10 crystal unless otherwise specified). The plastic case is two-tone grey. Price $150. Osborne Electronic Sales Corp., 13105 South Crenshaw Blvd., Hawthorne, Calif.

Marketplace

Dot-And-Dash Maker . . . Ham operators who prefer using code rather than voice will be interested in Hallicrafters' new Model HA-4 transistorized digital keyer. The unit makes dots and dashes automatically at any pre-set speed, with a constant dot-dash-space ratio over its entire speed range. It is transformer-powered and can be used with practically all ham transmitters. About $60. Hallicrafters, Chicago, Ill.

Ham Receiver . . . The newest addition (just now going on the market) to National's line of ham gear is the NC-155 receiver. National claims high sensitivity and stability for the new rig, which has double conversion on 80

through 6 meters. The specs list a sensitivity of 1 microvolt for 10 db signal-to-noise ratio on all bands, including 6 meters. Price for the receiver is $199.95 plus $19.95 for matching speaker. National Radio Co., Melrose, Mass.



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

A non-technical booklet explaining **How New FM Multiplex Stereo Works** may be obtained free from H. H. Scott, 111 Powdermill Rd., Maynard, Mass. It includes tips on what to buy and how to convert mono equipment (using Scott's products, of course).

In text, pictures and diagrams a new four-page booklet, **Why Stereo?**, gives the reader a basic concept of stereo hi-fi that is clear and simple. Free from EICO, 33-00 Northern Blvd., Long Island City, N. Y.

For replacement of tape recorder heads, you'll want to consult **Tape Recording Head Reference Guide** which lists 38 domestic manufacturers' models and their suitable replacements. Send 50¢ to Robins Industries Corp., 36-27 Prince St., Flushing 54, N. Y. (free to servicemen and industries).

An illustrated booklet on selecting **tape recorders** and tapes is available free from the National Better Business Bureau, 230 Park Ave., New York, N. Y.

Hard-to-find electronic items are included in **Barry's Green Sheet,** free from Barry Electronics Corp., 512 Broadway, New York 12, N. Y.

The products of 150 manufacturers are included in DeMambro Radio Supply's industrial **electronic catalog.** Free from Electronic Publishing Co., 133 N. Jefferson St., Chicago 6, Ill.

Browning **CB equipment specs** are listed in a free flyer offered by Browning Labs, Laconia, N. H.

1962 Catalogs are available, free for the asking, from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y.; Radio Shack, 730 Commonwealth Ave., Boston 17, Mass.; Heath Co., Benton Harbor, Mich., and Allied Radio, 100 N. Western Ave., Chicago 80, Ill.

EI's

24-HOUR SHORT-WAVE SCHEDULE OF ENGLISH-LANGUAGE PROGRAMS

With EI's 24-Hour Schedule at hand, a Short-Wave Listener will never be at a loss about where to find an English-language program on his dial. By consulting our schedule any time of the day or night, he can determine which international broadcaster is on the air in English, his frequency and the identification and location of his transmitter. The listings on the next eight pages are unusual in that they represent a broad scope of programs —news, music, discussions, commentaries, etc. Time designations are all Eastern Standard, eliminating bothersome conversion from GMT. Some of the stations are easy to receive virtually anywhere in the United States or Canada, while others are a challenge to the SWLer. Our program listings have been compiled from the latest schedules issued by the stations themselves and from reports by North American DXers. A detailed reception report sent to nearly any station will earn you an attractive QSL card for the wall of your shack. To make a handy stand-up version of EI's schedule like the one pictured on our cover, see the last page of our listings. Also pictured on the cover is a Hallicrafters S-120 receiver and radio shack clocks by Mastercrafters of Chicago. On the shelf are test and calibration instruments.

EI's
24-HOUR SHORT-WAVE SCHEDULE

ABBREVIATIONS USED IN THIS SCHEDULE

*—Programs beamed to North America and others offering especially good reception.
†—Strongest reception in Western U.S.
BC—Broadcasting Company (or Station)
R—Radio
V—Voice

All times listed are Eastern Standard Time. To convert, subtract 1 hour for Central Standard Time, 2 hours for Mountain Standard Time and 3 hours for Pacific Standard Time.

TIME (EST)	FREQ. (kc)	CALL	STATION NAME	LOCATION
12 MIDNIGHT				
	6035	3AM3	Ici Monte Carlo	Monte Carlo, Monaco (Fri.)
	7140	3AM4	Ici Monte Carlo	Monte Carlo, Monaco (Fri.)
	7265		VTVN	Saigon, Vietnam
	9525*	JOB9	NHK	Tokyo, Japan
	11800*	JOA11	NHK	Tokyo, Japan
	15235	JOA15	NHK	Tokyo, Japan
	17825	JOA17	NHK	Tokyo, Japan
12:15 A.M.				
	6130		R. Nacional	Madrid, Spain
	7105		R. Brazzaville	Brazzaville, Congo
	9366		R. Nacional	Madrid, Spain
	9730		R. Brazzaville	Brazzaville, Congo
	15445		R. Brazzaville	Brazzaville, Congo
12:30 A.M.				
	4915		Ghana B.C.	Accra, Ghana
	7200		R. Malaya	Singapore, Malaya (Mon., Thur.)
	11930	HLK6	V. Free Korea	Seoul, Korea
	15125	HLK41	V. Free Korea	Seoul, Korea
	17890	HLK42	V. Free Korea	Seoul, Korea
1 A.M.				
	4990		Nigerian B.C.	Lagos, Nigeria
	6095		V. America	Munich, Germany
	7205		V. America	Tangier, Tangiers
	7255		Nigerian B.C.	Lagos, Nigeria
	7265		V. America	Colombo, Ceylon
	9540	ZL2	New Zealand Calling	Wellington, N.Z.
	9650		R. S. Africa	Johannesburg, S. Africa
1:15 A.M.				
	9520	VLT9	Australian B.C.	Port Moresby, New Guinea
1:30 A.M.				
	7050		United Arab B.C.	Cairo, Egypt
	9745	HCJB	V. Andes	Quito, Ecuador
	11664		United Arab B.C.	Cairo, Egypt
	11915	HCJB	V. Andes	Quito, Ecuador

TIME (EST)	FREQ. (kc)	CALL	STATION NAME	LOCATION
2 A.M.				
	7125	XZK4	Burma B.C.	Rangoon, Burma (ex. Mon.)
	9510	GSB	BBC	London, England
	9540	XZK5	Burma B.C.	Rangoon, Burma (ex. Mon.)
	11785		V. America	Tangier, Tangiers
	15385		V. America	Tangier, Tangiers
2:30 A.M.				
	7235		R. Ceylon	Colombo, Ceylon
3 A.M.				
	6130*†	VLT6	Australian B.C.	Port Moresby, New Guinea
3:30 A.M.				
	9510*†	GSB	BBC	London, England
	9630	CKLO	R. Canada	Montreal, P.Q.
	9840		V. Vietnam	Hanoi, N. Vietnam
	11840		V. Vietnam	Hanoi, N. Vietnam
	17745		R. Pakistan	Karachi, Pakistan
	21590		R. Pakistan	Karachi, Pakistan
4 A.M.				
	4785		Tanganyika B.C.	Dar-Es-Salaam, Tanganyika
	5960	VQO2	Solomon Is. B.C.	Honiara, Solomon Is.
	7280		Tanganyika B.C.	Dar-Es-Salaam, Tanganyika
	9540	ZL2	New Zealand Calling	Wellington, N.Z.
4:15 A.M.				
	5981	ZFY	R. Demerara	Georgetown, Brit. Guiana
4:30 A.M.				
	6035	HLK52	V. Free Korea	Seoul, Korea
	9640	HLK5	V. Free Korea	Seoul, Korea
4:45 A.M.				
	6125	4VEC	V. Evangelique	Cap Haitien, Haiti (Mon.-Fri.)
	9770	4VWI	V. Evangelique	Cap Haitien, Haiti (Mon.-Fri.)
	11835	4VWI	V. Evangelique	Cap Haitien, Haiti (Mon.-Fri.)
	21520	4VWI	V. Evangelique	Cap Haitien, Haiti (Mon.-Fri.)
5 A.M.				
	15185		V. America	N. Luzon, Philippines
	15270	VUD	All India R.	Delhi, India
	15395		Windward Is. B.C.	St. Georges, Windward Is.
	17730	VUD	All India R.	Delhi, India
	17830	VUD	All India R.	Delhi, India
5:30 A.M.				
	11910	HSK9	Overseas B.C.	Bangkok, Thailand
6 A.M.				
	9585	YDF6	V. Indonesia	Djakarta, Indonesia
	11795	YDF3	V. Indonesia	Djakarta, Indonesia

TIME (EST)	FREQ. (kc)	CALL	STATION NAME	LOCATION
	17855		R. S. Africa	Johannesburg, S. Africa (TuThSa)
	21495		R. S. Africa	Johannesburg, S. Africa (TuThSa)
6:30 A.M.				
	11800		R. Warsaw	Warsaw, Poland
	11960*	OIX2	Finnish B.C.	Helsinki, Finland (autumn & winter; Tue. only)
	15190*	OIX4	Finnish B.C.	Helsinki, Finland (autumn & winter; Tue. only)
	17800*	OIX5	Finnish B.C.	Helsinki, Finland (autumn & winter; Tue. only)
7 A.M.				
	11875		V. America	Colombo, Ceylon
7:15 A.M.				
	11710*	VLA11	R. Australia	Melbourne, Australia
7:30 A.M.				
	11800*		R. Warsaw	Warsaw, Poland
	15275*		R. Warsaw	Warsaw, Poland
	17800*		R. Warsaw	Warsaw, Poland
7:45 A.M.				
	9520		R. Ceylon	Colombo, Ceylon
	9525		Ghana B.C.	Accra, Ghana
8 A.M.				
	6250		Korean Central B.C.	Pyongyang, N. Korea
	15245		Paris Vous Parle	Paris, France
	17765		Paris Vous Parle	Paris, France
	21620		Paris Vous Parle	Paris, France
8:15 A.M.				
	11895		R. Senegal	Dakar, Senegal
8:30 A.M.				
	17705	VUD	All India R.	Delhi, India
	17735	VUD	All India R.	Delhi, India
8:45 A.M.				
	17880	CSA45	Lisbon Calling	Lisbon, Portugal
	21495	CSA67	Lisbon Calling	Lisbon, Portugal
9 A.M.				
	7160		Paris Vous Parle	Paris, France (Sat.-Sun.)
	11690		R. Tashkent	Tashkent, Uzbek, U.S.S.R.
	15115*	HCJB	V. Andes	Quito, Ecuador
	17840*		R. Sweden	Stockholm, Sweden
	17890*	HCJB	V. Andes	Quito, Ecuador
9:30 A.M.				
	9585	YDF6	V. Indonesia	Djakarta, Indonesia
	11793	YDF3	V. Indonesia	Djakarta, Indonesia
	11930*	HLK6	V. Free Korea	Seoul, Korea
	25750	GSQ	BBC	London, England

TIME (EST)	FREQ. (kc)	CALL	STATION NAME	LOCATION
10 A.M.				
	11810*†	VLC11	R. Australia	Melbourne, Australia
	15120		Vatican R.	Vatican City
10:30 A.M.				
	9505		R. Belgrade	Belgrade, Yugoslavia
	11735		R. Belgrade	Belgrade, Yugoslavia
	15145		R. Pakistan	Karachi, Pakistan
	15240		R. Belgrade	Belgrade, Yugoslavia
11 A.M.				
	11920	DZF2	Call of the Orient	Manila, Philippines
	11930*†	HLK6	V. Free Korea	Seoul, Korea
	17865		Ghana B.C.	Accra, Ghana
	25880		V. America	Tangier, Tangiers
11:45 A.M.				
	7200		R. Belgrade	Belgrade, Yugoslavia
	9505		R. Belgrade	Belgrade, Yugoslavia
	15240		R. Belgrade	Belgrade, Yugoslavia
12 NOON				
	9770*†		R. Peking	Peking, China
	11755		R. Congo	Leopoldville, Congo
	11780	ZL3	New Zealand Calling	Wellington, N.Z.
	15280	ZL4	New Zealand Calling	Wellington, N.Z.
	15440		V. America	Munich, Germany
	17820	ZL14	New Zealand Calling	Wellington, N.Z.
	17855		S. African B.C.	Johannesburg, S. Africa
12:30 P.M.				
	11720		R. Athens	Athens, Greece
	15345		R. Athens	Athens, Greece
12:45 P.M.				
	9525		Ghana B.C.	Accra, Ghana
1 P.M.				
	6090		R. Luxembourg	Junglinster, Luxembourg
	12095	GRF	BBC	London, England
	15285		Ghana, B.C.	Accra, Ghana
1:15 P.M.				
	9009	4XB31	V. Israel	Tel Aviv, Israel
	11685		Vatican R.	Vatican City
	11922	4XB27	V. Israel	Tel Aviv, Israel
	11955		R. Addis Ababa	Addis Ababa, Ethiopia
	15120		Vatican R.	Vatican City
	15380		Emisora Nacional	Lisbon, Portugal
	17775		R. Addis Ababa	Addis Ababa, Ethiopia
	17895		Emisora Nacional	Lisbon, Portugal
1:30 P.M.				
	6100		R. Belgrade	Belgrade, Yugoslavia
	9505		R. Belgrade	Belgrade, Yugoslavia
	11735		Moroccan B.C.	Rabat, Morocco

TIME (EST)	FREQ. (kc)	CALL	STATION NAME	LOCATION
2 P.M.				
	9586	YDF6		Djarkarta, Indonesia
	11710	YDF6		Djarkarta, Indonesia
	17855		R. South Africa	Johannesburg, S. Africa
	9410	GRI	BBC	London, England
2:30 P.M.				
	9705		Trans World R.	Monte Carlo, Monaco
	9760*	ORU3	Belgian R.	Brussels, Belgium
	15165		Damascus Calling	Damascus, Syria
2:45 P.M.				
	15150	VUD	All India R.	Delhi, India
	17705	VUD	All India R.	Delhi, India
3 P.M.				
	6140*	ORU3	Belgian R.	Brussels, Belgium
	11755		R. Congo	Leopoldville, Congo
	15400		Windward Is. B.C.	St. Georges, Windward Is.
3:15 P.M.				
	9009	4XB31	V. Israel	Tel Aviv, Israel
	17773		R. Addis Ababa	Addis Ababa, Ethiopia
3:30 P.M.				
	11720	CHOL	R. Canada	Montreal, P.Q.
	11960*	OIX2	Finnish B.C.	Helsinki, Finland (Mon.)
	15190*	OIX4	Finnish B.C.	Helsinki, Finland (Mon.)
	15320	CKCS	R. Canada	Montreal, P.Q.
	17800*	OIX5	Finnish B.C.	Helsinki, Finland (Mon.)
4 P.M.				
	6020	PGD	R. Netherland	Hilversum, Netherlands
	9590		R. Netherland	Hilversum, Netherlands
	11730	PHI	R. Netherland	Hilversum, Netherlands
	15150	OAX4R	R. Nacional de Peru	Lima, Peru (Mon.-Wed.-Fri.)
	15440		V. America	Munich, Germany
4:15 P.M.				
	11860*	GSE	BBC	London, England
	15375*		BBC	London, England
4:30 P.M.				
	11915		United Arab B.C.	Cairo, Egypt
5 P.M.				
	6235		R. Addis Ababa	Addis Ababa, Ethiopia
	7220		R. Addis Ababa	Addis Ababa, Ethiopia
5:15 P.M.				
	9510*	GSB	BBC	London, England
5:30 P.M.				
	5955	ZAA	R. Tirana	Tirana, Albania

TIME (EST)	FREQ. (kc)	CALL	STATION NAME	LOCATION
	6010*		RAI	Rome, Italy
	9825*	GRH	BBC	London, England
5:45 P.M.				
	11835	4VWI	V. Evangelique	Cap Haitien, Haiti
6 P.M.				
	7000	EFE34	R. Atlantico	Las Palmas, Canary Is. (Sat.)
	7150		R. Moscow	Moscow, U.S.S.R.
	(also on 7210, 7290, 7390, 9570, 9610, 9620, 9660, 9690, 9720)			
	9490	EFE34	R. Atlantico	Las Palmas, Canary Is. (Sat.)
	11730	LRA35	R. Nacional	Buenos Aires, Argentina
	11760	CKRA	R. Canada	Montreal, P.Q.
	15190	CKCX	R. Canada	Montreal, P.Q.
6:15 P.M.				
	3255		R. Antigua	Antigua, Leeward Is.
	9515	TAT	Ankara R.	Ankara, Turkey
	9760	ORU3	Belgian R.	Brussels, Belgium
6:30 P.M.				
	6000*		R. Swan	Swan Island
	9580	GSC	BBC	London, England
	9700*		Sofia Calling	Sofia, Bulgaria
	11820	GSN	BBC	London, England
	11850*		Sofia Calling	Sofia, Bulgaria
	17805	DZ16	Call of the Orient	Manila, Philippines
	21515	DZ18	Call of the Orient	Manila, Philippines
7 P.M.				
	3300		Brit. Hond. B.C.	Belize, Brit. Honduras (ex. Sat.)
	7220*		This is Budapest	Budapest, Hungary
	9640*	DMQ9	Deutsche Welle	Cologne, Germany
	9833*		This is Budapest	Budapest, Hungary
	11720	ORU4	Belgian R.	Brussels, Belgium
	11795*	DMQ11	Deutsche Welle	Cologne, Germany
	11910*		This is Budapest	Budapest, Hungary
7:15 P.M.				
	6110*	GSL	BBC	London, England
	6130*†		R. Nacional	Madrid, Spain
	9363*†		R. Nacional	Madrid, Spain
7:30 P.M.				
	9575*		RAI	Rome, Italy
	9675*		R. Warsaw	Warsaw, Poland
	11800*		R. Warsaw	Warsaw, Poland
	11905*		RAI	Rome, Italy
	15135*	JOA15	NHK	Tokyo, Japan
	15160	VUD	All India R.	Delhi, India
	15275*		R. Warsaw	Warsaw, Poland
	17725*	JOA17	NHK	Tokyo, Japan
	21520*	JOA21	NHK	Tokyo, Japan
7:45 P.M.				
	11765	CP39	Southern Cross R.	La Paz, Bolivia (Mon.-Wed.-Fri.)

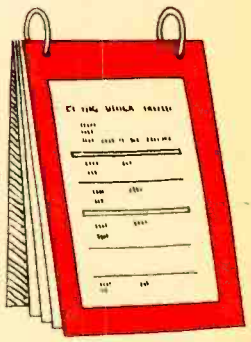
TIME (EST)	FREQ. (kc)	CALL	STATION NAME	LOCATION
8 P.M.				
	9480*		R. Peking	Peking, China
	9565	ZYK3	R. Jour. do Comercio	Recife, Brazil
	9585*†	CKLP	R. Canada	Montreal, P.Q.
	9700*		Sofia Calling	Sofia, Bulgaria
	9725*		R. Sweden	Stockholm, Sweden
	11720*†	CHOL	R. Canada	Montreal, P.Q.
	11825*	ELWA	R. Village	Monrovia, Liberia (Tue.)
	11945*		R. Peking	Peking, China
	15155*	ELWA	R. Village	Monrovia, Liberia (Tue.)
	21535*	ELWA	R. Village	Monrovia, Liberia (Tue.)
8:15 P.M.				
	11725		R. Brazzaville	Brazzaville, Congo
8:30 P.M.				
	4852		AVROS	Paramaribo, Surinam
	5980*		Bucharest Calling	Bucharest, Rumania
	(also on 6190, 7195, 7225, 9510, 11810)			
	6095	BED29	V. Free China	Taipei, Formosa
	6165*	HER3	Switzerland Calling	Berne, Switzerland
	9520*	OZF5	V. Denmark	Copenhagen, Denmark
	9535*	HER4	Switzerland Calling	Berne, Switzerland
	11840		V. Vietnam	Hanoi, N. Vietnam
	11865*	HER5	Switzerland Calling	Berne, Switzerland
	15235*	BED3	V. Free China	Taipei, Formosa
	15265		R. Ceylon	Colombo, Ceylon
	15465		AVROS	Paramaribo, Surinam
	17785*	BED56	V. Free China	Taipei, Formosa
	17890*	BED40	V. Free China	Taipei, Formosa
8:45 P.M.				
	11805*		R. Sweden	Stockholm, Sweden
9 P.M.				
	3285	HI7T	V. Dominican	C. Trujillo, Dominican Rep.
	5970	HI4T	V. Dominican	C. Trujillo, Dominican Rep.
	9735	HI2T	V. Dominican	C. Trujillo, Dominican Rep.
	(Usually heard all day on this frequency.)			
	9745*	HCJB	V. Andes	Quito, Ecuador
	11835*		V. America	Colombo, Ceylon
	11915*	HCJB	V. Andes	Quito, Ecuador
	15115*	HCJB	V. Andes	Quito, Ecuador
	15150*	OAX4T	R. Nacional	Lima, Peru (Fri.)
9:30 P.M.				
	9675*		R. Warsaw	Warsaw, Poland
	9725*†		R. Sweden	Stockholm, Sweden
	11815*		R. Warsaw	Warsaw, Poland
	15275*		R. Warsaw	Warsaw, Poland
10 P.M.				
	4845	HJGF	R. Bucaramanga	Bucaramanga, Colombia
	5935*		This is Prague	Prague, Czechoslovakia
	5952	TGNA	R. Cultural	Guatemala City, Guatemala
	6101	V3USE	Mauritius B.C.	Forest Side, Mauritius
	7340*		This is Prague	Prague, Czechoslovakia
	9520*†	OZF5	V. Denmark	Copenhagen, Denmark
	9550*	OLR3A	This is Prague	Prague, Czechoslovakia
	9640*†	DMQ9	Deutsche Welle	Cologne, Germany

TIME (EST)	FREQ. (kc)	CALL	STATION NAME	LOCATION
	9668	TGNB	R. Cultural	Guatemala City, Guatemala
	9690*	LRA32	R. Nacional	Buenos Aires, Argentina (ex. Sat., Sun.)
	11795*†	DMQ11	Deutsche Welle	Cologne, Germany
	11805*†		R. Sweden	Stockholm, Sweden
	11820		R. Peking	Peking, China
	11850*†		R. Moscow	Moscow, U.S.S.R.
	17810		R. Peking	Peking, China
10:15 P.M.				
	6125	GWA	BBC	London
	6130*		R. Nacional	Madrid, Spain
	9366*		R. Nacional	Madrid, Spain
	9575*		RAI	Rome, Italy
10:30 P.M.				
	7220*		This is Budapest	Budapest, Hungary
	9833*		This is Budapest	Budapest, Hungary
	11910*		This is Budapest	Budapest, Hungary
11 P.M.				
	6037	TIFC	Lighthouse of Carib.	San Jose, Costa Rica
	6165*	HER3	Switzerland Calling	Berne, Switzerland
	9535*	HER4	Switzerland Calling	Berne, Switzerland
	9565		R. Sarawak	Kuching, Sarawak (Thur.-Sat.-Sun.)
	9610*†	LLG	R. Norway	Oslo, Norway
	9645	TIFC	Lighthouse of Carib.	San Jose, Costa Rica
	9700*		Sofia Calling	Sofia, Bulgaria
	11770	GVU	BBC	London, England
	11865*	HER5	Switzerland Calling	Berne, Switzerland
	17745		R. Peking	Peking, China
11:30 P.M.				
	5050	ZK1ZA	R. Raratonga	Raratonga, Cook Is. (Thur.)
	5980*		Bucharest Calling	Bucharest, Rumania
	(also on 6190, 7195, 7225, 9510, 11810)			
	11910*	HSK7	R. Thailand	Bangkok, Thailand
	17805	DZ16	Call of the Orient	Manila, Philippines
	21515	DZ18	Call of the Orient	Manila, Philippines

HOW TO MAKE A HANDY STAND-UP SCHEDULE

CUT OUT SCHEDULE WITH RAZOR BLADE. USE 2 COPIES OF EI, ONE FOR THE RIGHT-HAND PAGES, THE OTHER FOR THE LEFT. (OR HAVE PHOTO-STATS MADE)

PASTE PAGES ON WHITE OR COLORED CARDBOARDS. LEAVE MARGINS AROUND PAGES.



PUNCH HOLES AT TOP OF CARDBOARDS. INSERT LOOSE-LEAF RINGS.

EI's NEW DX AWARDS

FOR SHORT-WAVE LISTENERS

ELECTRONICS ILLUSTRATED takes pride in announcing a new series of DX Awards for Short-Wave Listeners. Each award is a handsome certificate measuring 5⅜ by 8⅜ inches (see full-color reproduction on our cover).

The certificate, stamped and signed, is official recognition of your achievement in DXing. It makes an attractive addition to a listening shack, one in which you can take special pride because it was *earned*.

To administer the awards efficiently, we have created an "EI DX Club." In qualifying for an award, you become a member of the club. EI will publish the names of all award winners.

How to qualify: Clip out the log on the opposite page and fill in (we suggest using a pencil or ballpoint pen). List countries from which you have received *verification* of reception reports (authenticated by QSL cards or letters). Then send it to:

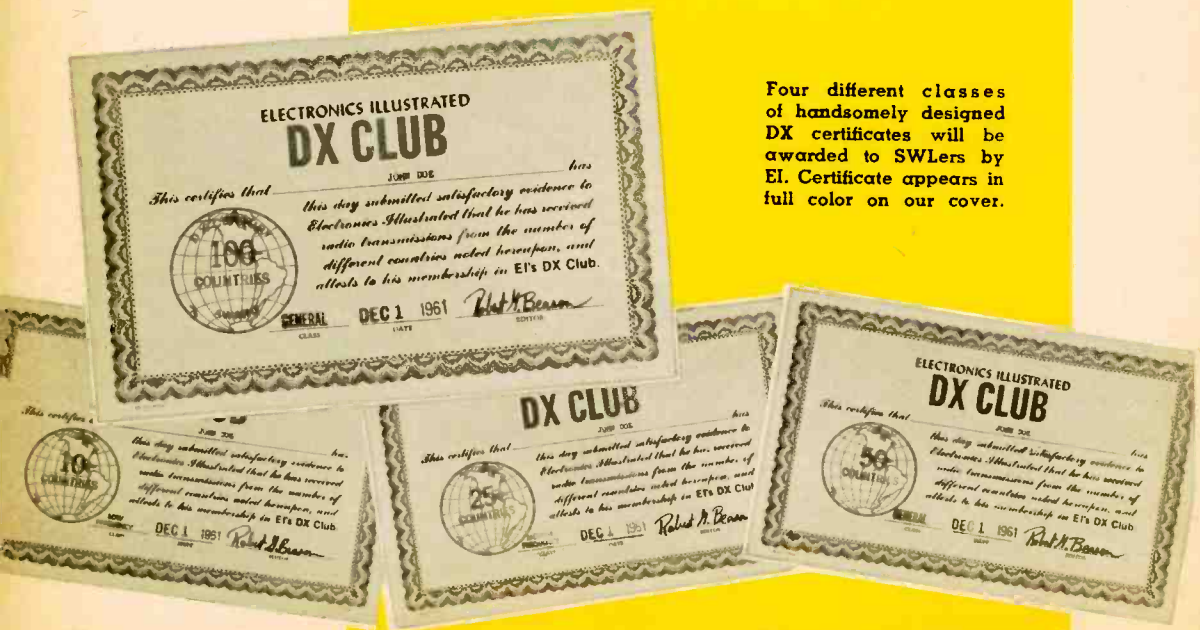
EI's DX Club
67 West 44th St.
New York 36, N. Y.

Do *not* send QSL's. Later, in the process of verifying your log, we may request that you send us one or more *specific* QSL's for inspection. These will be returned promptly.

[*Continued on page* 106]

AWARD REQUIREMENTS

Class	Frequency Limits	Countries Needed
1. General (Century Award)	None	100
2. General	None	50
3. Medium Frequency	535 kc to 3 mc	25
4. Low Frequency	535 kc and lower	10



Four different classes of handsomely designed DX certificates will be awarded to SWLers by EI. Certificate appears in full color on our cover.

EI DX CLUB LOG

NAME ..... ADDRESS .....

CITY ..... STATE .....

CLASS AWARD APPLIED FOR ..... YOUR RECEIVER .....

INSTRUCTIONS: Clip along broken line at left. In 'Class' blank write number of class from chart on opposite page. Give brand and model of receiver. Use figures (such as 12-1-61) in date column. Use local standard time and the 24-hour clock (0000 to 2359). Fill in all items for each entry. To list second 50 countries, make up additional log pages similar in style to this one. All log entries must be dated Jan. 1, 1950, or later. First award period ends March 1, 1962.

	DATE (local)	TIME (local)	FREQUENCY (kc)	STATION	LOCATION (city)	COUNTRY	TYPE OF QSL (check one)
1							card ☐ letter ☐
2							card ☐ letter ☐
3							card ☐ letter ☐
4							card ☐ letter ☐
5							card ☐ letter ☐
6							card ☐ letter ☐
7							card ☐ letter ☐
8							card ☐ letter ☐
9							card ☐ letter ☐
10							card ☐ letter ☐
11							card ☐ letter ☐
12							card ☐ letter ☐
13							card ☐ letter ☐
14							card ☐ letter ☐
15							card ☐ letter ☐
16							card ☐ letter ☐
17							card ☐ letter ☐
18							card ☐ letter ☐
19							card ☐ letter ☐
20							card ☐ letter ☐
21							card ☐ letter ☐

	DATE (local)	TIME (local)	FREQUENCY (kc)	STATION	LOCATION (city)	COUNTRY	TYPE OF QSL (check one)
22							card ☐ letter ☐
23							card ☐ letter ☐
24							card ☐ letter ☐
25							card ☐ letter ☐
26							card ☐ letter ☐
27							card ☐ letter ☐
28							card ☐ letter ☐
29							card ☐ letter ☐
30							card ☐ letter ☐
31							card ☐ letter ☐
32							card ☐ letter ☐
33							card ☐ letter ☐
34							card ☐ letter ☐
35							card ☐ letter ☐
36							card ☐ letter ☐
37							card ☐ letter ☐
38							card ☐ letter ☐
39							card ☐ letter ☐
40							card ☐ letter ☐
41							card ☐ letter ☐
42							card ☐ letter ☐
43							card ☐ letter ☐
44							card ☐ letter ☐
45							card ☐ letter ☐
46							card ☐ letter ☐
47							card ☐ letter ☐
48							card ☐ letter ☐
49							card ☐ letter ☐
50							card ☐ letter ☐

YOUR FIRST 100 COUNTRIES

Here's how to become an award-winning SWL-er!

HOW do you get QSL's from 50 or 100 countries to qualify for one of EI's new DX awards? What countries should you try? Here is a list of stations in 100 countries which can be received nearly everywhere in the United States, and all verify faithfully. Most are broadcast stations, although a few aeradios (beacons) also appear. If a station doesn't come in the first time you listen, try again. DX conditions vary continually. An asterisk (*) after a frequency listing means the frequency is approximate or varies. Other abbreviations are obvious: R.—Radio; V.—Voice; B.C. or B.S.—Broadcasting company or service; Aft.—Afternoon; Eve.—Evening, etc.

	COUNTRY	STATION, CALL	KC	TIME	ADDRESS
1.	Algeria	R. Alger	11835	Aft.	Algiers
2.	Andorra	Andorradio	6305	Late aft.	Andorra
3.	Angola	Emissora Oficial, CR6RZ	17705	Aft.	Luanda
4.	Argentina	RAE	11730	Eve.	Buenos Aires
5.	Australia	R. Australia	11710	0715 EST	Melbourne
			11810	0715 PST	
6.	Austria	Osterreichischer R., OE121	6155	Late aft.	Vienna
7.	Azores	Santa Maria Aeradio, CSY	13284.5	Day	Santa Maria Aeropuerto
8.	Bahamas	ZNS	1540	Early eve.	Nassau
9.	Bahrein	Bahrein Aeradio, 2AE	8845	Aft.	Bahrein
10.	Belgium	Radiodiffusion Natl. Belge	9765	Early eve.	Brussels
11.	Bermuda	ZBM, ZBM1	1235	Night	Hamilton
12.	Brazil	R. Dragao de Mar, ZYH29	4775	Eve.	Recife
13.	Br. Guiana	R. Demerara, ZFY	3265	Early eve.	Georgetown
14.	Canada	CBC, CKRA	11760	Eve.	Montreal
15.	Ceylon	V. America	11875	Morn.	Colombo
16.	Chile	Sociedad Nacional de Mineira, CE1196	11960	Eve.	Santiago (Casilla 2626)
17.	China	R. Peking	12010	Early eve.	Peking
18.	Colombia	Nueva Granada, HJKJ	6160*	Eve.	Bogota
19.	Congo Rep.	R. Brazzaville	11725	P.M.	Brazzaville (BP 108)
20.	Costa Rica	Faro del Caribe, TIFC	9645	Eve.	San Jose (Apt. 2710)
21.	Cuba	R. Havana	11770*	Eve.	Havana (Apt. 7026)
22.	Cyprus	BBC	9650	Eve.	Nicosia
23.	Czechoslo'ia	R. Prague, OLR3A	9550	Eve.	Prague
24.	Dom. Rep.	R. Caribe, HI4U	5050	Day	Ciudad Trujillo
25.	E. Germany	R. Berlin International	9735	P.M.	E. Berlin
26.	Ecuador	V. Andes, HCJB	11915	Night	Quito (Casilla 691)
27.	Eire	Shannon Aeradio, EIP	5671.5	Night	Shannon Airport
28.	El Salvadore	R. Nacional, YSS	655	Eve.	San Salvador
29.	England	BBC, GRV	12040	Eve.	London
30.	Ethiopia	R. Addis Ababa	11955	Early aft.	Addis Ababa
31.	France	Radiodiffusion Francais	17850	Mid aft.	Paris
32.	Guam	Guam Aeradio	8862.5	Early A.M.	Guam (c/o FAA)
33.	Ghana	R. Ghana	11800*	1400 EST	Accra

	COUNTRY	STATION, CALL	KC	TIME	ADDRESS
34.	Guatemala	R. Nacional, TGQB	11700*	Any	Quezaltenango
35.	Guadeloupe	Guadeloupe Aeradio, HYG	8837	Aft.	Point a Pitre
36.	Haiti	4VEC	6135	Eve.	Cap-Haitien
37.	Honduras	La Voz de Suyapa, HRDS	9705	Eve.	San Pedro Sula
38.	Hungary	R. Budapest	11910	Eve.	Budapest
39.	Iceland	Keflavik Aeradio, AJM2	11228	Aft.	Keflavik (USAF)
40.	India	All India R., VUD	11710	Eve.	Delhi
41.	Indonesia	R. Republic Indonesia, YDF6	9585	Morn.	Djakarta
42.	Iraq	Baghdad	7180	Late eve.	Baghdad
43.	Israel	Kol Israel, 4XB31	9009	Aft.	Jerusalem
44.	Italy	RAI	11904	Early eve.	Rome
45.	Japan	R. Japan	11800	Eve.	Tokyo (NHK)
46.	Jordan	Hashmite B.S.	11810	Aft.	Amman
47.	Lebanon	Lebanese B.S.	8022	Eve.	Beirut
48.	Liberia	ELWA	15120	1515 EST	Monrovia
49.	Luxembourg	R. Luxembourg	6090	Late aft.	Luxembourg
50.	Malta	Malta Aeradio, ZBJ	13334.5	Aft.	Malta (RAF)
51.	Martinique	R. Martinique	5998*	Early eve.	Fort de France
52.	Mexico	V. Latin America, XEWW	9500	Any	Mexico, D.F.
53.	Monaco	Transworld R.	9705	0230 EST	Monte Carlo
54.	Morocco	V. America	11785	P.M.	Tangiers
55.	Mozambique	R. Clube de Mozambique	11760	0330 EST	Lourenco Marques
56.	Netherlands	R. Nederland	9590	Eve.	Hilversum
57.	N. Caledonia	R. Noumea	6035	Early A.M.	Noumea
58.	New Zealand	New Zealand B.S., ZL2	9540	Early A.M.	Wellington
59.	Nicaragua	Ondas del Luz, YNOL	825	Eve.	Managua (Apt. 607)
60.	Nigeria	Western Nigeria B.S.	6185	2400 EST	Ibadan
61.	Norfolk I.	Norfolk Aeradio	8845.5	Early A.M.	Norfolk I.
62.	N. Korea	R. Pyongyang	6195	Early A.M.	Pyongyang
63.	N. Vietnam	V. Vietnam	9840	0530 EST	Hanoi
64.	Norway	R. Norway, LLK	11850	Eve.	Oslo
65.	Okinawa	V. America	11960	Morn.	Okinawa
66.	Pakistan	R. Pakistan	9595	Late aft.	Karachi
67.	Panama C.Z.	Panama Aeradio, WHZ	1540	Early eve.	Balboa (c/o FAA)
68.	Paraguay	R. Nacional, ZPA1	11940	Eve.	Asuncion
69.	Peru	R. Nacional, OAX4R	9530	Eve.	Lima
70.	Philippines	V. America	15185	1800 EST	Malolos
71.	Poland	R. Warsaw	11805	Eve.	Warsaw
72.	Portugal	Emisora Nacional, CSA45	17880	1215 EST	Lisbon
73.	Puerto Rico	San Juan Aeradio, WWA	8871	Day	San Juan Airport
74.	Rep. Congo	R. Leopoldville	11755	P.M.	Leopoldville (BP 3471)
75.	Rhodesia	Salisbury Aeradio	13304.5	Aft.	Salisbury Airport
76.	Rumania	R. Bucharest	11810	Late eve.	Bucharest
77.	Russia	R. Moscow	11890	Eve.	Moscow
78.	Senegal	National Station	11895	Aft.	Dakar
79.	Siberia	R. Khabarovsk	12015	Night	Khabarovsk
80.	Singapore	BBC	11955	Early A.M.	Singapore
81.	Solomon Is.	VQO2	5960	Early A.M.	Honiara
82.	S. Africa	Springbok R.	7185	0515 EST	Johannesburg
83.	S. Korea	Korean B.S., HLK6	11930	2400 EST	Seoul
84.	Spain	R. Nacional	9360	Late eve.	Madrid
85.	Sudan	Khartoum Aeradio, STK	13334.5	Aft.	Khartoum Airport
86.	Sweden	R. Sweden	9725	Eve.	Stockholm
87.	Swan I.	R. Swan	6000	Eve.	Swan I. (c/o Gibraltar Steamship Corp., 29 Broadway, NYC 22)
88.	Surinam	R. Surinam, PZC	15465	Early eve	Paramaribo
89.	Switzerland	Swiss Broadcasting, HER3	11865	Eve.	Berne
90.	Taiwan	V. Free China, BED29	6095	Eve.	Taipei
91.	Thailand	Overseas Bc. Station, HSK7	11910	0500 EST	Bangkok
92.	Tunisia	Radiodiffusion Tunisienne	11970	Aft.	Tunis
93.	U. Arab Rep.	R. Cairo	11915	Aft.	Cairo
94.	Uruguay	R. Electrica, CXA10	11900	Eve.	Montevideo
95.	U. S.	V. America	9650	0400 EST	Honolulu
96.	Vatican	Vatican R.	11740	Eve.	Vatican City
97.	Venezuela	Radio Continente, YVKM	5030	Eve.	Caracas (Apt. 866)
98.	W. Germany	Deutsch Welle, DMQ11	11945	Eve.	Cologne
99.	Windward Is.	Windward Is. B.S.	11975	Early eve.	Grenada
100.	Yugoslavia	R. Belgrade	9505	Eve.	Belgrade

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Edgar Wesotzke

Thanks to N.T.S. I have a business of my own right in my home. I am still in the Air Force but I have paid for all my equipment with money earned servicing TV sets. Yes, N.T.S. gave me my start in television.

Louis A. Tobat

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

Rev. Enoch P. Sanford

I have a TV-Radio shop in Yorkville, Illinois, about 4 miles from my home, and it has been going real good. I started part-time but I got so much work that I am doing it full-time. Thanks to National Technical Schools.

Alvin Spera

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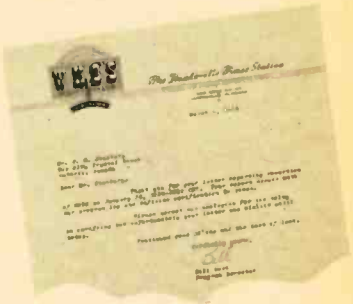
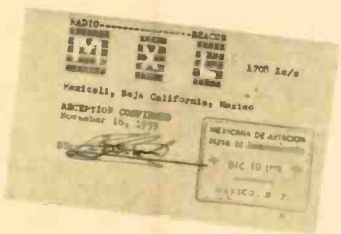
how to REPORT

An expert's advice on getting that QSL!

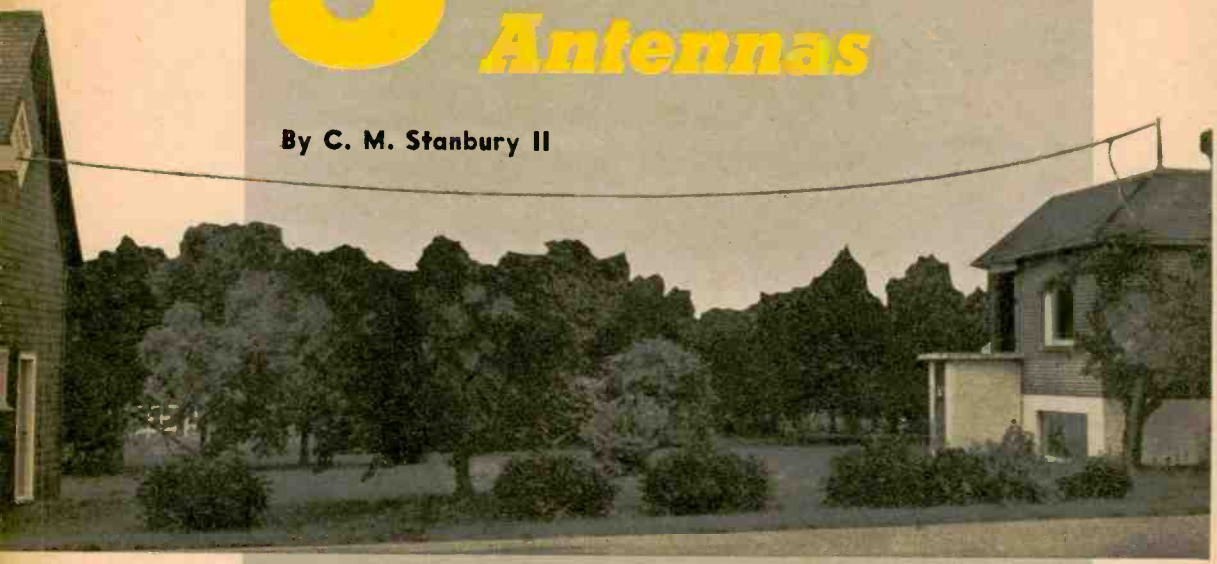
THE term QSL means an acknowledgement or verification in radio circles. When you send a reception report to a transmitting station you may receive a QSL card verifying your reception. Serious DXers value QSL cards because they prove a catch. Casual short-wave listeners like to tack the cards on the walls of their shacks. Because a QSL is a station's official word, you can't just write and ask for one. You must make a reception report that is meaningful, preferably interesting, and can be verified from station logs. It need not be lengthy but must be accurate. A good one should contain: 1) Your name and address. 2) Local time and date of reception. 3) Frequency. 4) Description of program, with sponsor if any, slogans used, description of program's content and station identification. Song titles are useful for musical programs. In the case of utility stations, it is illegal to divulge the contents of a transmission, so simply tell what station was worked by the station you heard. 5) Describe reception conditions, such as signal strength, static, interfering stations, etc. 6) Describe your antenna and receiver. End the report with a request for verification and sign your name. Enclose an International Reply Coupon (available at your post office). That's about it. I always recommend that reports be written in English (assuming that is your native tongue), regardless of the station's location. Reception conditions sometimes are described by various codes (SINPO, 555, etc.) but these unfortunately are not universally understood. Straightforward English is better. I've talked here exclusively about QSL cards, such as that shown at upper left. Actually, you *are* likely to get a card—sometimes a colorful and exciting work of art—from the international broadcasters. A good many broadcast-band stations in the United States, however, send regular letters on business stationery, such as at upper right. Utility stations often require a self-prepared, self-addressed card that they need only sign. One is shown at lower left. At lower right is a pennant which some Latin American stations now send out with their QSL's. No station is *required* to verify a reception report. International broadcasters are the best QSLers because they exist only to reach distant listeners. Others verify as a courtesy.—*C. M. Stanbury II*





3 Simple SWL Antennas

By C. M. Stanbury II



A SHORT-WAVE antenna need be neither complicated nor expensive. My own antenna at my home on Lake Erie is merely a 75-foot hunk of wire extending from an upstairs porch to the barn. It is pictured above and below (with the wire retouched to make it visible). Average height is 30 feet, orientation is north-south. As a professional DXer, I've found it does an excellent job.

We show diagrams for three simple SWL antennas on the opposite page. The most basic is the long-wire (Fig. 1). It is just that—a single wire suspended between insulators. The rule of thumb is as long as possible and as high as possible. Our diagram calls for

Photos by Paul Kassay, Jr.

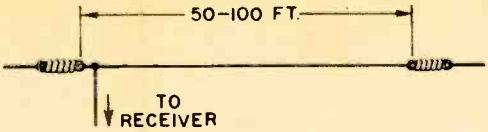


Fig. 1—Long-Wire Antenna is simplest type and one of the best. Mount it as high as possible.

a length of 50 to 100 feet. A fair length tends to make the long-wire non-directional (a desirable trait) and height enables it to pick up low-angle radiation (which covers most short-wave DX). Antennas should be at right angles to power lines. Use 12 or 14 gauge wire for the lead-in and insulate it well. It is a good idea to use stand-off insulators when bringing the lead-in down an outside wall.

Those who want to specialize in specific frequencies may be interested in putting up a dipole (Fig. 2), which usually is cut roughly to a half wavelength of the desired frequency. Actually, "end effects" make dipoles slightly shorter than half-waves. The correct length can be figured from the formula in Fig. 2. Dipoles also do a fair job on quarter-

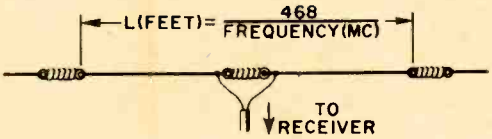


Fig. 2—Half-Wave Dipole Antenna is designed for specific frequency; formula gives exact length.

wave signals but are inefficient on in-between bands. They are directional broadside to the wire. The two halves of a dipole are separated by an insulator and the lead-ins come away at right angles. Use TV twinlead or 75-ohm coaxial cable. The twin leads are connected to the A1 and A2 posts on the back of the receiver.

The trap antenna (Fig. 3) is more complicated but covers several bands. It also is directional broadside to the wire. A trap, consisting of a capacitor and coil in parallel, presents a high impedance at its resonant frequency. The capacitor and coil values are determined by the frequency desired. At the values we show, the traps are seen as a high impedance (resistance) by 19-meter signals and have the effect of isolating the inboard (A) sections of the antenna from the outboard sections (B) . . . but only so far as 19-meter signals are concerned. At other wavelengths the traps are a low impedance, in effect connecting the B sections to the A sections.

On 19 meters our trap antenna serves as a half-wave dipole. On 60 meters the traps tune the antenna (lengthening it by adding the B sections) to approximately 5 mc, where it acts as a quarter-

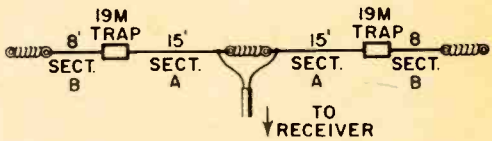


Fig. 3—Trap Antenna is complicated but covers several bands. Twinlead or coax is the lead-in.

wave dipole. The antenna also becomes a half-wave dipole on 28 meters.

In building a trap antenna, the sections of wire should be joined by egg type strain insulators. The capacitor and coil are bridged across the insulators (keep the leads short). A plastic cylinder, plastic sheeting or a coat of coil dope weatherproofs the assembly.

The trap's lead-in is the same as for a regular dipole.

Still more complicated arrays can be constructed with additional traps and lengths of wire. Rigs with four sets of traps are relatively common . . . as trap antennas go.

All antennas shown here are designed for outdoor use, although modified versions could be used inside.

What type of antenna you choose should depend on your receiver's tuning range, the number of bands that interest you and the space available.

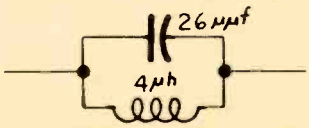


Fig. 4—19-Meter Trap for antenna above uses a 4-microhenry coil, 26-micromicrofarad capacitor.

THE LISTENER

Notes for the short-wave listener and DXer

By C. M. Stanbury II

BEHIND THE NEWS . . . Not long ago I launched a little personal project which turned out to be interesting and informative as well. I chose a hot news story of the day, clipped it out of the local papers and then started listening to international short-wave newscasts to see how stations of various political persuasions handled the same item. The result was a behind-the-scenes look at news reporting as practiced today by international broadcasters.

Radio Brazzaville, in "other" Congo (formerly French) sends out attractive two-color QSL card.

Any Short-Wave Listener or DXer with fair equipment and patience could duplicate or better my project, and make for himself an interesting little hobby with some point to it. One of the ways to kill your interest in SWLing in a hurry is to practice aimless listening. A project like this gives you a goal.

I started with a news story out of Katanga, the (Belgian) Congo's restless province, in which the government threatened to seek Communist aid. Katanga's station (11875 kc) merely said the idea was being considered.

Along came Radio Brazzaville (see QSL card), in the "other" (French) Congo, which is an affiliate of Radiodiffusion Francaise. Brazzaville gave big play to this seeming leftist leaning of Katanga, presumably because of France's troubles with rightists in Algeria.

Next, in stepped Radio South Africa, a neo-fascist crew who had been supporting Katanga's government. R. South Africa had little to say on Katanga's threat because the whole thing embarrassed them. They had played up Katanga as extremely anti-Communist.

Lastly, Radio Leopoldville, representing the central government of the Congo, ridiculed the whole idea. Katanga was in revolt against them at the time.

This news-slanting picture was fairly easy to put together because the story was important and the stations come in strong here. Also, background material on the item was easily had.

If you decide to do a little SW news sleuthing, be sure to pick a subject that interests you (fascist leanings, the shading of the Reds in Moscow and Peking and Havana, etc.) and then concentrate on the stations likely to give you what you want. Keep complete notes on what you hear (date, time, frequency, station and what is said) and

[*Continued on page* 116]

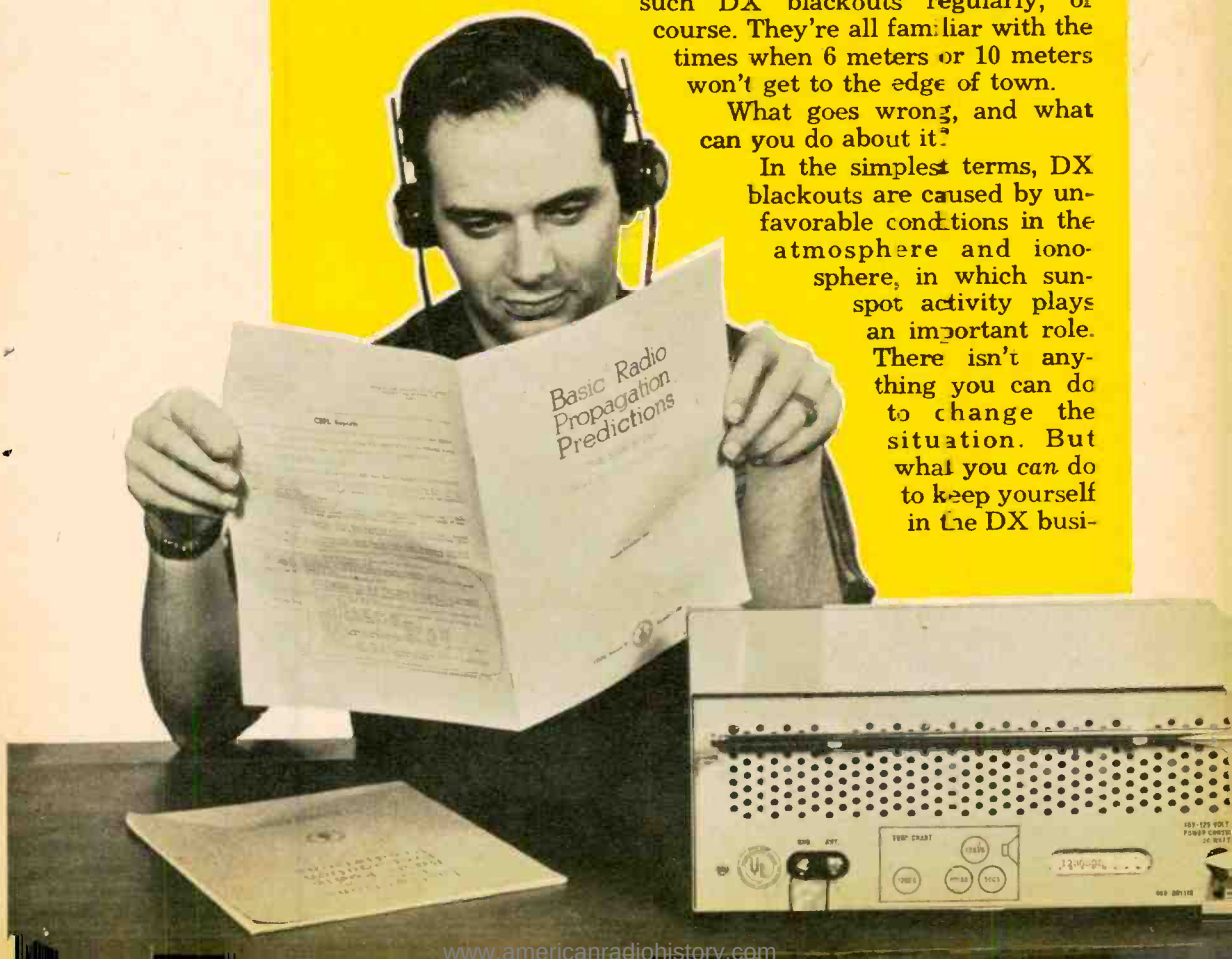
how to use RADIO PROPAGATION REPORTS

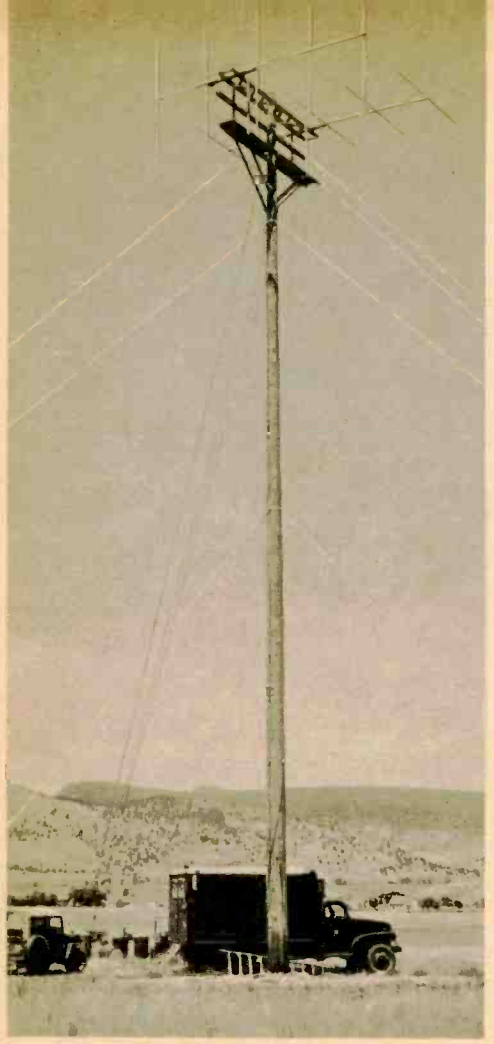
By Paul Daniels

IF YOU'RE a short-wave listener, this experience no doubt is familiar: you flip on your set and turn to some familiar station, such as the BBC at 15.375 mc, and wait for the signal to come booming in. But those British chaps never show up. All you get is some noise. Pretty soon you tune around and find the BBC's dial-mates also missing. The band is dead. Hams run into such DX blackouts regularly, of course. They're all familiar with the times when 6 meters or 10 meters won't get to the edge of town.

What goes wrong, and what can you do about it?

In the simplest terms, DX blackouts are caused by unfavorable conditions in the atmosphere and ionosphere, in which sunspot activity plays an important role. There isn't anything you can do to change the situation. But what you *can* do to keep yourself in the DX busi-





NBS antenna sounds ionosphere with elements of different polarizations, horizontal and vertical.

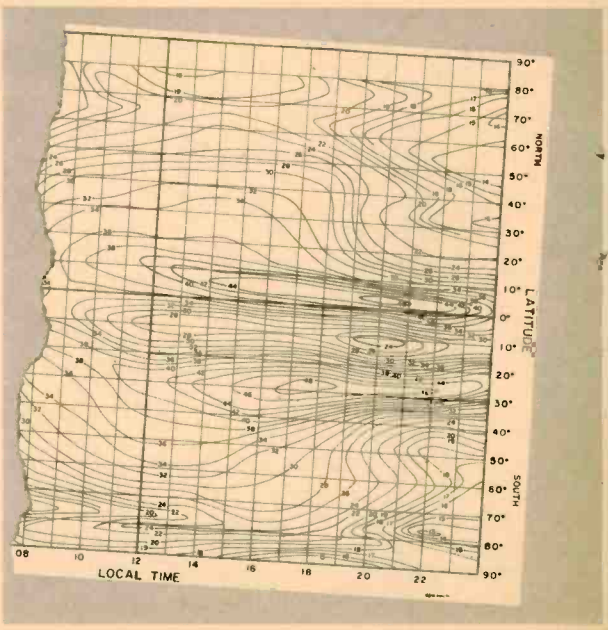
ness is to know when to expect such blackouts and where to look for open bands when your favorite ones close down.

You might have been somewhat prepared for the blackout situation we described in our opening if you happened to see a little squib in your local paper to the effect that the Department of Commerce (or National Bureau of Standards) predicted poor short-wave communications for that time. But if you flipped to other bands you probably would find the story not completely accurate because Cairo might be coming in fine on 11 mc, or even the BBC on 12 mc.

If you're a ham or a serious SWLer, you've probably heard of the Basic Radio Propagation Predictions issued by the National Bureau of Standards. It is only with these predictions in hand that you can know what to expect on the various DX bands at given times and where to turn when you run into blacked-out bands. The predictions are printed in the form of small bulletins and each one covers a calendar month. The most important information they offer is a maximum usable frequency (muf) for any given DX path (London to New York, Moscow to Los Angeles, etc.) for any hour of the day during the period they cover.

A maximum usable frequency is just that—a frequency given in megacycles. If for a certain DX path, say New York-Paris, the muf is 21.6 mc, it means transmissions much above (or below) that frequency won't get through. If you happen to be looking for the Paris Vous Parle people, you're in luck because one of the frequencies they use is 21.62 mc. But don't bother looking for them at 15.245 mc, another of their frequencies, because you aren't likely to find them there. Hams, knowing the area they

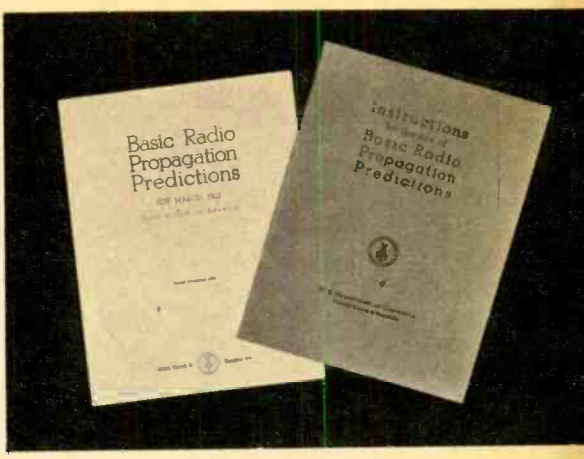
Part of propagation prediction chart. Numbers on wavy lines are frequencies, given in megacycles.



wish to work and the muf for the path, can quickly determine which band they must be on when they put out a CQ call.

To fully understand the importance of the NBS propagation predictions, we might backtrack a bit and review propagation itself.

For transmission of radio signals on the broadcast band or below, we depend on a direct groundwave, but when we move to higher frequencies we employ a skywave, which means the signal bounces off the ionized gases found from 40 to 350 miles up that we call the ionosphere. A short-wave signal that "takes off" here may come to earth hundreds of miles away. The reflective ionosphere is not one layer but consists of three or four layers into which ions and electrons group. These layers are labeled D, E, F1 and F2 in the order of their distance from the earth's surface. Through the night the F1 and F2 layers combine into the general F layer. In addition, there are clouds of ions and free electrons that simply float about at the same general altitude as the E level and are called sporadic E layers. The most important parts of the ionosphere for long distance communications are the E and F layers.

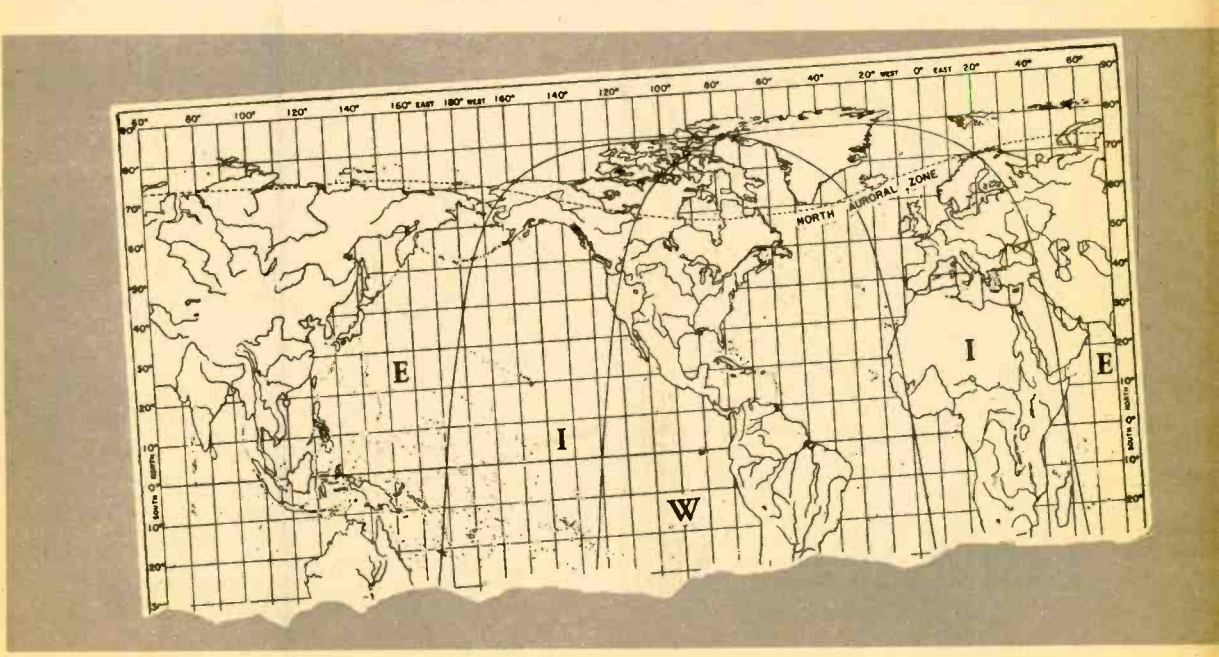


NBS issues monthly forecasts (left). Other booklet tells how to use them; it is priced at 30 cents.

The ionosphere is most important to radio communications in the 3- to 30-megacycle range. This covers most of the amateur and short-wave broadcast bands, as well as many military and

[*Continued on page* 111]

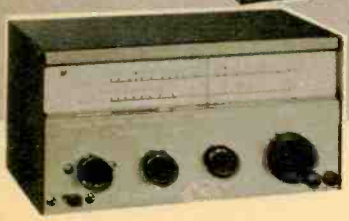
World is divided into lettered zones for predictions. Different charts are used in each. Chart at left is for zone W, which includes U. S. (see text).



SWL EQUIPMENT ROUNDUP

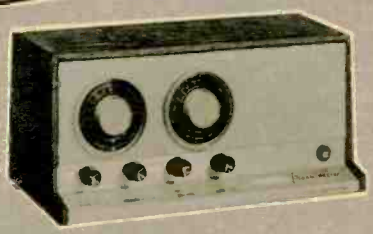
1 Knight-Kit Ocean Hopper is a low-cost regenerative receiver with coverage from 165 kc to 35 mc. Plug-in coils provide band switching. The receiver kit sells for $16.95 and the package of 5 coils costs $2.49. Headphones also extra. Allied Radio, Chicago 80, Ill.

2 Space Spanner by Knight-Kit features a 2-position band switch to select the broadcast band or short wave (6.5 to 17 mc coverage). Regenerative circuit has a built-in loudspeaker with optional headphone listening. Kit is $19.95. Allied Radio, Chicago 80, Ill.

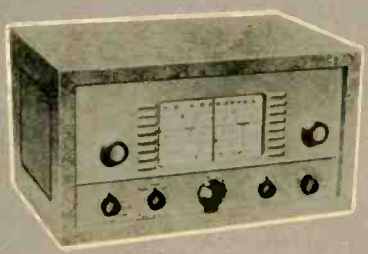


3 Knight-Kit DXer is a transistorized "portable" powered by 4 penlite cells. Covers BC band and SW from 7.5 to 17.5 mc. Circuit has 3 transistors. Comes with 25-ft. antenna, the headphones are extra. Kit is priced at $19.95. Allied Radio, Chicago 80, Ill.

4 Lafayette's Explor-Air is a regenerative receiver covering from the BC band to 30 mc in 4 bands switched on the front panel. The set has a built-in speaker and headphone jack. Price for the kit is $21.95 plus $2.75 cabinet. Lafayette Radio, Jamaica 33, N. Y.



5 Largest number of features among Knight-Kit's regen receivers are found in the Span Master, which has a built-in speaker, headphone jack, both coarse and fine regen controls. Covers BC band through 30 mc in 4 bands. $29.95. Allied Radio, Chicago 80, Ill.



6 Heathkit AR-3, a 5-tube superhet, is still available but is to be dropped in favor of GR-91 (see our preview in this issue). AR-3 covers 550 kc to 30 mc, has speaker, bandspread, noise limiter. Price is $29.95 for kit; cabinet $4.95. Heath Co., Benton Harbor, Mich.

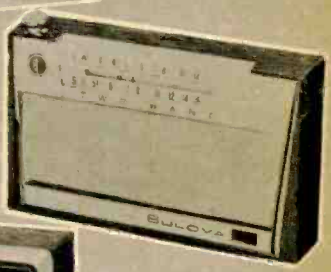
EQUIPMENT SWL ROUNDUP

7 Philmore's CR-5AC is a superhet kit with S-meter, bandspread tuning and coverage from BC band to 30 mc. (See our kit report in this issue.) Philmore sells the CR-5AC kit for $39.95. Metal cabinet costs $7.95 extra. Philmore Mfg. Co., Richmond Hill 18, N. Y.

8 Heathkit's new GR-91 (see preview in this issue) is a 4-tube (plus rectifier) superhet with illuminated tuning meter, noise limiter, built-in speaker. Printed circuit construction. Covers 500 kc to 30 mc. Price is $39.95. Heath Co., Benton Harbor, Mich.

9 Realistic-9 is a transistor portable covering BC, long-wave and SW bands (6 to 18 mc). Powered by one 9-volt battery. Has 28½-inch telescoping whip antenna, provision for external speaker. Earphone included in price of $44.88. Radio Shack, Boston 17, Mass.

10 Brand-new Hallicrafters receiver is Sky Buddy II, covering BC band plus 2-5.5 and 6-16 mc SW bands. Three tubes plus diode, built-in speaker. Front panel has code (BFO) and headphone switches. Kit is $39.95; wired model $49.95. Hallicrafters Co., Chicago 24, Ill.



11 Conquest, small 7-transistor portable by Bulova, covers BC band plus 4 to 12 mc on short wave. Powered by 2 penlite cells. Whip antenna; earphone and jack for external speaker. Price is $49.95; deluxe model, $59.95. Bulova Watch Co., Flushing 70, N. Y.

12 The National NC-60, a popular SWL rig, covers 540 kc to 31 mc in 4 switched bands. Five-tube circuit has built-in speaker, front-panel headphone jack and CWO on-off switch, bandspread tuning. The price is $59.95. National Radio, Melrose 76, Mass.

13 Knight-Kit R-55 is a superhet covering everything from the BC band to 36 mc and in addition the 6-meter ham band (50-54 mc). Main and bandspread tuning and provision for crystal calibrator. Kit is $67.50, calibrator $10.95. Allied Radio, Chicago 80, Ill.

EQUIPMENT ROUNDUP

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14 The famed Hallicrafters S-38 has given way to the new S-120, shown here. Hallicrafters' new rig covers the BC band up to 30 mc, has speaker, ferrite antenna, adjustable whip. Four tubes plus rectifier. The list price is $69.95. Hallicrafters Co., Chicago 24, Ill.

15 KT-200 by Lafayette is a 9-tube superhet covering 535 kc to 30 mc in 4 bands. Has built-in Q-multiplier for sharp selectivity, electrical bandspread, edgewise S-meter, noise limiter. Set is $79.95 wired, $64.50 as kit (without speaker). Lafayette Radio, Jamaica 33, N. Y.

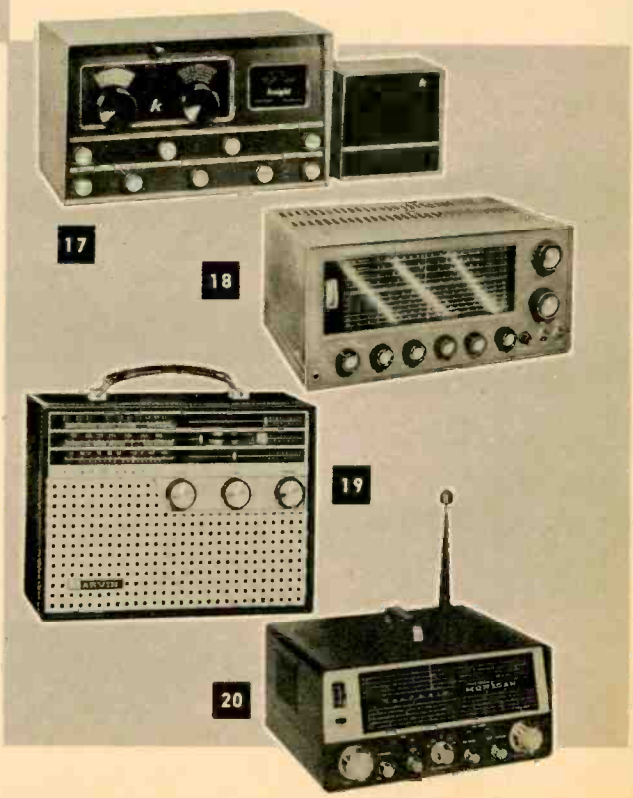
16 Seven tubes and rectifier are in Hallicrafters S-107. Covers BC band plus 2.5 to 31 mc and 48 to 54.5 mc (the 6-meter ham band). Phono input is provided. Features include electrical bandspread and noise limiter. $94.95. Hallicrafters Co., Chicago 24, Ill.

17 Knight-Kit R-100 is a professional-quality receiver kit used by many amateurs (see kit report in this issue). R-100 covers 540 kc to 30 mc in 4 bands, has special bandspread on 80 to 10 meter ham bands, 12 front-panel controls. Basic kit $99.95; speaker kit $9.75; S-meter kit $12.95. Allied Radio, Chicago 80, Ill.

18 HE-30 by Lafayette is factory-wired superhet covering 550 kc to 30 mc in 4 bands. Built-in Q-multiplier, electrical bandspread, edgewise S-meter, noise limiter. Kit is $99.95; speaker (HE-11) is $7.95. Lafayette Radio, Jamaica 33, N. Y.

19 Arvin 9598 is a 7-transistor portable that covers long wave, BC band and SW from 2.1 to 6 mc in 3 switched bands. Telescoping whip antenna. List price of the set is $100. Arvin Industries, Columbus, Ind.

20 Ten transistors, 6 diodes are featured in GC-1, a portable, general coverage receiver by Heathkit. Five bands tune from 550 kc to 32 mc; 54-in. built-in whip; powered by 8 C cells or 117-v power supply that costs $9.95 extra. Mohican kit is $109.95, wired version is $193.50. Heath Co., Benton Harbor, Mich.



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EQUIPMENT ROUNDUP

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21 Columbia's table-top model 625 is an AM-FM set which has an extra short-wave band covering 6 to 18 mc. Magic-eye tuning aid at upper right. The 8-tuber has a price of $119.95. Columbia Phonographs, New York 22, N. Y.

22 RCA's Strato-World 9-transistor portable operates on 9 size D cells. It covers the BC band plus 6 SW bands extending to 18.2 mc. Omnidirectional whip antenna telescopes to 48 inches. World map in lid gives global time zones. RCA, New York 20, N. Y.

23 National's NC-190 is a double-conversion receiver covering 540 kc to 30 mc in 5 ranges. Has S-meter and bandspread, selectivity, antenna tuning controls on front panel. SSB/CW Automatic Gain Control. $219.95 plus $19.95 speaker. National Radio, Melrose 76, Mass.

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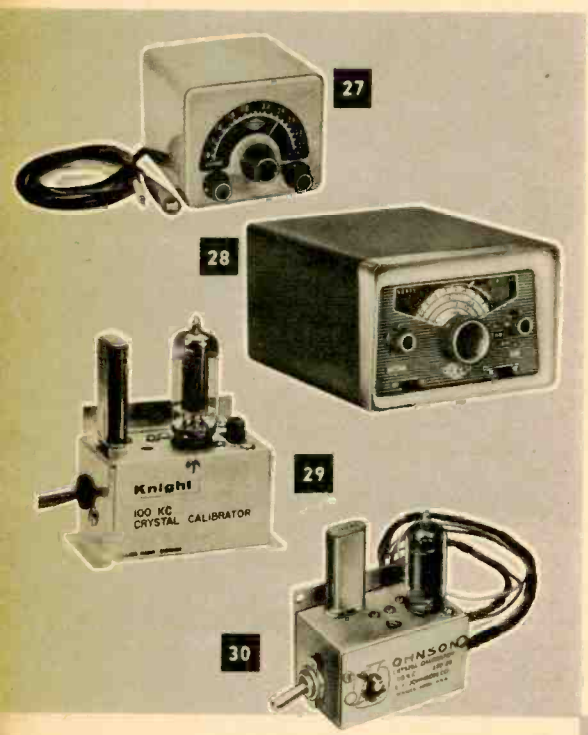
24 Philco T-9 Trans-World portable is all-transistorized unit that covers the BC band plus short wave to 18.2 mc. Powered by 6 D cells. Telescoping whip antenna. Time-zone map comes in lid, along with a listener's log book. $230. Philco, Philadelphia 34, Pa.

25 Zenith Royal 1000 Trans-Oceanic is 9-transistor portable that uses 9 size D cells. Covers BC band and 6 SW bands to 22.4 mc. It has ferrite and whip antennas, time-zone scale and logging chart, electrical bandspread. Retail price is $250. Zenith Corp., Chicago 39, Ill.

26 Hammarlund HQ-145X receiver has provision for crystal control on a single channel. The 11-tube superhet covers 540 kc to 30 mc in 4 bands, has dual conversion on 10 through 30 mc. Price with clock but without crystal is $279. Hammarlund Mfg. Co., New York 1, N. Y.

EQUIPMENT ROUNDUP



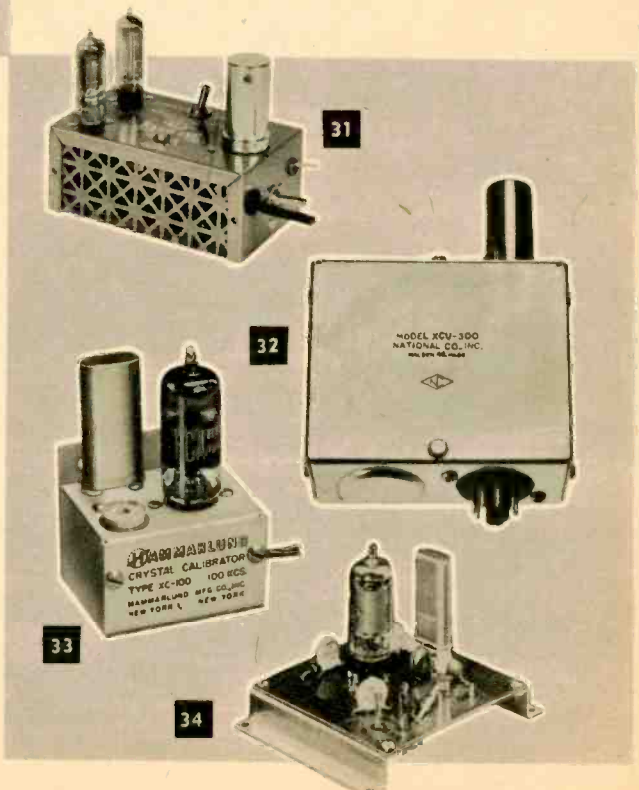
27 Marine band is covered by Gonset 3163 converter, made for use in car. It requires 12 volts, plays through AM radio, brings in ship-to-ship, ship-to-shore, Coast Guard, etc. between 1.6 and 3 mc. Has antenna tuner. Price is $29.50. Gonset Div., Burbank, Calif.

28 Gonset Super 12, a converter that works through car's AM radio, covers 19 and 49 meter shortwave bands and the major ham bands. Requires 12 volts; no internal connections to the automobile's radio. The price of the unit is $69.50. Gonset Div., Burbank, Calif.

CRYSTAL CALIBRATORS serve as frequency standards for SWLers. Most produce marker signals every 100 kc on the dial, permitting the user to locate stations and band edges with great accuracy. Some operate on 117 v., others take power from receiver. Most can fit inside receiver.

29 Knight-Kit 100-kc calibrator kit goes to 54 mc, requires 6.3 v. @ 0.15 amp and 150-300 v. DC @ 3-6 ma. Kit is $10.95. Allied Radio, Chicago 80, Ill.

30 Johnson calibrator goes to 55 mc, has 6BH6 tube, ceramic trimmer for zero beating of crystal to WWV. $17.95. E. F. Johnson Co., Waseca, Minn.



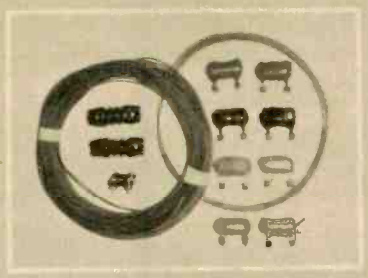
31 Bud FCC90B calibrator produces 100-kc check points to 30 mc, operates on 117 v. AC, has 2 tubes. Price of unit is $20.48. Bud Radio, Cleveland 3, Ohio.

32 National offers 3 crystal calibrators ranging in price from the XCU-300 (shown) at $23.95 to $34.95. All are 100 kc. National Radio, Melrose 76, Mass.

33 Hammarlund XC-100 calibrator employs a quartz crystal and 6BZ6 pentode, provides 100-kc signals. $15.95. Hammarlund Mfg. Co., New York 1, N. Y.

34 International Crystal 100-kc FO-1L calibrator has printed circuit board. It sells for $12.95 as kit, $15.95 wired. Intl. Crystal, Oklahoma City, Okla.

EQUIPMENT ROUNDUP



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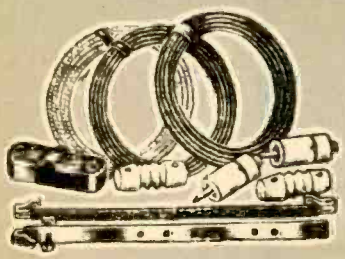

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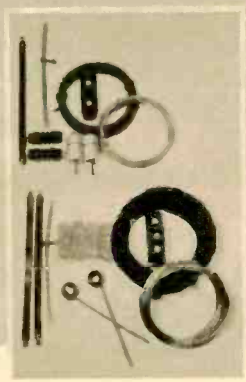

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35 Mosley SWL-7 dipole trap antenna kit is resonant on 7 bands (11, 13, 16, 19, 25, 31, 49 meters), measures 40 feet in length. Kit includes traps, wire, lead-in, insulators. $14.75. Model RD-5 is antenna kit for ham bands. Mosley Electronics, Bridgeton, Mo.

36 Allied short-wave antenna kit includes bare copper wire, lead-in, ground wire, insulators, lightning arrester, clamp, etc. Deluxe kit price is $2.04. Standard kit costs $1.03. Allied Radio, Chicago 80, Ill.

37 Consolidated SWL antenna kits include low-cost No. 507 (top), a 50-footer selling for $1.49, and No. 615, a 100-footer usable as dipole, double-dipole, inverted L, etc. It sells for $4.26, all hardware included. Consolidate Wire, Chicago 16, Ill.

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38 Mastercrafters 24-hour clock for the listening shack has a south polar map projection to indicate time anywhere in the world. Face is 8 inches in diameter; AC operation. Price is $8.47. A 12-hour model of the clock is available. Mastercrafters, Chicago 12, Ill.

39 Recorded samples of what is to be heard on short-wave bands is offered by Hallicrafters for 25¢. Features bits of plane, ship and ham transmissions, President Eisenhower's voice being transmitted from satellite. 45 rpm. Hallicrafters Co., Chicago 24, Ill.

40 A description of how short-wave signals behave is contained in paperback book, Shortwave Propagation, by Stanley Leinwoll, as well as time chart in foreground. The book lies on a National NC-188 receiver. $3.90. John F. Rider, Inc., New York 11, N. Y.

Win $100 in EI's ELECTRICITY Contest

WHAT is electricity? Your answer to that question may win you a cash prize of $100! Each month EI publishes the best answer received and pays the author $100.

Our Electricity Contest is a continuing competition. If you don't win with your first answer, try again! Follow the rules at right. You can use *any* source material but your answer must be in your own words. Pay particular attention to the clarity of your answer (see winning entry below).

Entries for prize No. 5 must be received by January 2, 1962.

Rules: Entries will be judged on aptness of thought, clarity of expression and originality. Entries must be typewritten and double-spaced and may be no longer than two pages of 8½ x 11-inch paper. Ideally, a definition should be short. Print your name and address on your envelope and the first page of your answer. One entry per envelope. EI's Editors are the judges. Entries will not be acknowledged or returned.

Prizes: $100 will be paid the writer of the best definition. One winning definition will be published in each issue of EI. In case of ties, duplicate prizes will be awarded. Other entries of merit also may be published and will be paid for at the rate of $10 each.

Mail entries to: EI Electricity Contest, 67 W. 44th St., New York 36, N. Y.

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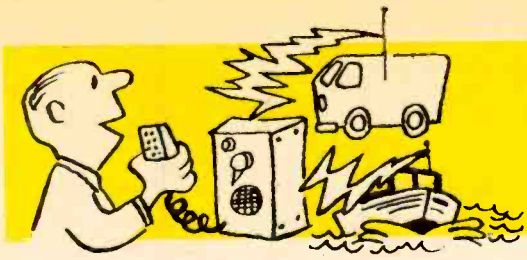
ELECTRICITY--Electricity is the tension found between the electron and proton (two basic units of matter). When you separate an electron from an atom you are pulling on a sort of "atomic rubber band" that immediately attempts to return to its normal, unstretched condition. This attractive force of the disengaged electron is what we call electricity.

John Holland



CB CORNER

Citizens Band News and Comments

by Len Buckwalter, 1W5733

LET'S GO NATIONAL . . . That's an expression you hear frequently nowadays in Citizens Band circles. It reflects a tide of sentiment felt all over the country.

While the flood of CB licenses climbs toward 300,000, and not so slowly, people are beginning to realize that CB radio needs much more than just an informal club on the local level (although that, too, is important). What CBers are agitating for is a national organization which reflects and acts upon the problems confronting them all.

A wide divergence of views was expressed to this reporter last July at a big CB Jamboree held at Fort Mountain, Ga. Although the roundup was sponsored by a local organization, the Tri-State Radio Club, it was billed as a national jamboree and very nearly was just that. Hundreds of CBers showed up, representing more than half the call areas of the country.

While I was taking notes on what was being said and done on that Georgia mountain, two ideas were expressed more often than any others. The first dealt with the need for self-policing. Many operators are still smarting from the welter of FCC regulations that descended on the band last year. They feel the new restrictions probably were brought about by excesses and illegal operation (and I'd have to agree), and that unless some concerted effort is made by CBers themselves to curb errant practices the service that is enjoyed and used by so many is going to by legislated right into a strait jacket.

The other concept expressed by dozens of individuals, including many club officers, was the pressing need for general national agreement on setting aside certain channels for specific purposes—calling, travel, marine, etc. Anyone who goes on a cross-country jaunt with a mobile rig in his car, or who moves from one area to another, is aware of the chaos on CB channels. If he wants to contact a local CBer about motels, for instance, he hasn't the slightest idea of which channel to use.

Thus the movement toward a national organization picks up steam, carrying the hopes of most operators that a strong and representative voice can turn the CB band into the efficient medium of communication it was intended to be.

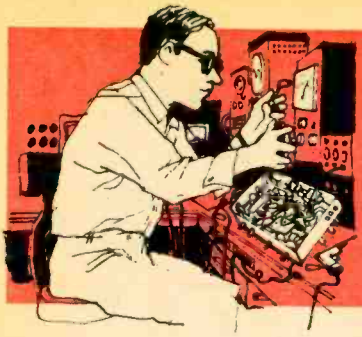
CB Jamboree scene: Tri-State Club President Charles Agan (at mike) directs group doings.

We'll have more on this score later but, meanwhile, we'd like to sound out more individuals and clubs on the "go-national" idea. Your comments are welcome here. Just write to me in care of EI.

—o—

Wanted: More Clubs . . . The FCC, which once was known to oppose CB clubs, has now reversed its stand and *encourages* the formation of local Citizens Band organizations (as long as they are more concerned with business than

[*Continued on page* 115]



Tech Editor's Test Bench

by Larry Klein

KITS, KITS, KITS

WHEN I first became interested in electronics World War II was near and defense shortages were being felt by electronic hobbyists like myself. We were like the family that was too poor to afford garbage—we didn't even have a junk box to raid. In those days aluminum chassis were what airplanes had and resistors were something you made out of the innards of lead pencils or filed to size from old cannibalized carbon jobs.

During the war, I spent after-school hours in a radio repair shop learning how to make a 6J5 serve as a 35Z5 (AC/DC tubes were *scarcer* than hen's teeth), how to recone speakers, and even rewind defective IF transformers.

At the end of the war a flood of surplus appeared and the ads in the electronics magazines reflected the deluge of "dumped" electronic equipment. Some EI readers may have noticed a small item in a November 1947 magazine to the effect that the Heath Company (who previously had specialized in surplus only) was offering a 5-inch oscilloscope kit for $39.50. From that little acorn . . . etc. I, for one, had always wanted a scope (those dancing green lines fascinated me) and I sent off for the kit. I was in the Signal Corps at the time and built the scope during several evenings in the barracks (while my buddies were out raising hell) which shows the kind of electronic nut I was, and probably still am.

Electronics and Heath have come a long way since a single 6SJ7 tube served as the complete vertical amplifier section of their scope. And to Heath goes much of the credit for starting the post-war trend to kits.

Heath however, was not the first to produce electronic kits. About 1929 the Pilot Radio Corporation (which is still producing fine hi-fi equipment—although not in kit form) marketed a four-tube, plug-in coil short-wave receiver kit dubbed the *Super Wasp*. This was before my time, but according to EI's Bob Hertzberg, over 100,000 of these reflex jobs were sold at $29.95.

Kit production tended to be somewhat sporadic after that, with a manufacturer here and there marketing an AC/DC radio or a reflexed short-wave receiver in build-it-yourself form. One of the first kits I tackled was produced by Meissner. To the best of my recollection, it had a 6J5 reflex detector and a 25Z5 rectifier. A set of plug-in coils covered a wide range of frequencies.

[*Continued on page* 119]

The first Heath Kit ad—Nov. 1947.

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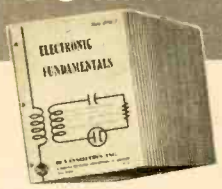

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A "must" for aligning and trouble-shooting receivers. Build it for your own use. 170 KC to 50 MC fundamental frequencies for all radio and TV work.

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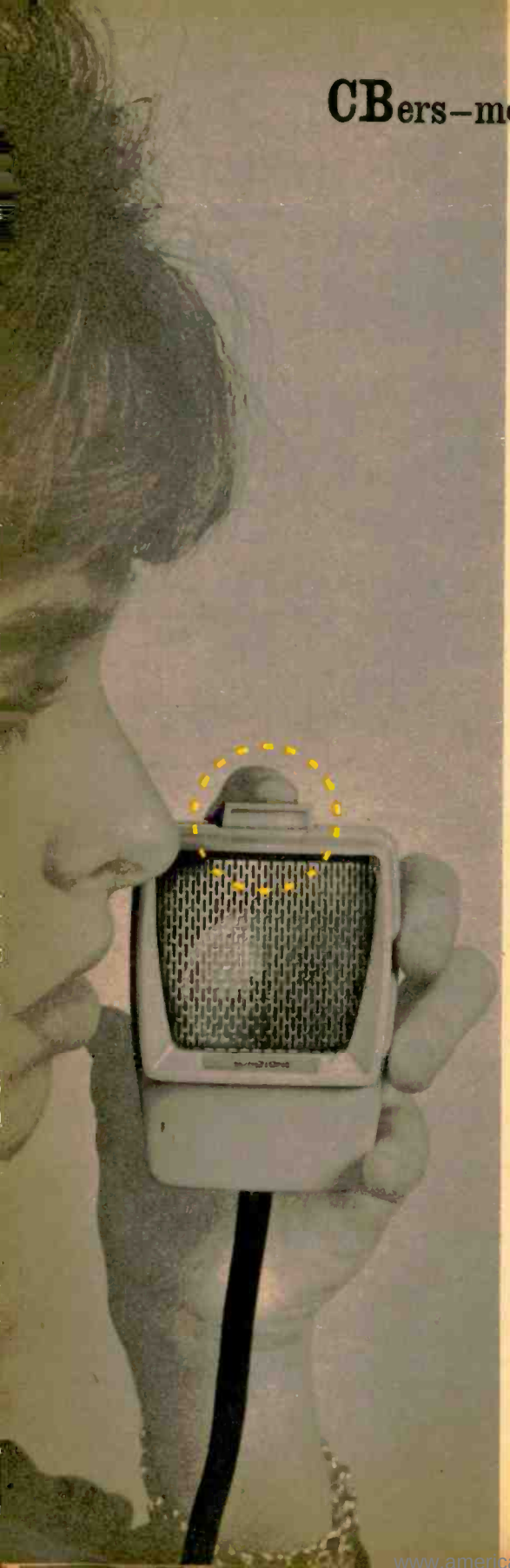


CBers—modernize your rig with...

PUSH-TO-TALK SWITCHING

By Herb Friedman, 2W6045

MANY a mobile Citizens Band transceiver which otherwise does a fine job is traded in because it lacks push-to-talk (PTT) switching. The constant stretching across the car seat or down to the floorboard to work the transmit switch is not only annoying, it can lead to a serious accident.

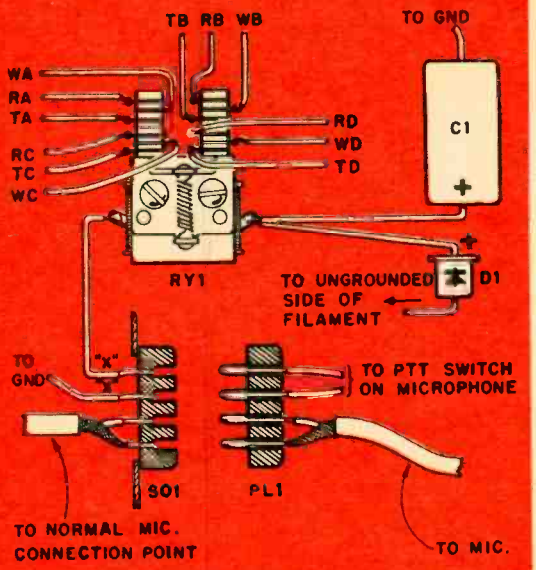
For a few dollars and a couple of hours' work, you can modernize your mobile transceiver with a simple PTT setup—which is also worth installing in your base station.

Installation of PTT is generally not difficult. Fig. 1 illustrates a typical 4-pole, double-throw transmit-receive (T-R) switch. All you need do is replace the manual T-R switch with a 4PDT relay (RY1) and half the battle is won. In the unlikely event your transceiver requires *more* switching than a 4PDT relay provides, use the alternate 6PDT relay specified in the Parts List.

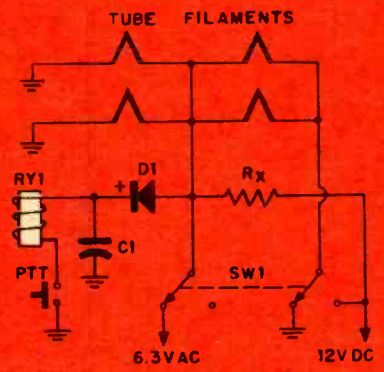
The PTT conversion is designed so the relay works equally well whether the transceiver is powered by AC or DC. When the rig is used in a car or truck, DC filament voltage passes through diode D1 and energizes RY1. When the unit is AC-operated, the filament AC is rectified by D1 and filtered by capacitor C1. (If relay RY1 chatters or hums, double the value of C1.)

For mobile-only use, RY1 could be operated without the rectifier, but it would then be difficult to service and test the transceiver with an AC power source. With the circuit as shown, the transceiver can be shifted from home to car without difficulty.

Even if you plan to install the PTT in an AC-only transceiver, *do not use an AC relay*. The push-button control wire runs through the microphone cable and severe hum will result from the AC field.



Relay rectifier diode D1 connects to filament line at nearest tube socket. Mount it rigidly with an insulated terminal lug. If desired, lock-in operation of RY1 may be achieved by a switch connected to the wires at SO1 marked "X".



SW1 SHOWN IN 6.3VAC POSITION

Units whose filament strings operate on 6-volt AC on line operation and 12-volt DC on mobile are wired as above. SW1 represents connections made by power plug. Rx is equal to sum of D1's forward resistance and relay RY1's coil.

PARTS LIST

RY1—4PDT relay—Potter and Brumfield GA17D-6DC (for 6 volt operation) or GA17D-12DC (for 12 volt operation)

Alternate 6PDT Relay

Guardian, Universal "200" series, available from Allied Radio and elsewhere. 6 or 12 volt coil plus 4PDT contacts plus switch part set.

C1—160 mf./15 VDC (for 6 volt operation)
160 mf./25 VDC (for 12 volt operation)
D1—Silicon rectifier rated 300 ma. or higher.
J1—4-prong socket (Amphenol 78-S4S)
PL1—4-prong plug to match above (Amphenol 91-MPM4L)

The first step is to identify the T-R switch wiring. Check out the wires in sets of three—labeling them W (iper) A, T (alk) A, R (cvr) A; WB, TB, RB, etc. A close look at the switch contacts while you operate it will show you what terminals make contact in each position. Make plenty of notes and sketches before unsoldering any wires.

Mount RY1 on some convenient spot under or on the chassis as close as possible to the T-R switch. Then unsolder the T-R switch wires in sets of three and connect them to the equivalent terminals on RY1. Shielded cable should be used for any audio lead over an inch long. Ground one end of the shield.

If the CB unit is to be employed in a car or truck, D1 must be polarized according to the battery grounding system. If your car has a *negative* battery ground, connect D1's negative lead to the filament supply. If the car has a *positive* ground, connect D1's Cathode (positive end marked with "+" or a band) to the filament supply and reverse the polarity of C1 to match.

A four-conductor system is used for the microphone and switching circuit. A shielded wire serves as the mike leads and two additional wires for the PTT switch. Do not use a three-wire system with a common ground for the mike and switch circuits, for hum and distortion due to RF pickup can result.

The microphone jack of your transceiver must be replaced with a four-pin socket wired as shown.

For added convenience when testing your equipment, the original T-R switch can be connected as a holding switch. Connect two terminals from the T-R switch across the relay switching terminals (marked X in the schematic) so the relay closes when the T-R switch is in transmit position.

To finish the project, you can either add a PTT switch to your microphone (one of the new fancy doorbell push-buttons will do) or you can purchase a microphone with a PTT switch. If you purchase a microphone, make certain it has a dynamic or ceramic element such as the Sonotone unit shown. An auto cooking in the sun can develop an inside temperature high enough to destroy a crystal element.

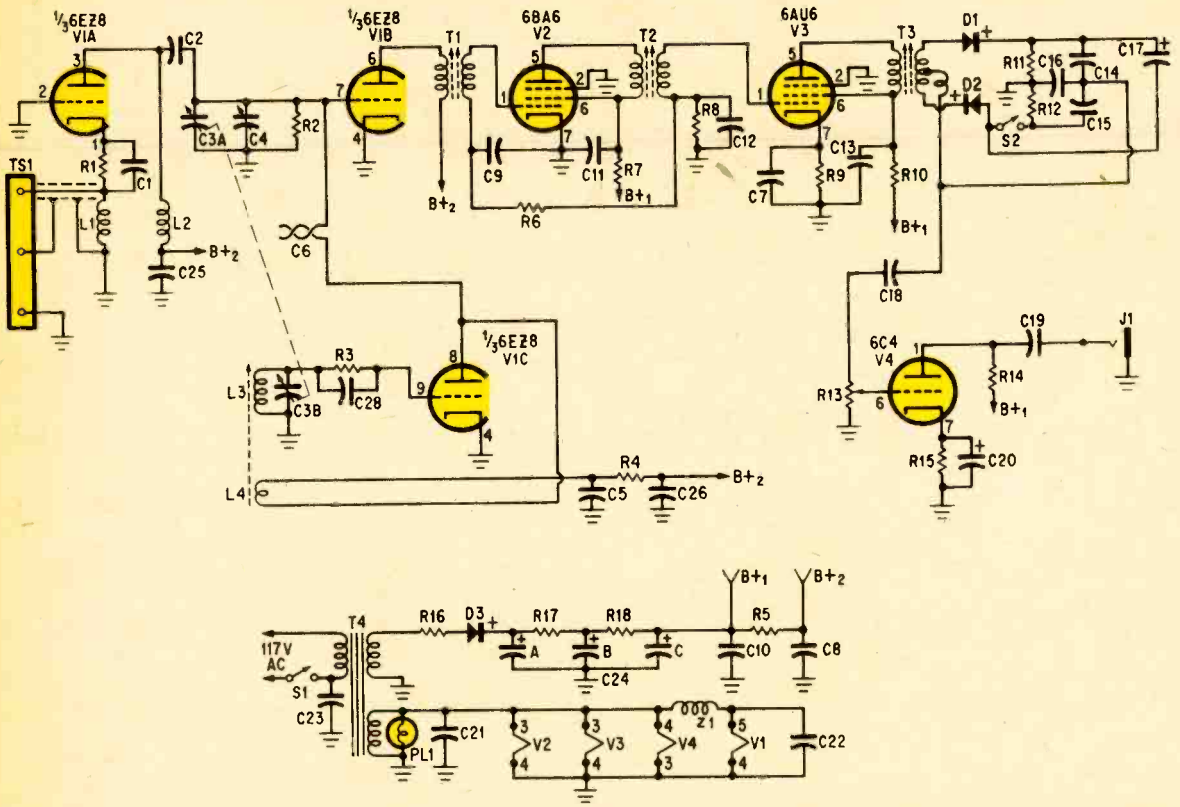
EI's 30-50 SPECIAL

By Herb Friedman, W2ZLF

The "band between" comes alive on an AM-FM receiver covering frequencies the SWL rigs can't reach

TUCKED BETWEEN the 6 and 10 meter amateur bands is a relatively unexplored area containing some of the most interesting DX listening available. Here you can ride along in a police car on an emergency call, eavesdrop on government agencies, listen in on mobile telephone calls and hear all kinds of chatter between service trucks and home offices. This is the Public Service Band, extending from 29.7 to 50 mc.

Because of its location, the PSB has been called the "in-between" band (see DXing IN BETWEEN, April '61 EI). The band's relatively unexplored state is due to the inability of most short-wave receivers to tune above 30 mc. Using EI's 30-50 Special, short-wave listeners can open up a whole new territory for themselves. Besides the stations mentioned above, on the PSB you can find fire departments, county sheriffs, telephone paging, intra-lot chatter of the



For highest sensitivity, the 30-50 uses a standard FM superheterodyne circuit. Heavy RF bypassing using .005 mf disc capacitors is employed throughout.

PARTS LIST

Resistors: ½ watt, 10% unless otherwise indicated
R1—270 ohms
R2,R6—1.2 megohms
R3—12,000 ohms
R4—3,300 ohms
R5,R7,R10—560 ohms
R8—22,000 ohms
R9—100 ohms
R11,R12—8,200 ohms
R13—500,000 ohm potentiometer (audio taper)
R14—22,000 ohms
R15—1,000 ohms
R16—33 ohms
R17,R18—330 ohms, 2 watts
Capacitors: disc ceramic, 400 v. or higher rating unless otherwise indicated.
C1,C5,C8,C9,C10,C11,C13,C21,C22,C23,C25,C26—.005 mf
C2—500 mmf
C3—2-gang (each 25 mmf) variable capacitor (Hammarlund HFD-25) Available at any Amateur Radio parts supplier
C4—30 mmf trimmer
C6—gimmick (see text)
C7—150 mmf
C12—50 mmf
C14,C15,C16—270 mmf
C17—5 mf @ 50 v. electrolytic
C18—.01 mf tubular
C19—.01 mf
C20—25 mf @ 25 v. electrolytic
C24—80/40/40 @ 300 v. electrolytic can
L1—4 microhenry RF choke (National R-60)
L2,L3,L4—see text
Z1—.8 microhenry filament choke
T1,T2—10.7 mc. IF transformer (Miller 1463-PC)
T3—10.7 mc. ratio detector transformer (Miller 1465-PC)
T4—Power transformer, secondary 125 v. @ 50 ma. 6.3 v. @ 2 a. (Allied Radio 61G411 or equiv.)
D1,D2—1N34 crystal diodes
D3—130 v., 75 ma. selenium or silicon rectifier
V1—6EZ8, V2—6BA6, V3—6AU6, V4—6C4
S1,S2—SPST toggle switch
J1—phone jack
TS1—3-screw terminal strip
PL1—6.3 v. bulb and pilot assembly
Misc.—Coil form (Cambridge Thermionic, LS3-20 mc or LS3/B) Cabinet with 8"x10" panel space (Bud CD-1481 or equiv.), chassis to fit above, 1½"x9"x7½" (Bud CB-976), tube sockets, tuning dial and drive assembly

The printed circuit board is available from the Mahler Research Foundation, GPO Box 1159, N. Y. 1, N. Y. $3.35 postpaid. Specify PC-70.

movie-makers, intra-airport communications and dozens of other types of transmissions.

Basically an FM receiver, one side of the 30-50's ratio detector is opened up to make AM reception possible. Although designed for headphone listening, you can feed 30-50's output into any small amplifier to drive a speaker.

To simplify construction and avoid layout problems, a printed-circuit board is used. For those who don't want to etch their own, EI has arranged to have boards made available at minimum cost. The PC board, while not pre-drilled, comes with component layout and drilling instructions and is gold-plated for easy soldering. See Parts List for address of supplier.

If you would like to make your own PC board, a full-size template will be sent free if you send a stamped, self-addressed envelope to Electronics Illustrated, Template, Dept. 67 West 44 Street, N. Y. C. 36, N. Y.

Prepare the PC board by drilling the component mounting holes as indicated on the board template. Before drilling the holes, check their location on the board against the specific components you are using to insure proper spacing. *Note that all components are mounted on the board on the side opposite the printed wiring.*

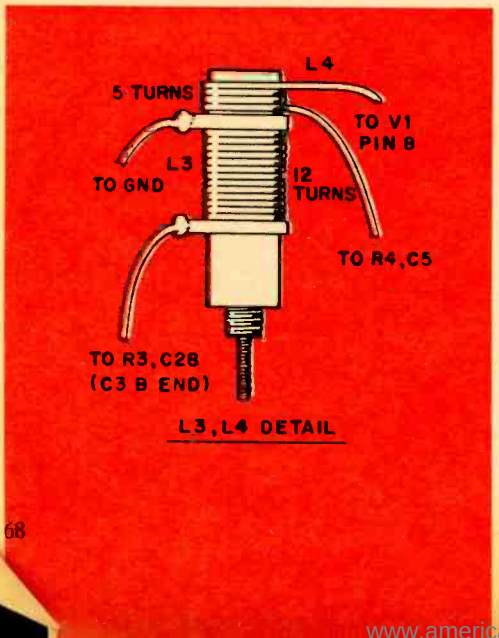
Standard 7- and 9-pin shielded tube sockets are modified for PC use. Bend the socket lugs flat and solder a half-inch bare lead to each one. Then pass the leads through the appropriate holes on the PC board. Holding the socket firmly against the board, solder the leads.

Next, mount the three IF transformers, T1, T2 and T3. Orient the transformers on the board as shown, using the oval slot on top of the can and the color dot below as a guide. Solder the transformer mounting tabs to the board. Avoid excessive heat when soldering the transformer lugs.

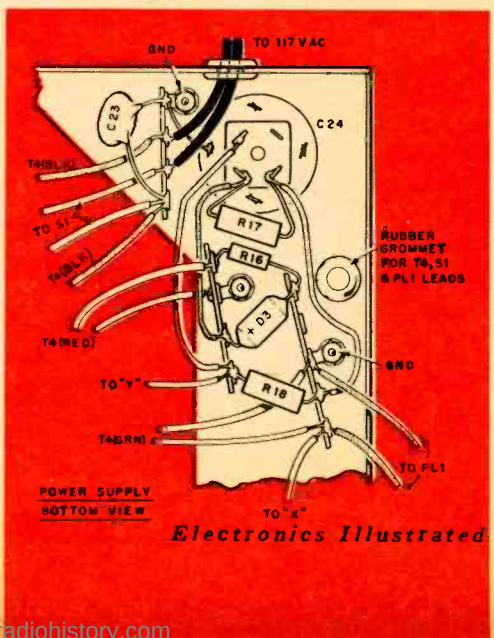
Mount tuning capacitor C3 to the board using star lockwashers between the screws and the board for good grounding. It may be necessary to ream the mounting holes slightly, but there's plenty of room in that part of the board. Solder in all other board components except C18 and C19 and the lead to TS1. Detector diodes, D1 and D2, are soldered last. Be sure to use a heat sink (such as an alligator clip) on the diode leads to prevent heat damage.

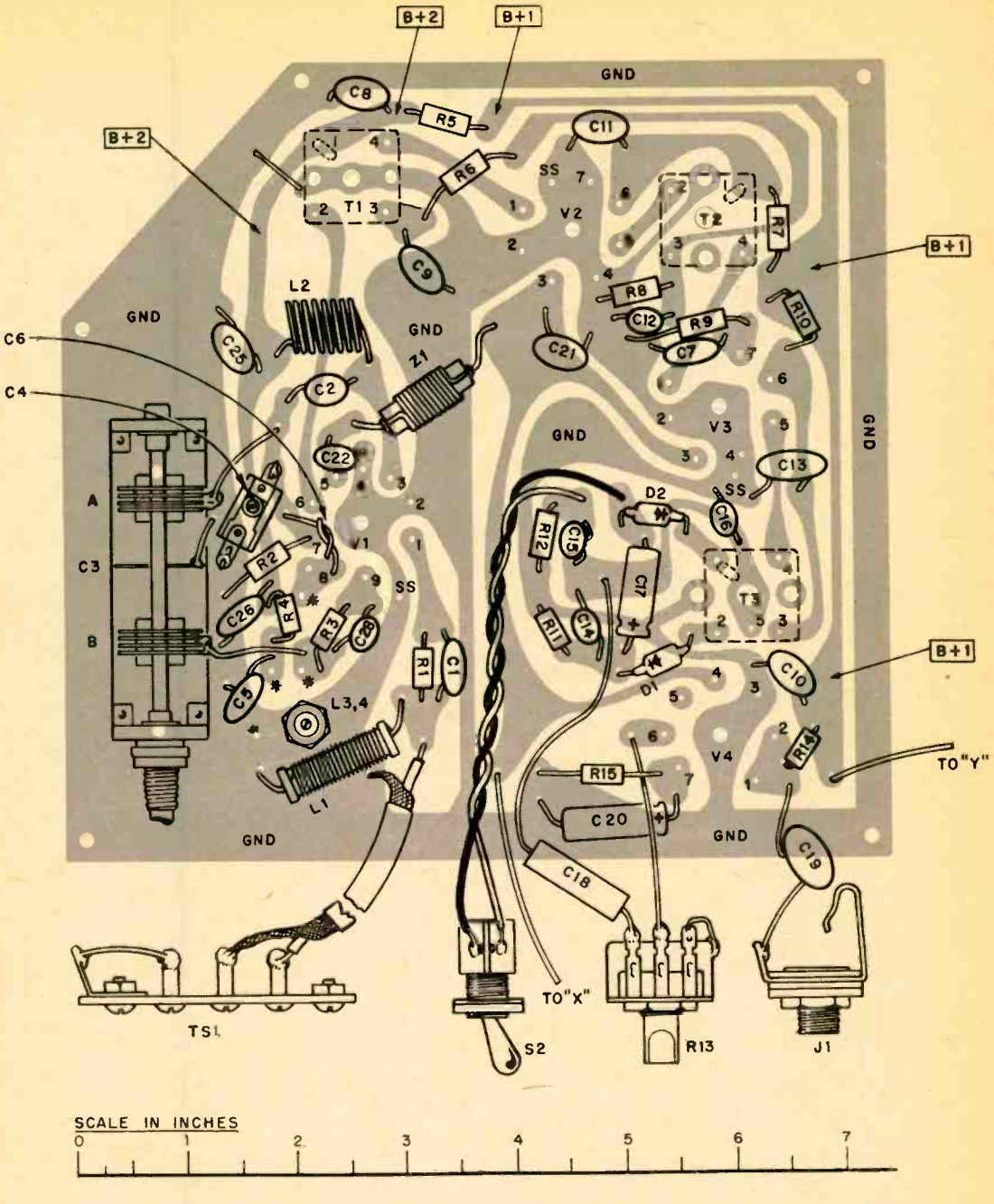
The various coils have few turns on them because of the high frequencies involved. Coil L2 consists of eight turns of #22 enameled wire closewound on a ⅜" dowel. The dowel is then removed and the coil is supported by its own

Detail of the oscillator coil's windings and connections. Observe the winding precautions in text.



Connections to C24 depends on brand. In any case, D3 should connect to highest capacity section.

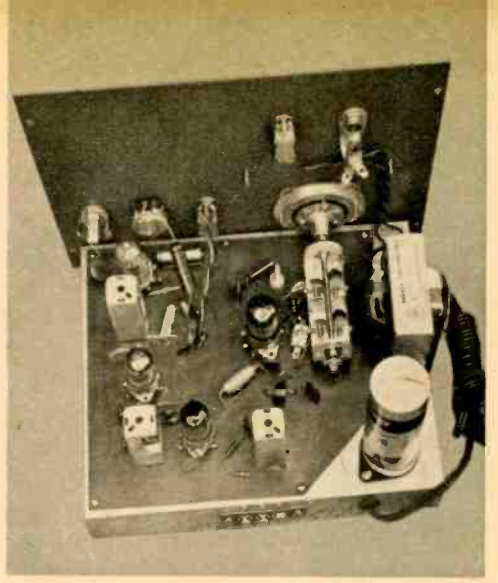




PC board above is shown from the non-foil side for clarity of parts mounting. A professionally etched board or full-size template is available; see text and Parts List. Solder holes labeled "SS" take the lead soldered to the shield of the tube sockets. See p. 70 for closeup view of mounting technique. Holes marked with * are the connection points for L3 and 4. Voltage checks at the plates and screen grids (if present) of the tubes should indicate about 100 v. DC ± 20%. The plate of the 6C4 tube will probably read somewhat lower.

leads. Coil L3-L4 is wound on a Cambridge form. Place one of the form's ring terminals about ⅜" from its top (adjustment end) and close wind on 12 turns of #26 enameled wire (L3). Solder the other end of the coil to the second ring terminal, pressing the terminal firmly against the coil to hold it in place. The feedback link (L4) is

Closeup of tube socket mounting. Note bent lugs and bare wire soldered to metal socket shield.



Completed receiver. Printed circuit board is installed foil side down: components are on bare side.

five turns of #22 enameled wire, close-wound. Winding L4 *must* be wound in the same direction as L3. The coil leads are connected as shown in the detail view. If V1 does not oscillate, reverse the connections to L4.

Cut the chassis to fit the PC board and the power supply components. The cutout for the PC board is actually, $\frac{3}{8}$" *smaller* than the board to allow for overlap.

Cut the panel and mount the panel components, taking particular care that the vernier drive is lined-up with C3's shaft. It may be necessary to file some metal either from the bottom of the vernier housing or the chassis to obtain clearance. To allow for the cabinet lip when mounting the panel to the chassis, place two washers on each mounting screw *between* the panel and the chassis. Note that R13, J1 and TS1 all have a terminal grounded to the panel, which in turn is connected to the chassis.

Wire the remaining panel-mounted components to the PC board using the shortest possible leads. One of S2's leads connects to the same PC area as diode D2, so be sure to use a heat sink on D2 when soldering this lead.

The antenna input lead from TS1 can be either coax cable (as shown) or twin-lead. If twinlead is used, the conductor nearest L3 serves as the ground lead.

Oscillator coupling capacitor C6 is a "gimmick." Solder one end of each of two *insulated* 1¼" leads to the PC board. Twist the two leads together tightly (two twists), making sure the bare wires do not touch.

For IF alignment, set C3's plates to full mesh and switch S2 to FM (closed). Connect an RF signal generator set to 10.7 mc to V3, pin 1. Use a 20 mmf capacitor in series with the generator's "hot" lead. Connect a VTVM (set for about five volts DC or higher) positive probe to + side of C17. Adjust the bottom slug of T3 for maximum meter reading. Move the generator's output lead to V2, pin 1. Adjust both slugs of T2 for maximum reading. Next, connect the generator to V1, pin 7 and adjust both slugs of T1. Readjust T2 and the bottom slug of T3. As the alignment is performed, reduce the generator output, maintaining a reading on the VTVM of two to three volts. Leave the generator connected to V1. Detach the

[*Continued on page* 116]

30-50 MC GUIDE

Use	*Frequency (mc)*
Industrial and Transport	30-32
Public Safety	30.66-30.82
Government	31.98-33.1
Public Safety	34-35
Government	37.02-37.42
Public Safety	38-39
	39.02-39.98
	42-43
Land Transport	43.22-44.6
Government	46.6-47

Soup Up Your SWL Rig

By Len Buckwalter, K10DH

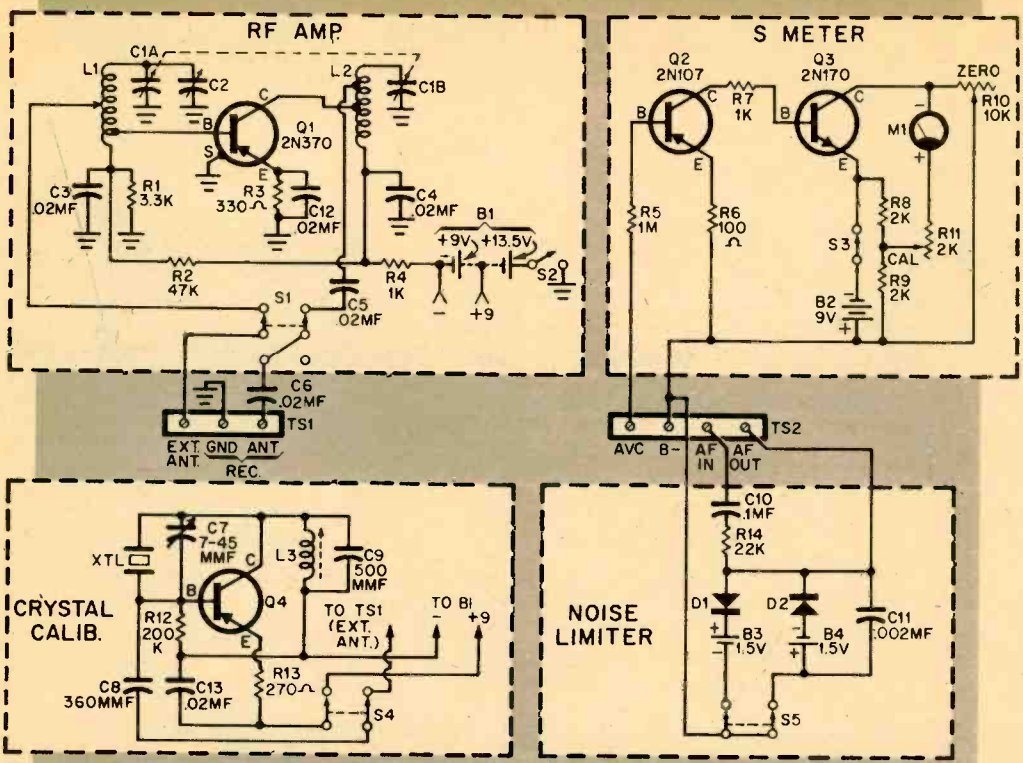
Transistorized adaptor adds professional features

THE Short-Wave Listener who finds himself harassed by the limited performance of a low-cost receiver can take heart in EI's transistorized Soup-Up package. By adding the unit to his present rig, the SWLer can realize some big-set features at a fraction of the cost of a new receiver.

Our Soup-Up rig actually is a combination of four independent circuits housed in a single cabinet. You can build all four or only the ones you desire. Should you wish to restore your receiver to its normal operation, you can do so in an instant because only four wires connect the SU rig to the main receiver.

Although we picture the unit in operation with an aging Hallicrafters S-38B receiver, it can work its wonders on *any* inexpensive short-wave set.

RF Amplifier. Virtually all SW sets in the under-$100 class lack a radio-frequency amplifier stage and, therefore, lose sensitivity in the higher frequency ranges. The SU unit compensates for this deficiency with a one-transistor amplifier designed to boost gain between 13.5 and 30 mc (band 4 on most sets). In-



PARTS LIST

Resistors: ½ watt, 20%
R1—3,300 ohms
R2—47,000 ohms
R3—330 ohms
R4,R7—1,000 ohms
R5—1 megohm
R6—100 ohms
R8,R9—2,000 ohms
R10—10,000 ohm potentiometer
R11—2,000 ohm potentiometer
R12—200,000 ohms
R13—270 ohms
R14—22,000 ohms
Capacitors: 400-VDC or higher unless otherwise noted
C1A/C1B—2-gang TRF-type variable, approx. 360 mmf each gang
C2—single gang variable, approx. 2-14 mmf
C3,C4,C5,C6,C12,C13—.02 mf disc
C7—7-45 mmf (approx.) trimmer
C8—360-mmf disc
C9—500-mmf disc
C10—.1-mf paper
C11—.002-mf disc

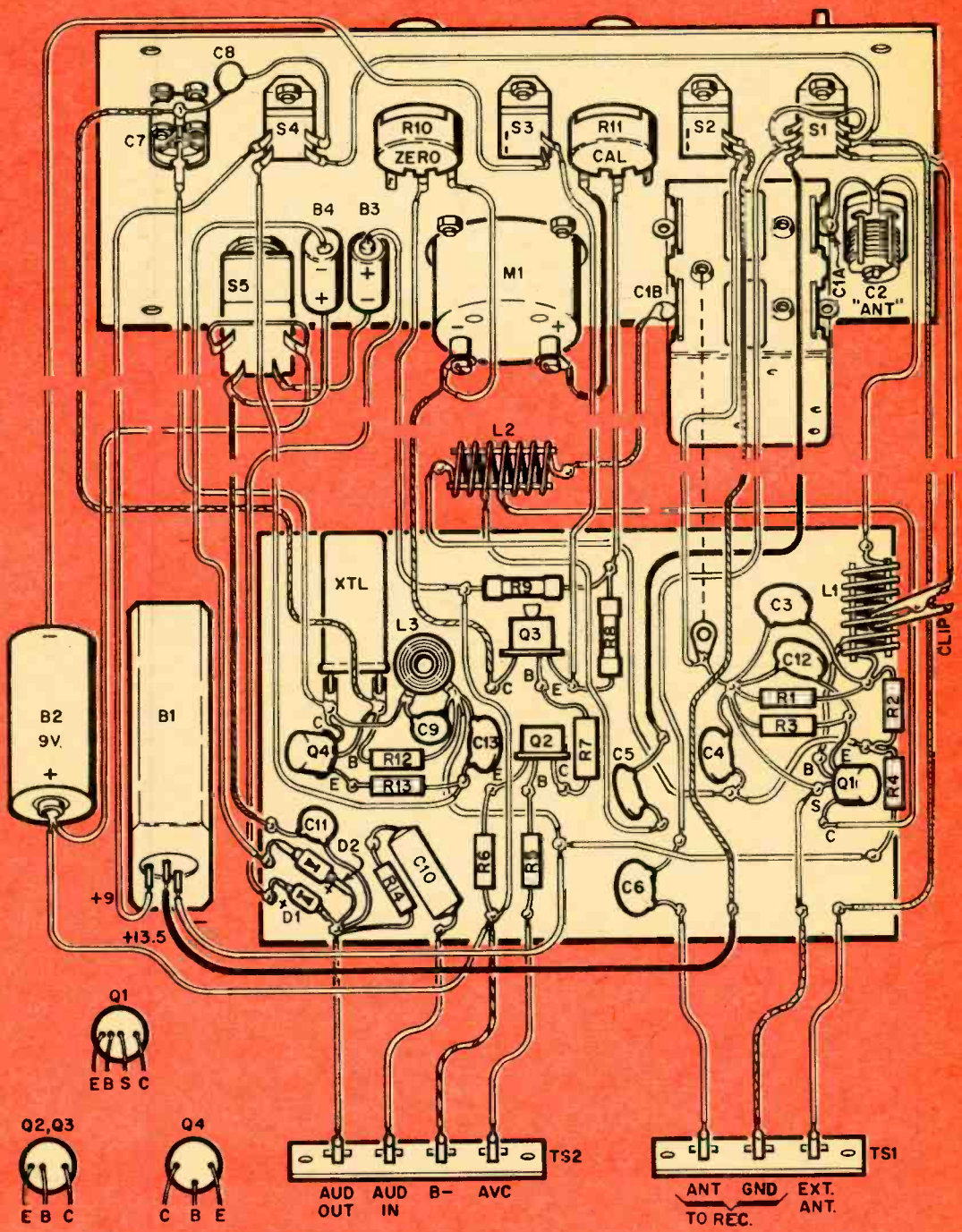
D1,D2—1N34A diode
Q1—2N370 transistor
Q2—2N107 transistor
Q3—2N170 transistor
Q4—CK768 transistor
B1—9, 13½ v. battery (Burgess XX9 or equiv.)
B2—9-volt battery (Burgess P6 or equiv.)
B3,B4—1.5-volt penlite cell (Burgess Type N or equiv.)
M1—S-Meter (Olson Electronics ME-40 or equiv.)
Xtl—100-kc crystal
S1—DPDT slide switch
S2,S3—SPST slide switch
S4—DPST slide switch
S5—DPST toggle switch
L1,L2—Coil, 7 turns, ⅝" dia., 8 turns/inch, tapped as shown (both may be cut from one B&W 3006 coil)
TS1—3-screw terminal strip
TS2—4-screw terminal strip
Misc.—Aluminum cabinet, 5"x9"x6" (Premier PAC-596, or equiv.); perforated board; miniature alligator clip or Mueller RF test clip #88; solder lug; flea clips; knobs; etc.

The four independent functions of the SU unit are shown above. One or all may be built.

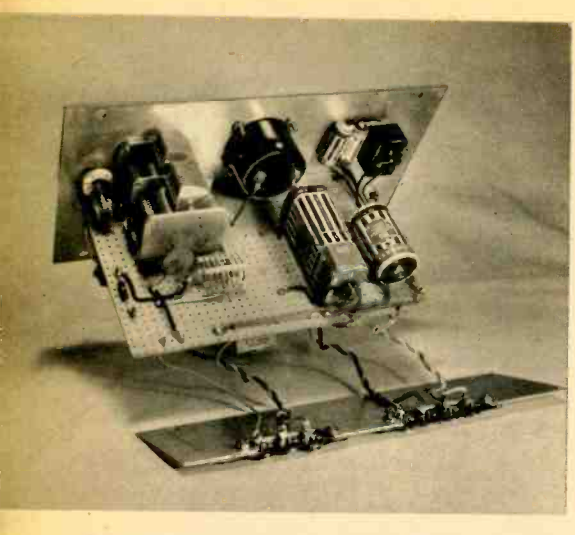
cluded also is a means of tuning the antenna input for the best match.

S-Meter. A signal-strength meter is excellent accessory for the SWLer who wants to boost this QSL-card collection. By reporting signal strength in S units, the DXed station gets a clear idea of how well their signal is reaching the listener's area, and is more likely to respond (QSL). The meter is also an excellent tuning aid.

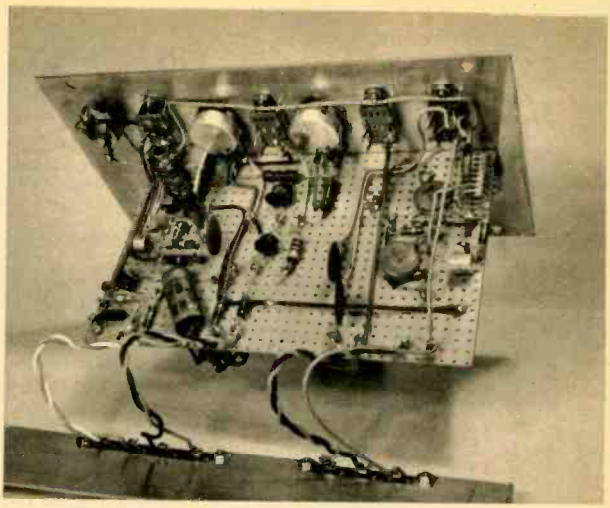
Crystal Calibrator. Trying to pinpoint a piece of DX with a receiver whose dial has only approximate calibration can give grey hairs to the most ardent DXer. A crystal calibrator answers the problem by placing highly accurate frequency reference signals on all bands. The 100-kc crystal oscillator in the SU unit generates frequencies every 100 kc on the dial. The close (and accurate) spacing of the signals also overcomes the lack of frequency markings on the bandspread tuning indicator.



Pictorial shows front panel as viewed from bottom, rear. For clarity board has been removed from bottom of tuning capacitor C1. Note ground lug to be held in place by board-mounting screw. Cover terminals on TS1 with tape to avoid shock.



Top view of completed adaptor before cabinet installation. Note location of L2. Batteries are held in place with wires threaded through board.



Chassis board as seen from bottom. Components are mounted and wired to flea clip terminals. Use a heat sink when soldering transistors and diodes.

The calibrator itself has provision for zeroing-in to WWV.

Noise Limiters. This is a simple arrangement of two diodes biased by penlite cells. When switched into the circuit, it clips the sharp pulses of ignition and other noise. The limiter can often make readable signals out of noisy hash.

Construction

The illustrations show parts placement and wiring, but here are some tips to ease the job:

Tuning capacitor C1 is fastened to the front panel by the three tapped 6-32 screw holes in the frame of the capacitor around the shaft. If you don't have short screws for these holes, place several washers under the screw heads when attaching to the front panel. Otherwise, the moving plates of the capacitor may strike the screws.

The other three screw holes on the capacitor's underside are used to hold one side of the perforated board in place—and be sure to put a solder lug under one of the screw heads as shown, to provide a ground return for the board-mounted components.

The other end of the perforated board is fastened to the front panel by a small angle bracket. This can be any piece of scrap metal bent into an "L" shape with a screw hole drilled into each tab.

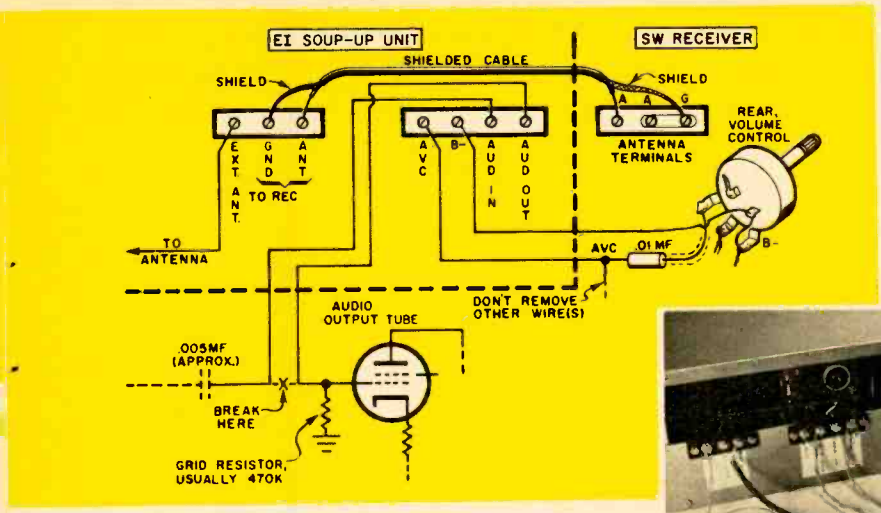
Before mounting C2 on the front panel, find a position that will not obstruct the travel of C2's plates.

The two large batteries (B1 and B2) and 100 kc crystal (Xtal) are secured by running a length of bare wire around them, threading the ends through the board and twisting the wire. Penlite cells B3 and B4 are held in place by wires soldered directly to their terminals and by a touch of glue on the panel where the cells make physical contact.

SW Receiver Connections

Most 4- and 5-tube sets are transformerless AC/DC types. Their chassis or B— return connects directly to one side of the AC line. To prevent shock hazard, it is important to observe the system of separate grounds between the SW receiver and SU unit. Check the illustrations and these points:

RF Amplifier. The grounds in this circuit are connected directly to the metal cabinet of the SU unit, via the solder lug on the board. The RF output runs through a shielded cable to the receiver. There's no shock hazard since the antenna terminals of the SW set are



Low capacity shielded cable connects output of SU unit to antenna terminals of receiver. Only four other wired connections are required for adaptor.

not connected directly to its chassis.

S-Meter. This circuit is driven by AVC, a negative voltage developed in the receiver that varies with signal strength. The ground return for this is designated B— and *must* be kept isolated from the metal cabinets of the unit and SW set. A handy B— point in the SW set is found on the volume control. With the three lugs in an upright position, the left one will be the B— point. This lug connects directly to one side of the AC line so exercise suitable precautions in insulation, etc.

Crystal Calibrator. This unit picks up an antenna ground point within the SU unit. When the panel switch energizes the calibrator, its output is automatically applied to the SW receiver's antenna input terminal.

Noise Limiter. There are two external connections for this circuit (it picks up the hot B— ground within the unit so take care). As shown, the *Audio In* and *Audio Out* are routed from the grid of the SW receiver's audio output tube.

Adjustment and Operation

After the unit is wired and connected, the various sections are set up in this order:

S-Meter. With no signal being received, set *zero control* R10 for a meter reading of "0." Tune in a strong local broadcast station and adjust the reading to approximately 10 db over S9 with *Calibration control* R11. Notice that you will not be able to raise the meter to full scale with R11; only an extremely strong signal can do this. However, there is sufficient leeway for calibration purposes. The S-meter should never be left on when the SW receiver is set to CW or BFO. This injects a powerful signal that may damage the meter.

Noise Limiter. This circuit is switched into operation any time that noise clipping is required. A slight lowering of audio output is normal during limiter operation.

Crystal Calibrator. Initial adjustment should be done with the receiver tuned precisely to one of WWV's frequencies (2.5, 5, 10, 15 or 25 mc). Adjust L3's slug for maximum output as indicated by the S-meter. Tuning is quite broad and not critical. Then adjust front panel trimmer C7 for zero beat; the tone lowers in pitch and disappears entirely. Don't confuse this with the tone transmitted by WWV which shuts off and permits calibration.

[*Continued on page* 107]

Heath's New Receiver Kit

THE POPULAR Heathkit AR-3 SWL receiver is now being replaced by a new Heathkit, the GR-91. Although the new kit was not available for test building before press time, EI presents a preview of the GR-91.

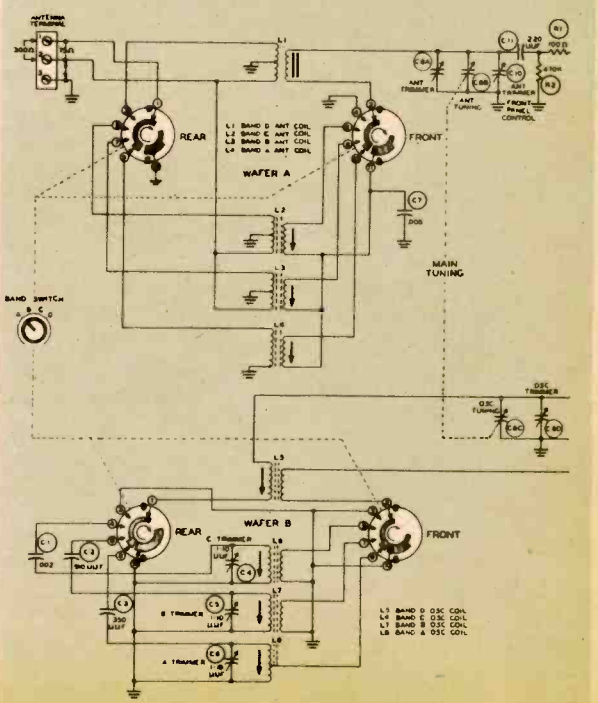
Heathkit's new entry in the field presents a striking design with a pleasing, functional appearance. First to be noted is an illuminated tuning meter above the main tuning knob. Its job is to indicate the relative signal strength of each station. Six other knobs grace the front panel. From the left they read *audio gain, BFO control, AM-STBY-CW, band switch* and *ant. trimmer*. The bandspread control is located logically beneath the tuning knob. The rear chassis sports a noise limiter on-off switch, headphone jack, antenna input (you have a choice of 300 or 75 ohms) and a Q-multiplier input jack.

As might be expected from its price of $39.95, the GR-91 makes a few tubes do a lot of work. Basically, four AC/DC types are used in a superheterodyne configuration. The power supply is *not* AC/DC, however, and this is important. An isolation transformer is used to feed both the series-connected filament string and a silicon rectifier, eliminating shock hazard to external ground.

The departure from the standard broadcast superhet design starts right at the antenna, where a four-position band switch selects the antenna coil providing the band coverage desired. An antenna trimmer (C10—one of the front panel controls) adjusts the tuning circuit to an exact impedance match to your antenna for maximum signal gain.

A 100-ohm resistor (R1) in series with the grid of the 12BE6 mixer-converter tube serves as a parasitic suppressor. A bandspread capacitor also shunts the main tuning capacitor and serves as an electrical vernier control.

The oscillator section of the tube is standard except



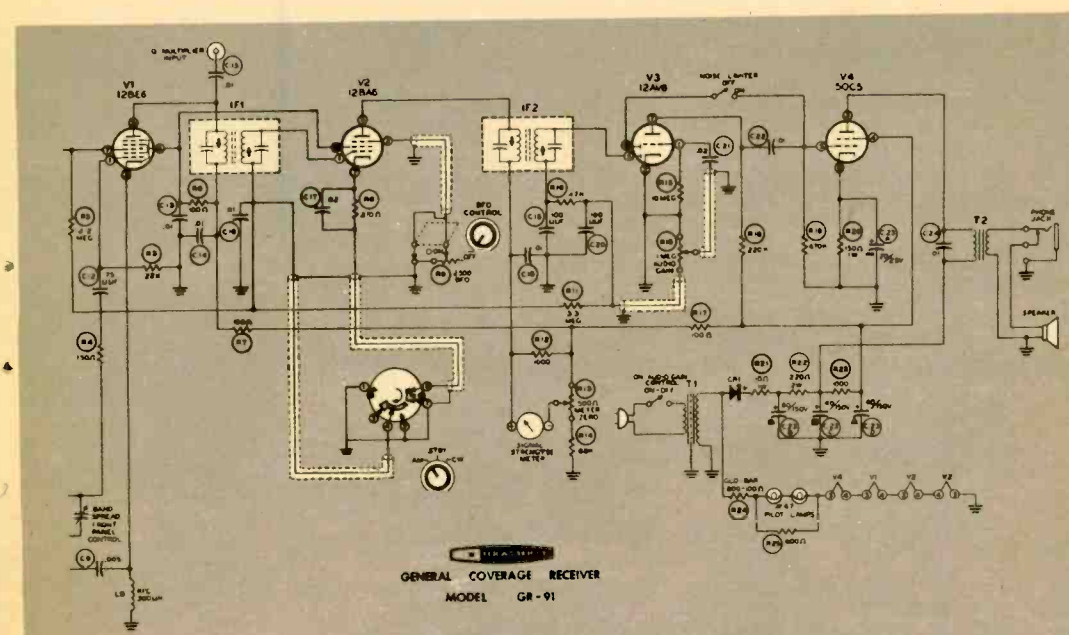
for the separate oscillator coil for each band. In common with almost all SWL and communications receivers, the GR-91 covers from 550 kc to 30 mc in four bands.

The IF stage is conventional and uses a 12BA6 tube (V2). The signal strength meter responds to the plate current of V2, which is under direct control of the Automatic Volume Control (AVC) voltage developed by the carrier of the incoming signal. Therefore, the stronger the carrier, the greater the AVC voltage, the lower the plate current of V2. The meter reflects this plate current in reverse—the lower the current, the higher the S-unit indication.

A standard audio triode/double diode tube serves as detector, AVC, first audio and noise limiter. This last function deserves discussion. When the noise limiter is switched on it connects one of the 12AV6's diodes to the grid of the 50C5 output tube. This diode clips the peaks of any sharp noise pulses getting through to the 50C5. You can visualize the diode as connected from the grid of the 50C5 to ground. The diode's cathode is the cathode of the 12AV6, which is connected to ground. This type of noise limiter is fairly effective in subduing atmospheric and similar types of interference.

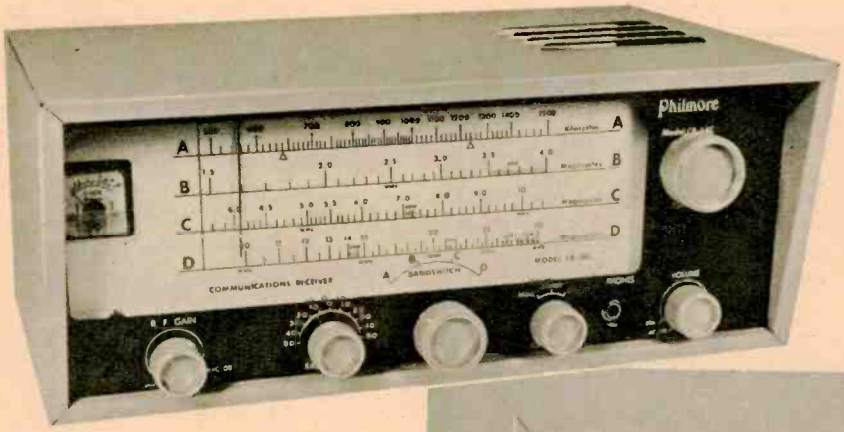
The Beat Frequency Oscillator (BFO) control is a clever bit of circuitry. Although not a new idea, it does its job effectively with minimum hardware. The control consists merely of a potentiometer connected from the suppressor grid of the 12BA6 IF tube to ground. In normal operation, the suppressor grid is always connected directly to ground (its normal job is to reduce inter-electrode capacitance). When the BFO pot is turned on, however, it lifts the grid above ground and the 12BA6's reaction is to become regenerative, introducing a squeal or tone into the circuit. When you're tuning for CW or single-sideband signals, of course, that tone (or re-inserted carrier) is just what you want.

Summing up, the GR-91 appears to have many things going in its favor—price, a generous number of big-set features and an attractive design. It should be popular among Short-Wave Listeners.



Schematic of Heathkit's new GR-91 receiver shows four AC/DC type tubes used in a superhet configuration. Note isolation transformer (T1) in power supply.

Philmore CR-5AC



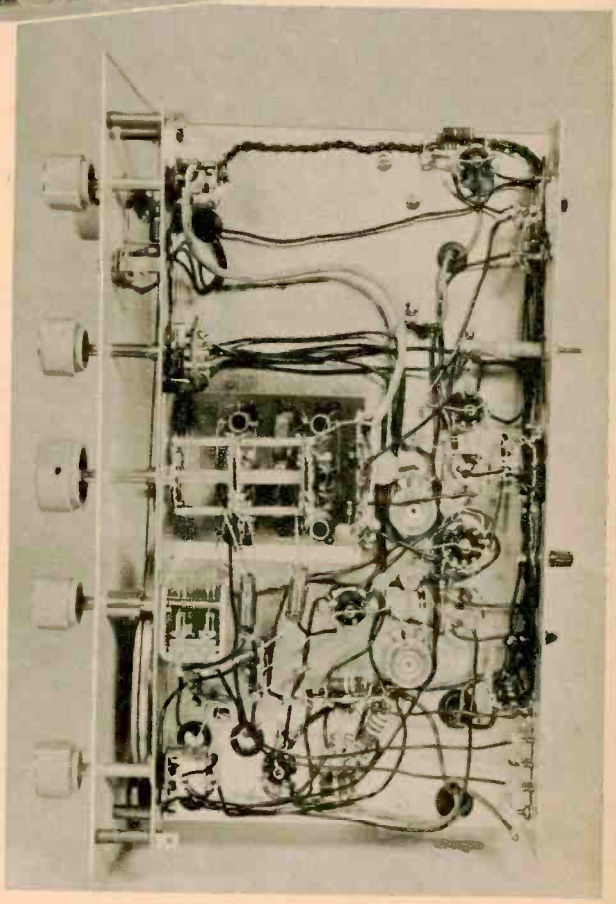
THE Philmore Model CR-5AC is a relatively inexpensive four-band, AC-operated superheterodyne receiver, available as an easy-to-build kit. Frequencies covered range through the broadcast band to 30 mc. The unit includes a self-contained speaker and such necessary SWL features as a noise limiter, bandspread, BFO, S-meter, etc.

Circuit Features

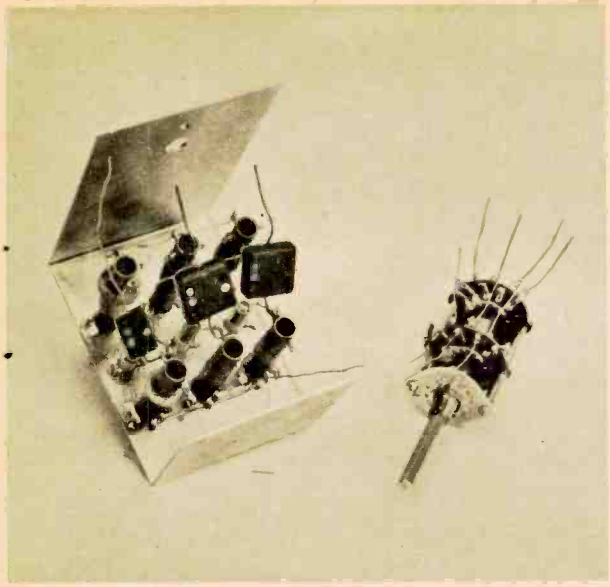
When the receiver's RF gain control is rotated counter-clockwise from the full *on* position, the AVC line is shorted to ground and the receiver gain is manually controlled. Without this defeat position, weak signals would be lost.

When the function switch is in the **CW** position, the BFO is activated. A reflex configuration is employed, where the first audio triode (6AV6) doubles in brass as an RF oscillator. The oscillator frequency is adjusted (by the BFO coil slug) to beat with the IF frequency, yielding an audio-frequency tone.

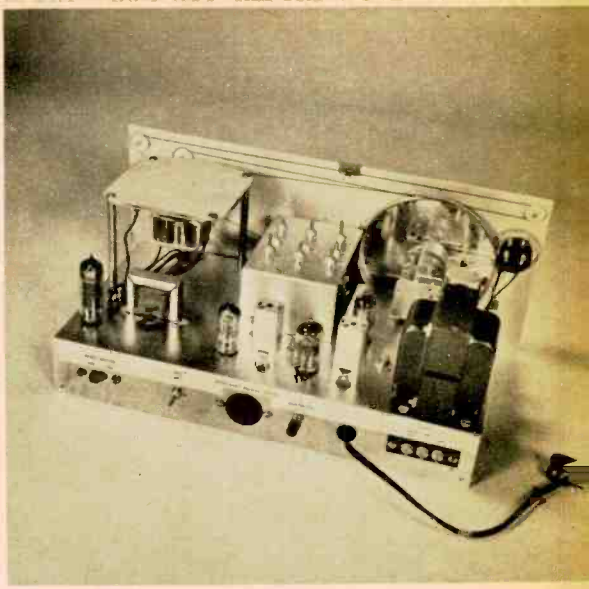
The S-meter circuit in the Philmore is, in effect, a miniature vacuum-tube voltmeter which reads the AVC voltage. The triode section of the 6AZ8 triode-pentode tube serves as one leg of a bridge configuration; the dynamic resistance of this tube is controlled by the



Underchassis view of completed receiver shows the open, easy-to-build type of construction used.



Coils are installed on a sub-chassis. Entire sub-assembly is then mounted by the bandswitch.



Chassis before being installed in the cabinet. Speaker at upper left is mounted on stand-offs.

AVC voltage applied to its grid. Any change in the AVC voltage is reflected in a change in the meter reading. Two S-meter controls are moved—one to balance the bridge (set to zero) and the other to adjust the sensitivity of the meter. The S-meter is connected so that it can provide signal indication with the AVC switch on or off.

Kit Construction

The kit was, in general, fairly easy to build, but a little caution is in order for the beginner. A few more pictorials would have been helpful. The wiring and mounting of the bandswitch and coil sub-assembly, for example, were obscure because of the absence of a specific pictorial.

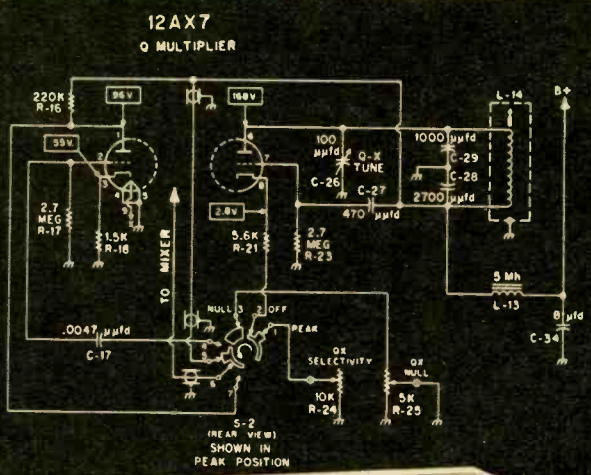
This kit has a trick that deserves mention. Special standoffs are used to mount the set's speaker. But since the speaker mounting is one of the last steps, Philmore has the chassis so arranged that the standoffs serve as props when you're working on the underside of the chassis. Anyone who has struggled to prop up a chassis to get at the underchassis wiring knows what this means.

Although some of the steps may cause a bit of head-scratching, no serious problems will arise. The chassis is compact, but there is plenty of space to get around in. The point-to-point wiring is well described and there are fold-out pictorials of the chassis mounting and wiring. About seven hours of careful work will find you with a completed kit ready for alignment.

Alignment, Performance

Careful alignment is a must if you want to realize the good performance this unit is capable of. All that is required is an RF signal generator, since the S-meter serves as an indicating meter. There are many good inexpensive RF generators in kit form, but if you don't wish to purchase one you probably can borrow or rent the instrument from a local serviceman. The minor trouble involved will be more than made up for by the hours of enjoyment you can derive from this kit.

The Philmore CR-5AC communications receiver kit should be of interest to many people. Good performance, simple alignment procedures, many features and price of $43.95 (plus $7.95 for steel cabinet) make this unit a good buy for the SWLer.



Q-multiplier circuit, built in the Knight-Kit may be used to peak the desired signal or "notch" an interfering signal. Circuit is tunable and both the amount and width of the notch or hump are set by panel controls.

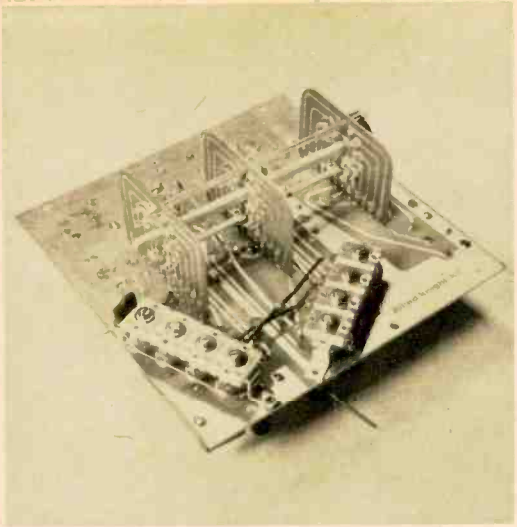
Knight-Kit R-100

IS it possible to build a professional communications receiver from a kit that is the equal of a factory-wired job? The answer to the question, if you choose a Knight-Kit R-100, is an unqualified yes. Here's a receiver that combines the professional features and quality found in the $200 price range with the saving inherent in kit construction.

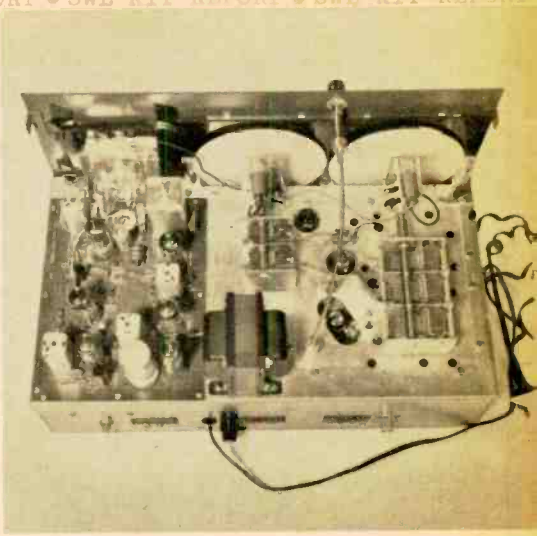
In addition to all the usual conveniences of the lower-priced communications receivers, the R-100 boasts a built-in Q multiplier, better than 1% calibration accuracy, an effective noise limiter and several other DX-pulling features. More on this later.

Construction is relatively easy despite the complexity of this nine-tube kit. A printed-circuit band-switch and the two printed-circuit boards which contain almost all the stages can take credit for this. The PC boards insure proper component positioning as well as correct lead length—a critical matter at the higher RF frequencies. Large fold-out pictorials and many insert detail drawings insure that the novice can find his way as easily as a more experienced kit-builder.

Here are a couple of hints that may help you along with the R-100. When involved with the under-chassis wiring (after the PC boards are mounted)



Printed circuit bandswitch assembly shown mounted on separated PC board. Coils and other components are mounted on board's reverse side.



Completed receiver. Three-gang main tuning capacitor is at right, bandspread capacitor center. Other PC boards are mounted beneath the chassis.

we found the work went a lot easier with the chassis propped up at its four corners on wood blocks, books or anything else handy. These corner props avoid damage to top-of-chassis components and you'll find everything is far more accessible than if you stand the chassis on its side as Knight suggests.

So much emphasis has been given to the fragility of printed circuit boards that some builders are almost afraid to put a soldering iron to them. Knight points out that too little heat is as bad as too much. The boards are not *that* delicate and they should be soldered in the accepted fashion; use as much heat as is necessary to insure good solder flow—but use a standard brand solder.

Despite all the aids found in this kit, don't think its construction is a one-evening job. This is a professional-caliber unit and hence contains an awful lot of circuitry. It's best to take it slow and easy. We spent about nine hours on this kit before we reached the alignment procedures.

The R-100 Circuit employs nine tubes in an AC-operated superhet design. The frequency range of .54-30 mc is divided among four bands with calibrated bandspread available on the 10, 15, 20, 40 and 80-meter ham bands.

The Knight-Kit includes such special items as a tuned RF amplifier and a voltage-regulated B+ supply for the oscillator tube (which is separate from the mixer tube). This type of arrangement gives maximum oscillator stability.

The Q-multiplier circuit inserts at the plate of the mixer tube. This is actually a variable bandwidth control which in the *peak* position will let you pin-point a desired signal and lift it out of the mud of adjacent interference. Or with the *QX* set for the *null* position you can tune in adjacent QRM and suppress it to the tune of about 60 db. Another interesting feature is the R-100's delayed AVC action. Unlike the usual AVC circuit which has a tendency to suppress weak signals, the Knight-Kit's AVC doesn't get into the act until a full two-volt signal reaches it. In other words, AVC action is there—but only when required. Of course, the AVC also can be switched out if desired.

Proper instrument alignment is necessary for maximum performance and Knight's instruction book makes no bones about it. Only an RF signal generator and a VTVM or VOM (of at least 5000 ohms/volt AC sensitivity) is re-

[*Continued on page* 107]

AN EI SCOOP

build your own

Stereo FM Adaptor

By Harry Kolbe
Contributing Editor, Audio

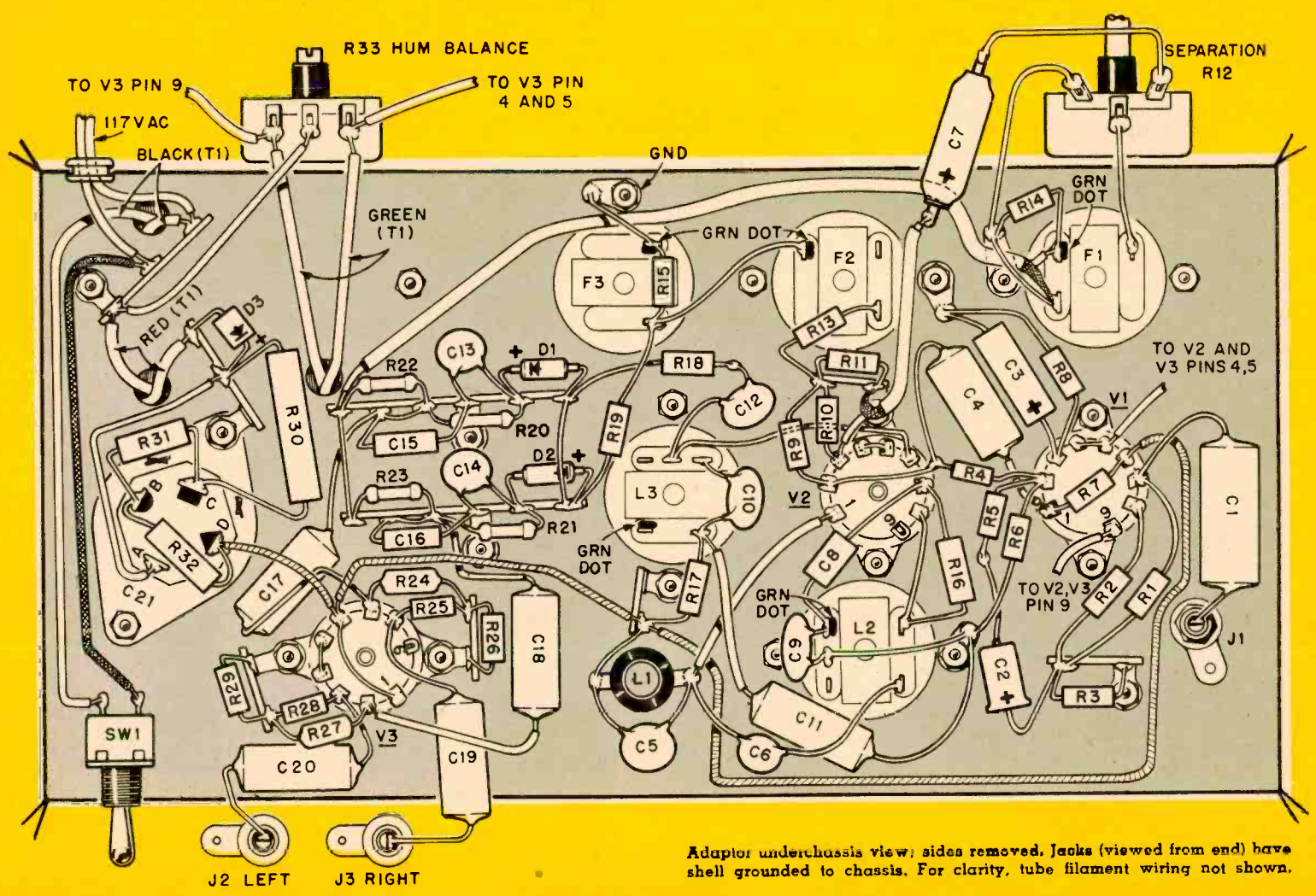
Complete plans for a universal multiplex adaptor that will work with any modern FM tuner

NOW IS THE TIME to go stereo! If you weren't sure whether stereo was here to stay, if you've complained about the high cost of stereo records and tapes—your troubles are at an end. Shortly, you will be able to hear all the *high-quality* stereo you want—free, over the airwaves!

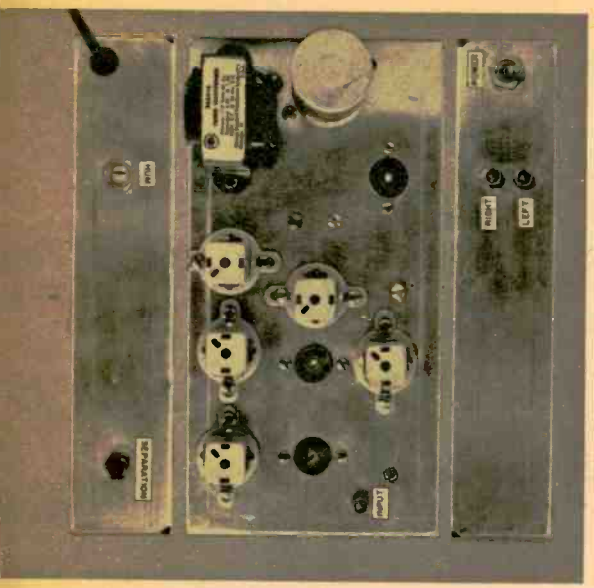
Previous stereo broadcasts using AM and FM channels were makeshift at best and have been discontinued. Now by simply adding a multiplex adaptor to your present stereo system you can have, at low cost, a superb source of stereo programs—both live and recorded. By the time you read this, more than 75 FM stations will have started stereo broadcasting and the number will double or triple in 1962. If you have a single-channel mono rig, now is the opportune time to convert to stereo to get the benefit of these new stereo broadcasts.

EI's Stereo Adaptor is designed to make conversion to stereo FM as painless as possible, both technically and financially. Equivalent in performance to units two or three times as expensive, EI's adaptor is designed to work with *any* quality FM tuner which can supply .5 volts of signal from its multiplex output jack.

Separation obtainable depends on signal strength, sensitivity and frequency



Adaptor underchassis view; sides removed. Jacks (viewed from end) have shell grounded to chassis. For clarity, tube filament wiring not shown.



Top view (with sides folded out) shows parts layout. Note socket keying and coil arrangement.

response of the tuner. In fact, the quality of the stereo delivered by the EI adaptor seems to be directly proportional to the quality of the tuner used with it.

It should be stressed that stereo FM requires a stronger signal to reach your tuner than mono. Although a hank of wire may be adequate for mono FM reception in your locality, noise-free stereo reception may require a good outdoor antenna.

EI's adaptor as presented here is a basic model. In our next issue we will publish cabinet plans, instructions for adding filters (desirable for tape recording and noise suppression) and a stereo beacon which indicates when a stereo signal is being received. The deluxe model is shown in the drawing at the head of this article.

The audiophile who owns a multiplex adaptor may notice the great differences in stereo quality between one station and another. This is not necessarily a malfunction of the adaptor. The trouble may originate at the station. Until stations with newly-acquired stereo transmitters are able to make optimum adjustments, a lot of noisy and distorted stereo will be heard.

EI's adaptor uses five special coils which are not readily available at retail. However, they can be obtained prealigned from the Audio Workshop, Inc., 732 Broadway, New York, N. Y. There are no direct substitutes for the coils. For those who have an aversion to the intricacies of point-to-point wiring, a printed-circuit board which includes provisions for noise filters also is available from the Audio Workshop, Inc. (See box for details).

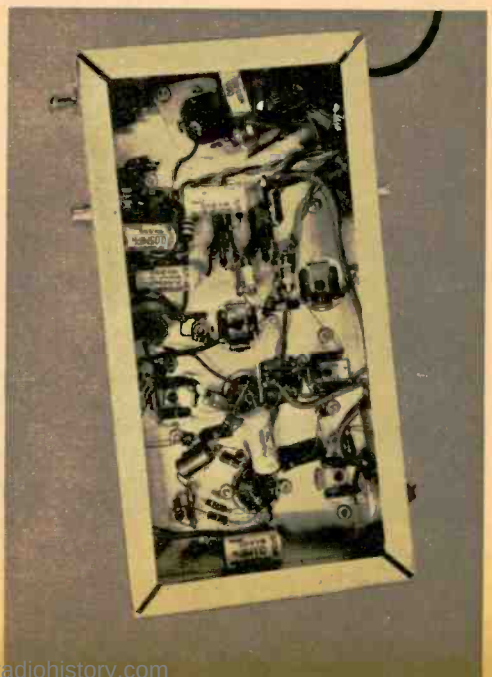
Construction of the adaptor begins with chassis layout. Follow the pictorial and photographs closely since changes could result in stray radiation and feedback between stages. The holes for the

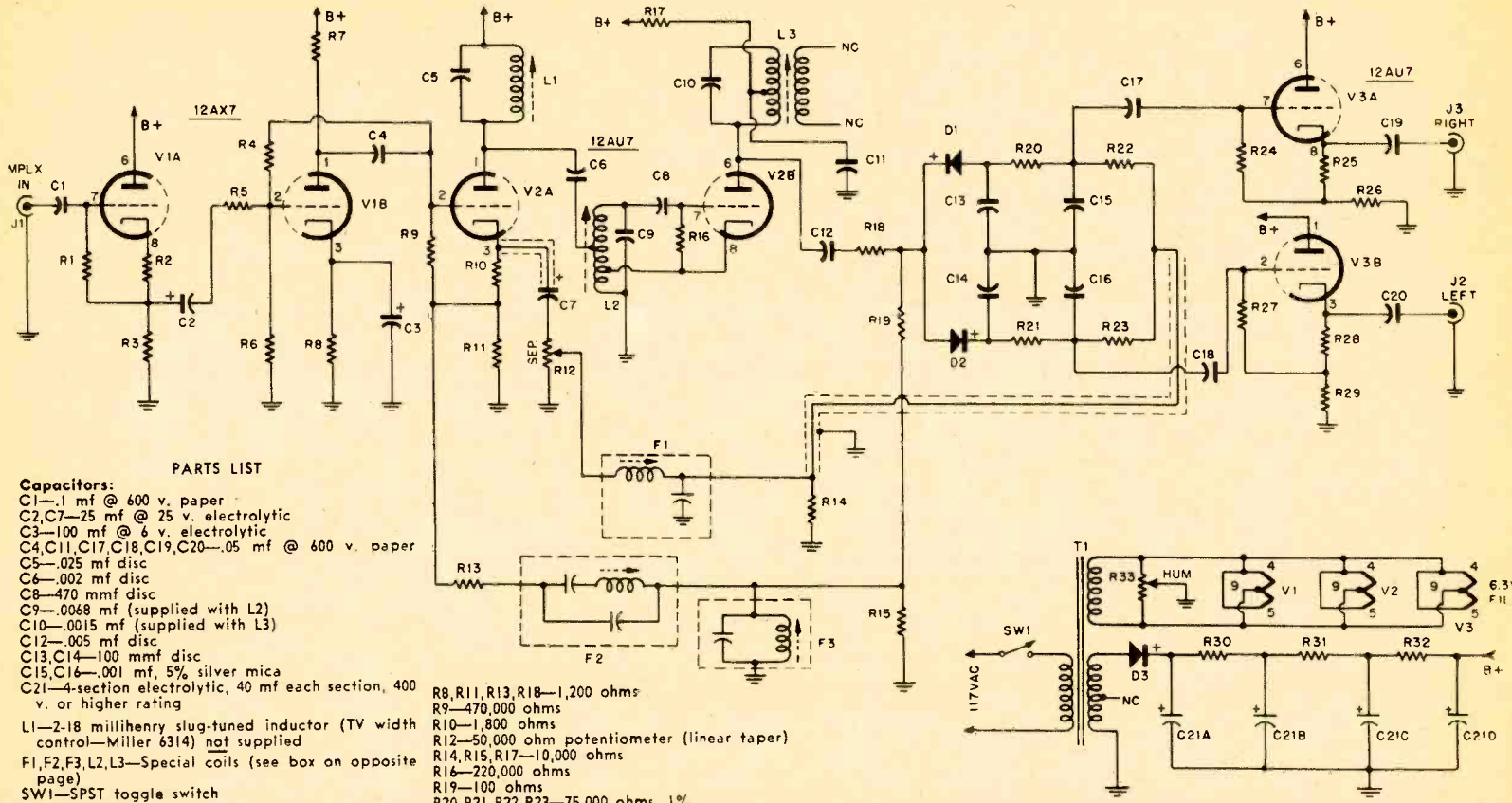
[*Continued on page* 108]

How to order SPECIAL COILS and PRINTED CIRCUIT BOARD

Since the special prealigned coils in EI's Stereo FM Adaptor are not commercially available we have made arrangements with the Audio Workshop, Inc., 732 Broadway, New York 3, N. Y., to supply the coils and matched detector diodes at $8 a set postpaid. A printed circuit board for the adaptor is available from the Workshop for $2 postpaid.

Bottom view of adaptor shows uncrowded layout.





Complete schematic of multiplex stereo adaptor.

PARTS LIST

Capacitors:

C1—.1 mf @ 600 v. paper
C2,C7—25 mf @ 25 v. electrolytic
C3—100 mf @ 6 v. electrolytic
C4,C11,C17,C18,C19,C20—.05 mf @ 600 v. paper
C5—.025 mf disc
C6—.002 mf disc
C8—470 mmf disc
C9—.0068 mf (supplied with L2)
C10—.0015 mf (supplied with L3)
C12—.005 mf disc
C13,C14—100 mmf disc
C15,C16—.001 mf, 5% silver mica
C21—4-section electrolytic, 40 mf each section, 400 v. or higher rating

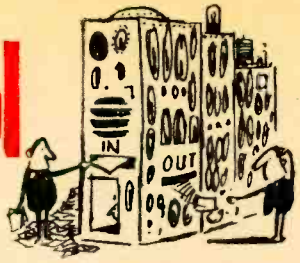
L1—2-18 millihenry slug-tuned inductor (TV width control—Miller 6314) not supplied
F1,F2,F3,L2,L3—Special coils (see box on opposite page)
SW1—SPST toggle switch
V1—12AX7 tube
V2,V3—12AU7A tube
T1—Power transformer, secondary: 250 v. @ 25 ma. center-tapped; 6.3 v. @ 1A (Stancor PS8416 or equiv.) Center-tap not used

Resistors: ½ watt, 10% unless otherwise specified

R1,R6,R24,R27—1 megohm
R2—470 ohms
R3—3,300 ohms
R4—39,000 ohms
R5,R25,R28—2,200 ohms
R7—100,000 ohms
R8,R11,R13,R18—1,200 ohms
R9—470,000 ohms
R10—1,800 ohms
R12—50,000 ohm potentiometer (linear taper)
R14,R15,R17—10,000 ohms
R16—220,000 ohms
R19—100 ohms
R20,R21,R22,R23—75,000 ohms, 1%
R26,R29—22,000 ohms
R30,R31—400 ohms, 4 watts
R32—330 ohms, 4 watts
R33—100 ohms, 2-watt wirewound potentiometer
D1,D2—1N60 diodes (matched pair) supplied with coils
D3—300 v. (600 PIV) 50 ma. or higher diode (Texas Instrument 1N2071 or equiv.)

J1,J2,J3—Single hole mounting phono jacks
Chassis—Approx. 5"x9½"x2"

ELECTRONIC BRAIN



Have a question on electronics? Send it to Electronic Brain, Electronics Illustrated, 67 West 44th St., New York 36, N. Y. Enclose a stamped, self-addressed envelope for prompt reply.

Mercury in Space

Will a mercury switch operate in space where there is no "up" or "down?"

Martin Alter
Bridgeport, Conn.

A mercury switch contains a globule of this liquid metal in an evacuated glass tube. When operated, the mercury *falls* by gravity to a lower point in the tube where it establishes electrical connection between two electrodes and completes a circuit.

Under conditions where a man can float around inside a space ship, so would the mercury globule; and its ability to act as a switch would vanish.

Lamp Brightness

While experimenting with ordinary incandescent lamps, I found to my amazement that when a 50-watt lamp is connected in series with a 100-watt lamp the 50-watt lamp glows more brightly. This is the opposite of what happens when these lamps are used in house fixtures. What causes this?

Peter Neumann
Olkegger, Kentucky

The brightness of a lamp depends entirely upon the amount of power being dissipated in its filament. In a series circuit, the current in every component is the same as in every other component. This means that the factor that governs the brightness of the lamp must be its *resistance* in a series circuit. This comes from the equation:

$$W = I^2R$$

in which W = power in watts, I = current in amperes, and R = resistance in ohms. Since the I is the same for both lamps, only the R can affect the power.

The nominal resistance of an operating 100-watt lamp on a 120 volt house line is 144 ohms. The resistance of a 50-watt lamp under the same conditions is twice this value, or 288 ohms. Since the 50-watt lamp has the higher resistance, it will dissipate more power when connected in series with the 100-watt lamp and it therefore glows brighter.

Gilbert's Force

I recently ran across a reference to something called magnetomotive force *measured in* gilberts. *Can you explain these terms?*

Gene Clough
Long Beach, California

In an electric circuit, the difference of potential between the terminals of a battery is called the *electromotive force* because it causes the *current* to move through the *resistance*. In magnetism, a similar effect exists: when a current flows through a coil of wire it sets up a *magnetomotive force* which causes a *magnetic flux* (lines of force) to move around through the *reluctance* of the magnetic circuit. Reluctance is determined by the type of core material, its cross-section, and its length. Thus, it bears some resemblance to electrical resistance.

A law very similar to Ohm's Law governs magnetic circuits. For electricity Ohm's Law reads:

$$\text{current} = \frac{\text{EMF}}{\text{Resistance}}$$

and for magnetism, the law reads:

$$\text{flux} = \frac{\text{MMF}}{\text{Reluctance}}$$

where MMF is magnetomotive force.

Magnetomotive force is most often measured in terms of *ampere-turns*. Thus, a coil of 100 turns carrying 2 amperes has a magnetomotive force of 200 ampere-turns. Another unit of magnetomotive force sometimes used is the *gilbert*. The gilbert is defined as $4\pi/10$ ampere-turns or .794 ampere-turn. The gilbert is, therefore, a somewhat smaller unit of magnetomotive force than the ampere-turn.

HI-FI RECORD GUIDE

by Warren DeMotte

EVER since the beginning of commercial electrical recording a new release by Leopold Stokowski has been a notable event. This great conductor has an understanding of acoustics that is admired by engineers and musicians alike. He draws an unfailingly beautiful tone from any orchestra he conducts, and he is always eager to have it recorded in the most technologically advanced manner possible.

In new recordings of music by Richard Wagner for RCA Victor and Virgil Thomson for Vanguard, Stokowski leads the Symphony of the Air. In the Wagner selections, he also employs a women's chorus. He conducts this romantic music from Die Walkuere, Tristan und Isolde, Das Rheingold and Tannhauser with breadth and ardor, and the rich tone he achieves is acknowledged in the record's having been titled The Sound of Stokowski and Wagner.

Stokowski's interest in modern music has never flagged. He has introduced and recorded numerous contemporary compositions. The two orchestral Suites by Virgil Thomson are taken from documentary films of the 1930's: The River and The Plow That Broke the Plains (see cut). They are American in spirit, tuneful and positive. These performances are played with authority and deep sympathy, and the recording is excellent.

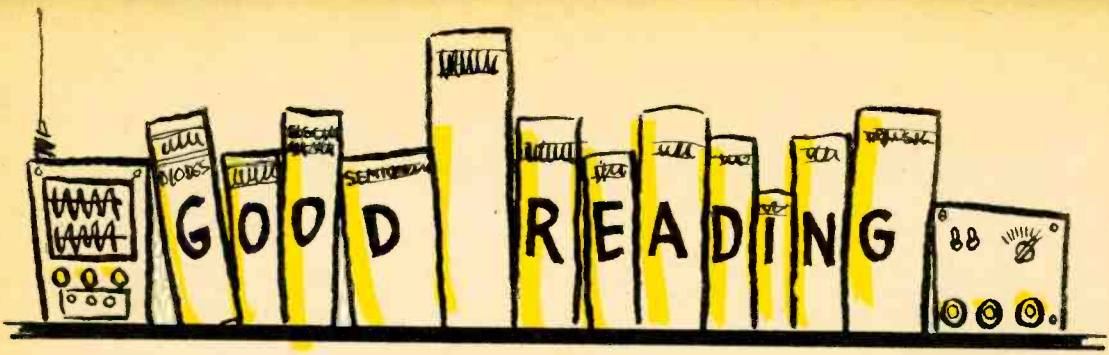
Pianists Van Cliburn and John Browning came to the attention of the public as contest winners. As yet, the former has not been heard on records in a solo performance, although his recording of Beethoven's Emperor Concerto is his fifth disc with orchestral collaboration. He plays with power and finesse, and Fritz Reiner conducts the Chicago Symphony with vigor and intensity, but there are moments when the principals do not seem to see eye-to-eye.

Browning's recording of Serge Prokofiev's Third Concerto inevitably will be compared to Cliburn's recent recording of that modern masterpiece. The Browning is more spirited and lively, and altogether a more successful presentation. Paired with the Russian piece is a scintillating rendition of Maurice Ravel's Concerto for the Left Hand. Erich Leinsdorf leads the Philharmonia Orchestra in alert collaboration in both concertos, and the recording is brilliant.

An excellent buy is Richmond's release of Beethoven's Ninth Symphony complete on one record. Sturdily performed by the late Erich Kleiber and the Vienna Philharmonic, with chorus and soloists, this was released originally on two London records. No quality has been lost in the transfer to a single disc.

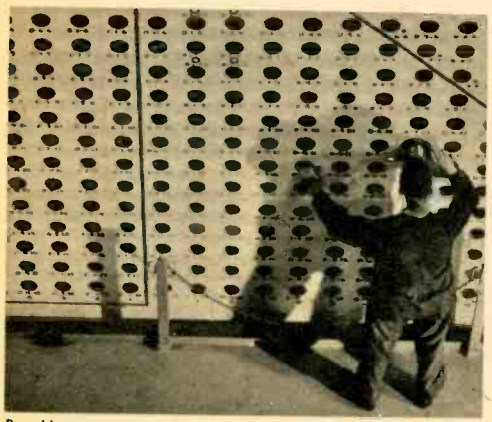
With the Civil War Centennial now in full bloom, the songs that were sung during the conflict are again heard. Tennessee Ernie Ford treats North and South with equal favor in performances of those tunes with gallantry and sentiment. It is interesting to note in passing, that of the three songs most popular in the Confederacy—Dixie, The Bonnie Blue Flag and Maryland, My Maryland—not one employed a melody composed by a Southerner.

[*Continued on page* 112]



ATOMIC ENERGY: THE STORY OF NUCLEAR SCIENCE. By Irene D. Jaworski and Alexander Joseph. Harcourt, Brace & Co., New York. 218 pages. $4.95.

By now, all of us know enough about atomic energy to do our share of worrying over its destructive potential. But most of us, especially those who managed to duck the study of physics, can stand to know a great deal more about the atom itself. Here is a fine introduction to its secrets. It is readable, beautifully organized and well illustrated (the photo we reproduce from the book shows one face of the Brookhaven reactor, which is loaded with uranium through the holes). This book obviously is intended primarily for the high school student, but it deserves a much wider readership. Its clarity and simplicity are not achieved at the expense of necessary information, and the authors are not talking down to anyone. Included are some simple—and safe—experiments and construction projects nicely gauged to give the reader the feel of the subject. All in all, a welcome little volume



Brookhaven Natl. Laboratory

HOW DOES IT WORK? By Richard M. Koff. Doubleday & Co., Garden City, New York. 288 pages. $3.95.

If every now and then you feel a bit uncomfortable in a world full of gadgets, here is an invaluable book. It's a practical and entertaining guide to the workings of almost anything you are likely to use in your everyday life. It also tackles everyday phenomena—like electricity—and provides good working explanations. Its aim? To keep you from being at the mercy of the things you use and see around you. And little, from aerosol cans to automobile transmissions, escapes the author's attention. With deceptive ease he moves from a discussion of how to get a window unstuck into an explanation of the mysteries of your doctor's X-ray machine. By all means take a glance at the table of contents. This book may prove to be endlessly useful to you.

ELECTRONICS AND NUCLEONICS DICTIONARY. By Nelson M. Cooke and John Markus. McGraw-Hill, New York. 543 pages. $12.

This book needs little explanation, except to say that it's comprehensive and up-to-date. It provides definitions, abbreviations, and synonyms for over 13,000 terms now in use in *all* branches of electronics and nuclear physics. The definitions are not lengthy—the book is *not* intended to be an encyclopedia—but they are accurate, and there are more than 450 illustrations. This should be an indispensable volume for anyone seriously involved in electronics, from a student to a stenographer.

FIRST-CLASS RADIOTELEPHONE LICENSE HANDBOOK. By Edward M. Noll. Howard W. Sams

[*Continued on page* 110]

EXCLUSIVE!

how RUSSIAN SPY RADIOS WORK

EI for the first time reveals the exact design of famed bug that Reds planted in our embassy.

By S. David Pursglove

DURING our long cold war with the Communists we've heard a lot about secret listening devices planted (and discovered) by our side or theirs to eavesdrop on conversation between high government officials. But we seldom are shown any of these little electronic spies, and even less often do we find out how they operate. On May 26, 1960, U. S. Ambassador Henry Cabot Lodge astounded the United Nations by displaying a tiny bug which had been discovered in our embassy in Moscow. It was secreted in the Great Seal hanging over the Ambassador's desk. And the Seal was a gift from the Russians! As the story came out, the bug actually had been unearthed in 1952 but the fact was not revealed for eight years. After the UN incident, the gadget dropped from sight and its operation was never explained. Now, for the first time, EI reveals the device's design and workings.

May 26, 1960: In United Nations, U.S. Ambassador Henry Cabot Lodge shows secret listening device the Russians planted in Great Seal they gave our Moscow embassy. EI now discloses how the clever bug operated.

Tricky, Those Russians

The Government's security experts are becoming more concerned over the development of listening devices by the Soviet and other intelligence services.

President Kennedy was warned before his departure that the only safe place to talk was outdoors. It seems that the Russians have developed a gadget that even picks up sound waves off a window pane. Thus they could intercept a talk between the President and his advisers in the United States Embassy in Paris or Vienna.

Even consultation outdoors is becoming tricky because of the perfection of long-distance directional microphones.

N.Y. Times item indicates worry about bugging during President Kennedy's '61 trip to Europe.

Actually, the Great Seal bug is only one of an army of Red eavesdroppers we've unfrocked. In the last ten years 128 others have turned up in embassies, missions and consulates. We still don't know design details of most of the others, but we hazard the guess that the Great Seal's little pal is the most fiendishly clever of the lot.

The bug shown by Lodge consists of a cylinder about as big around as a quarter and measuring $\frac{11}{16}$-inch from front to back. A nine-inch rod protrudes from one side and on the front of the cylinder is a perforated cover holding a diaphragm (see diagram). In operation, the device was secreted in a cavity between the front and back section of the Great Seal (made of maple). Just below the eagle's beak several tiny holes opened on the bug's diaphragm. Sound waves passed through the holes and struck the diaphragm.

The idea of this bug—and all others—is to convert acoustical energy to electrical energy so the information (speech) it contains can be sent by wire or radio waves to a listening post. The Great Seal apparatus used radio waves in a way so diabolically simple as to astound even people sophisticated in electronics. It had no circuit as such and was devoid of any local power supply.

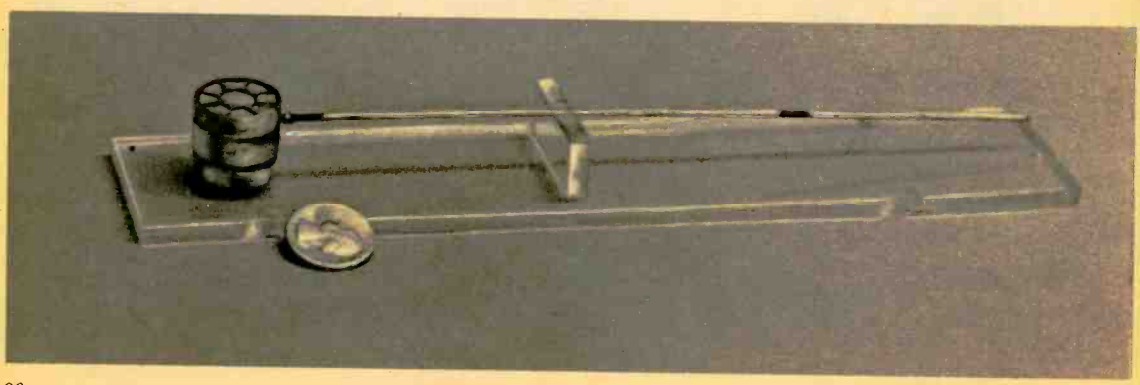
Let's look at our captured spy in detail. Its cylinder, made of copper and silver plated, is hollowed out inside to such close tolerances as to create a high-Q (sharply tuned) cavity. Our State Department experts estimate the Q factor to be as high as 1,000.

Mounted on the back of the cavity is a tuning post (or electrode) holding a quarter-inch-wide flat plate parallel to the three-mil diaphragm. The tuning post's plate and the diaphragm are capacitively coupled.

Next, we find that the nine-inch antenna (a silver-plated copper rod) passes through one wall of the cylinder and terminates in a small plate which it holds near the tuning post. The post and antenna plate, then, also are capacitively coupled. The back cover of the cavity is threaded for precise adjustment of cavity size.

In operation, the Russians placed a

Listening gadget that Reds put in Great Seal lies on plastic stand; quarter is for size comparison.



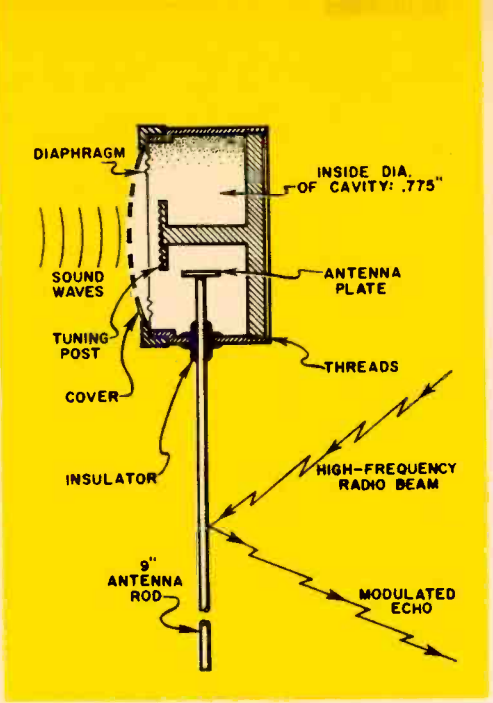
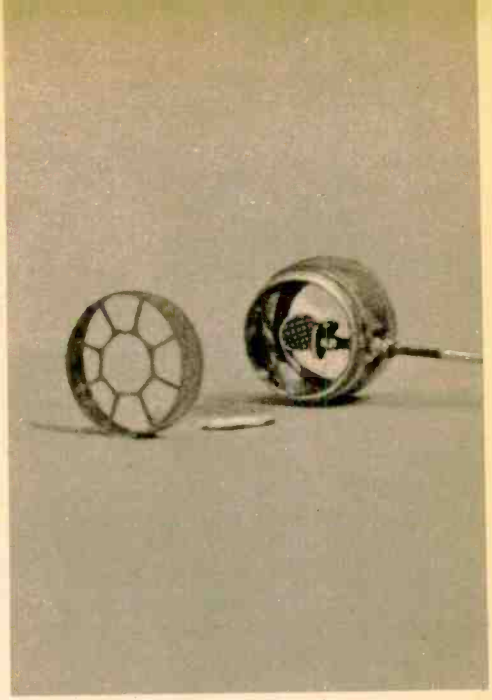


Diagram of bug shows how capacitive changes in cavity alters charge on antenna, which in turn modulates radio beam (see copy for details).



Visible in closeup of cavity are tuning post in center and the antenna plate. The threaded cover holds diaphragm. Quarter lies on table.

high-frequency transmitter with directional antenna at some near-by spot. Out of the antenna came a signal at around 1600 megacycles. The antenna must have looked something like a small radar dish and the signal also was radar-like, except not pulsed.

The RF beam struck the bug's tiny antenna and a misuscule signal echoed back. As long as the antenna kept the same electrical length the echo remained at a set frequency. Now the fiendish bit developed.

Anyone who spoke near the Great Seal generated sound waves which struck the bug's diaphragm, causing it to vibrate. This altered the cavity's size ever so slightly and varied the capacitive values described above. The changes in capacitances altered the charge on the antenna rod (radiated to it from the transmitter) and caused its echoed signal to vary accordingly. In effect, the bug modulated a little piece of the beamed signal before sending it back as an echo. The echo was picked up by a receiver and demodulated to reproduce the original speech.

State Department security officers say this bug was particularly hard to spot since its power was controlled by the eavesdropper. They liken the device to echo boxes that once were placed in front of radar units to tune them. The entire bug weighs only 1.1 ounces and its cavity has an inductance of 1/100 *micro*henry.

In the years since 1952 our experts have put the Great Seal's little friend to many tests. They say it works well in free space but is extremely sensitive to environment. It must have given its creators fits now and then because its operation is so critical as to go haywire when any small piece of metal (a watch, the nails in shoes, etc.) is brought near.

Electronic eavesdropping has become a major headache to our government because the bugs are getting smaller, more efficient and easier to hide. Our foreign buildings are vulnerable because they are put up by *local* workmen who, if they dislike us, can salt the whole premises with bugs that may take years to find. A bug in the wall, it is said, is worth two in the bush, or almost anyplace else.

Meanwhile, one wonders what the Commies have produced as a successor to the Great Seal bug.

TESTING, TESTING . . .

AFTER several months of building, testing, and checking all nationally available tuner kits, EI's audio staffers have gained not only some gray hairs but a few new insights into the subject of tests and specifications.

By now, hi-fi no longer requires the average audiophile to wade through a stack of specs to get an idea of what's going on. Manufacturers now condense their major specs for easy reading. But some of these "major" specs turn out to be not so major any more. Let's just take a gander at the one-time "sacred" matter of frequency response, for instance. After testing a dozen tuners and finding *all* of them to cover the 20-20,000 cps range within 1 db or so, we ended up not even listing that factor in our chart.

Tuner sensitivity seems to be a subject more or less in the same category. At the moment, some tuner manufacturers find themselves riding hell-for-leather in a "sensitivity race." It's hard to say what an extra microvolt or so of sensitivity really means in a tuner's performance. If a tuner with a sensitivity of *three or four* microvolts doesn't perform well in your locale, will another with a *two* microvolt rating do the trick? We don't honestly know. But we suspect that it won't—and that any extra cash put aside for a tuner with that extra microvolt or two of sensitivity might be better spent on a good, rotatable outdoor antenna. We have coming up in EI a discussion and complete listing of FM antennas and their accessories.

The sensitivity race shows no signs of letup. At this point, some manufacturers (or starry-eyed copywriters in their advertising department) claim sensitivity on the order of a *microvolt or less.*

Several questions immediately arise. First of all, is that one microvolt arrived at using the IHFM standards or has the manufacturer gone off in some never-never land with his own individual quieting level standard . . . which is not legitimately comparable with anyone else's? We've said it before, but it bears repetition—unless a manufacturer states in full what his standards are (and they should be the IHFM standards whenever applicable) his specs are of little, if any, use.

The Editor's at EI had a fine example of exactly how touchy some companies can be around the sensitivity question. The men at the helm of one firm went off like a row of Roman candles when they learned that our tests checked out their tuner at a fraction of a microvolt less sensitive than a competitor's. The fact that their tuner actually checked out in our tests *slightly better* than the figures *in their own instruction manual* made no difference. The manufacturer agreed with us that the fraction of a microvolt couldn't possibly make any difference in the performance of the tuner, but as far as they were concerned, the sensitivity race was on—and they weren't going to come out behind.

Obviously, this particular manufacturer is convinced that in the hi-fi buying public's mind, sensitivity is the overriding factor—and that a tuner's sales will rise or fall on an extra fraction of a microvolt in advertising claims.

Other factors are also of decided importance. It's almost always a grave mistake to focus on a single specification. In the case of an FM tuner for example, anyone who uses the sensitivity figure (assuming it's legitimate) as the *only* criterion for his tuner might end up with a good sensitivity, but with too narrow a bandwidth for multiplex—or a bad signal/noise ratio, a high level of distortion, etc., etc. In short, approach a tuner —or any other high fidelity component for that matter—with an eye to its complete specifications and how they will fit in with the rest of your system.

getting to first Bass

HI-FI CLINIC

I have a 10-watt integrated amplifier and would like to get more bass boost from the tone controls. How can I do this?

Phil Carter
Croyden, Penna.

The mark of the hi-fi novice is an inability to keep his hands off tone controls. The experienced audiophile seldom finds it necessary to add more than 4-5 db bass or treble boost.

According to its specs, your amplifier has 16 db of boost available from the bass control. This should be enough to give you all the bass you could legitimately want. If you were to attempt to add any more bass electronically it would only result in overload of the stages following the bass control and increased distortion.

I would suggest that you check the other components in your system as they may be responsible for the inadequate bass. It's also possible that your system's bass may be okay but your ear has been fouled up by too much listening to the juke box in the corner candy store. It can't be stressed too strongly that juke-box bass with its boom-boom around 80-100 cycles is not true bass but actually a form of frequency distortion. True bass is felt as a sort of pressure not unlike the sort of rumble felt in the ground from a passing train.

Phono Stage Noise

Recently my preamplifier has been exhibiting a crackling noise, in fact it almost sounds like the static from an AM radio. Could you tell me what is wrong and would it be possible for me to fix it myself? I do not have any test instruments.

R. Bouly
Trois Rivieres, Can.

It sounds as though there is a noisy resistor in your unit. As the noise is only present when the preamp is set to phono, it is probably caused by a noisy resistor in the plate or cathode circuit of the phono preamp stage.

Short of taking a look at the noise with an oscilloscope, instruments would not be much help in this case since the voltage and resistance measurements would probably be correct.

Simply bridge the resistors, one at a time, with a .1 mf, 600 volt capacitor. The capacitor will short out the noise signal without upsetting the DC voltages. When the capacitor is bridged across the offending resistor, the noise will greatly decrease or stop completely. Simply replace the resistor (preferably with a low-noise type).

As this check must be carried out while the set is turned on, take care to avoid shock.

Microphonic Mixup

What happens to a tube when it becomes microphonic? Also, why doesn't a microphonic tube taken from my preamplifier act up when I insert it in my amplifier?

R. Albrecht
Scranton, Pa.

Calling a tube microphonic is another way of saying that it is vibration sensitive. Usually, one or more of the tube elements become loose enough to sustain vibrations. Such a vibrating element increases and decreases element spacing and in so doing, acts as a generator of a fluctuating signal. This is what causes the ping you hear when a microphonic tube is tapped.

Microphonics are particularly troublesome in preamplifiers that have high gain and are therefore extremely sensitive to the signals generated by a microphonic tube. Power amplifiers, on the other hand, have much less gain and the minute signal generated by the microphonic tube is of no consequence because it never gets amplified to an annoying level.

The Ham Shack

By Robert Hertzberg—W2DJJ

A REAL HAM . . . Call letters including the combination HAM are issued in all ten radio districts but, the number of licenses being what it is, your chances of working a HAM are fairly remote. I hit this jackpot a few months ago when I called CQ and was answered by K2HAM.

"Are you for real?" I asked.

"Everyone asks me that," replied Moe Swedgal, 2111 Albemarle Rd., Brooklyn, N. Y. "This really *is* my FCC call. It's always good for a laugh."

—o—

VOX . . . Several chaps I worked recently on 20-meter AM phone were surprised when I described my rig and mentioned that I was using VOX (that is, voice-operated transmitter energizing, receiver silencing, antenna changeover). Apparently they thought VOX is found only in single-sideband transmitters. As a matter of fact, this type of automatic switching is a function of the microphone circuits and has nothing to do with the type of modulation.

VOX came into general use just as SSB was becoming popular, but this was only a coincidence. Since most SSB transmitters incorporating VOX also are usable on double sideband, the convenience of VOX goes along with AM operation.

—o—

Singular or Puerile? Check your phone operating habits. Are you guilty of saying "we" when you're alone at the mike? What's the matter with being natural and saying "I"?

Whenever I work a ham who uses the first person plural, I always shoot back with, "How many of you are there?" If the answer indicates puzzlement, I cut the QSO short, not caring to encourage stuffed shirts.

FULL HOUSE—Vera Miles, W7TGG, Brady, Mont., shows off her 6 receivers and 3 transmitters.

—o—

Talented YL . . . Wives of hams often pose in pictures of the radio shack to give a needed touch of human interest. However, Vera K. Miles of Brady, Mont. is no mere model. In her own right she is W7TGG, an experienced gal who can use all the elaborate equipment shown in the accompanying picture. She is active on the air and is known far and wide. Her OM is Ray, W7SFK.

The Miles shack is a ham paradise. It contains no fewer than six receivers and three transmitters, in addition to numerous accessories. The QSL-plastered walls are proof that the stuff works.

—o—

Check the Book . . . There are so many new hams coming into the game and so many old ones moving around that you can't be sure of names and addresses for QSL purposes unless you verify them

[*Continued on page* 106]

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SHORT-WAVE LISTENING

TEST EQUIPMENT (C)

THEORY AND PRACTICE

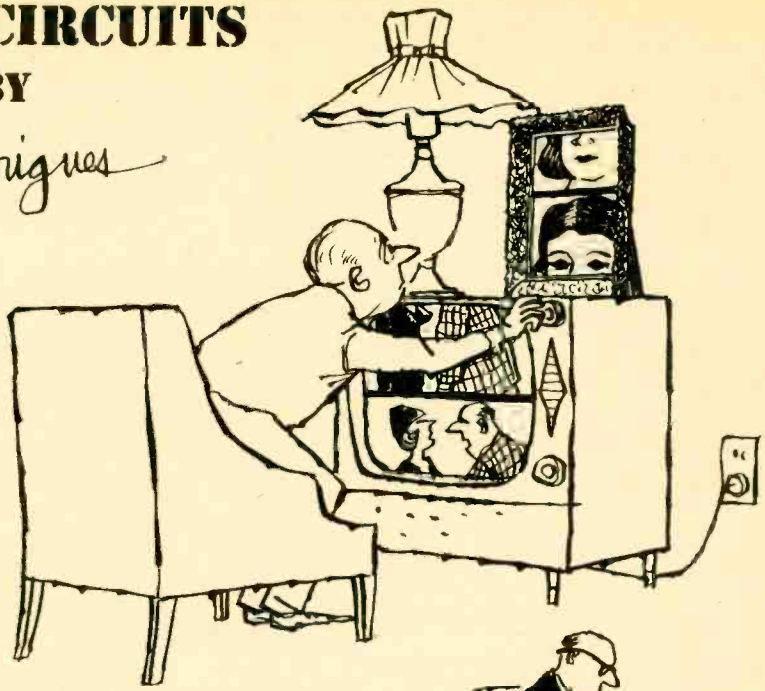
FEATURE ARTICLES

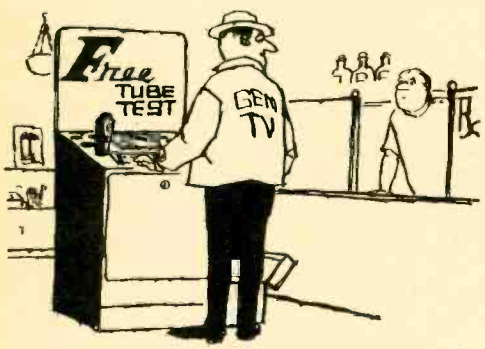
MISC. CONSTRUCTION PROJECTS

SHORT CIRCUITS

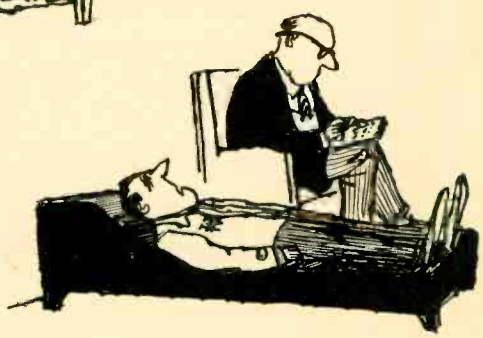
BY

Rodrigues

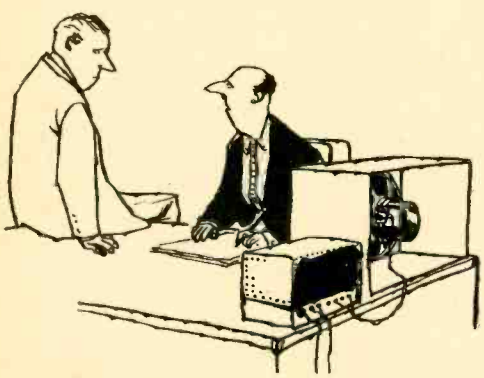




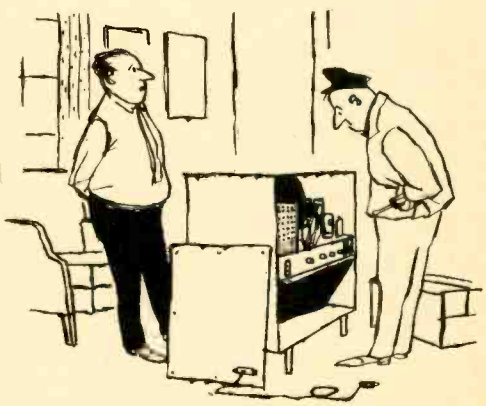
"Hi!"



"... and every time I use the cheater cord I get this terrible guilty feeling. ..."



"When Mr. Bascom calls, he only calls once."



"What make? Well, since I built it myself I guess it's a Stengleheimer."

how they make

Hi-Fi Turntables

The only job they have is to spin those records, but turntables take a lot of care in the making.

WHEN you get right down to it, a hi-fi turntable has a pretty simple job in this world. All it has to do is go around and around, carrying on its back a record whose grooves are filled with the mechanical distillation of music and voices, or perhaps cannon shots or roaring sports cars. When translated by a phono cartridge and the rest of a hi-fi system, these sounds become pleasure to the listener.

But, simple though its job may be, the turntable is put to a severe test during every second of its operation. The accuracy with which it makes its revolutions is a critical factor in the quality of the sound coming out of the speaker system at the other end of the hi-fi rig. Just how much accuracy is demanded of a turntable depends on its owner. To a great many people, music is pretty much music and most any turntable or automatic record changer from $5.95 up produces satisfactory results. To more acoustically conscious hi-fi fans, slight variations in turntable speed, called wow, produce subtle changes in the pitch of the music, which irritates them. Similarly, if a turntable has a rumble, their golden ears detect this noise coming through the speaker system and it makes them even more unhappy.

High-quality turntables, then, must do their simple job with infinite accuracy. Although it is impossible to remove all wow, rumble and other frailties from any turntable produced by mortal man, such defects can be reduced to such low levels that their workings within a hi-fi system are unseen and unheard.

1 . . . Turntable drive motors, made by an outside supplier, are checked out on a Gisholt electronic balance device after assembled from components.

2 . . . Clustered motors are run in on bench to assure stable operation. A Strobotac is used periodically to check on rpm of individual motors in group.

3 . . . Skilled workers on the assembly line put together the components to make up two types of hi-fi turntables. Supervisor is in background.

What goes into the production of such a turntable?

In a typical quality factory you find that some parts and materials (such as drive motors) are produced by outside companies, but practically every component of each turntable reaches its final form right in the plant. Aluminum castings for turntable blanks, for instance, may be made elsewhere but final machining is done at the location where assembly takes place.

The motors likewise may arrive as components, which are put together and tested before going into turntables. Each motor is checked for balance and speed and each goes through a running-in period. On top-line models, the spindle may be ground by using the unit's own motor as the power source. This insures concentricity of shafts.

The photographs on these pages show some of the more important steps in the assembly of high-quality turntables. They were taken at the Rek-O-Kut factory in Corona, N. Y.

Like rockets and motor cars and toothpaste, turntables today are getting better and better. This translates into the fact that buyers are getting more and more for their money.

We've talked about speed control as being vital in a turntable's performance, so it follows that the motor, which controls speed, is an important factor. At one time the motor of record players was a hand-wound spring. And then came two- and four-pole electric motors with centrifugally-operated governors. Still later, the synchronous hysteresis motor was developed. The four-poler, getting its four bursts of power per second, produced pretty accurate speeds. But the hysteresis motor, which in effect has 16 poles and other subtle refinements, is many times more accurate.

The only trouble with the hysteresis was its price—it was extremely expensive. As a result, only the top-line turntables were hysteresis-driven. All others were equipped with four-pole motors. But now the hysteresis has dropped down through the price levels until you can find it on turntables carrying almost any price tag.

How much does a good turntable cost? The price range is wide. You can get a kit type for as little as $50. From there, you can go all the way up to $150 and far beyond for professional-quality units. The particular turntable pictured here, the N-33-H, is about $80.

4 . . . Six-ton press inserts spindle in turntable. Centering of spindle is shown being checked on delicate gauge during its 360-degree rotation.

5 . . . Just before cover is put on the assembled turntable it gets a stroboscope speed test to make sure it operates in certain narrow limits.

6 . . . In the last step before it is shipped out, newborn turntable plays while a worker uses stethoscope to listen for rumble and other possible ills. The panel instruments check wow, flutter in assembly.

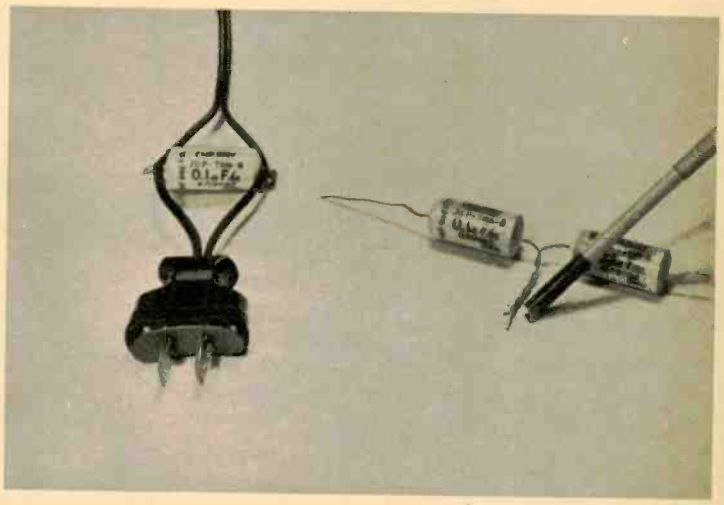
TRY THESE

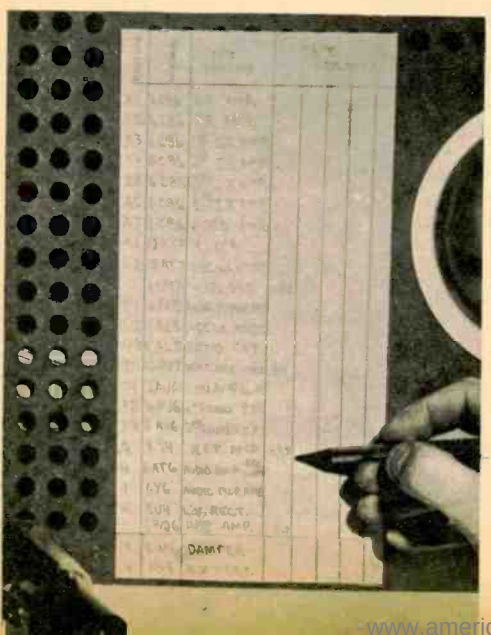
Can-Opener Knob Puller

To help loosen a tight radio, TV, or hi-fi push-on knob, a puncture-type can opener makes an ideal tool. The opener is bent at just the right angle and its wide tip won't cause damage to either the push-on knob to be removed or the unit's cabinet.

Interference Reducer

You can kill most radio noise from appliances with a .1 mf, 600-volt capacitor. Connect it across the line inside the appliance, if possible, or mount in a small metal or plastic box. Tougher cases may require two capacitors with the outside leads connected across the line and their center leads twisted together and grounded to a water pipe.



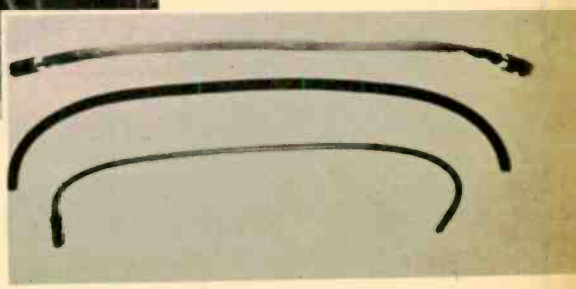


Tube Maintenance Record

A chart of all the tubes in your TV, their function and replacement date pasted to the back of the set will help in predicting the life in each tube. Mark down the location of each of the tubes also.

Light That Bends

Student sees an image of tooth on TV screen (in background) picked up by probe held by dentist.



The probes are 3/16" in diameter and 40" long. Each is composed of many tiny transparent fibers.

This is how the magnified image of tooth looks on a TV screen. Black dots are broken fibers.

IF you ever got to wondering how your dentist came by his skill at finding, drilling and filling that tiny cavity in your left eyetooth, it probably occurred to you that he couldn't learn all that from a textbook (it's a thought that could make you nervous if you're in the waiting room). It is a cinch also that nobody gave him a mirror, drill and patient and told him to go to work.

Chances are, he acquired his skill by peering over his instructor's shoulder and into a patient's mouth. But that is awkward, time-consuming and allows only one student at a time to observe the correct procedures and ask questions.

In an ideal teaching situation, an entire class could see a tooth being filled or extracted. This could be done with equipment that would pick up the image of a tooth and make a magnified display of it.

In a project [*Continued on page* 107]

The Ham Shack

Continued from page 94

at the time you work the stations. It isn't always sufficient to ask, "Is your listing in the Call Book okay?" There are dozens of editions of the Call Book.

I always say, "My book shows you as Joe McGlook, 37 River Rd., Gloomsville, Ga. Is that correct?" If Joe isn't Joe and lives elsewhere, he's happy to give you the right dope.

—o—

CQ Two . . . Because 2 meters is the only band where novices are permitted voice transmission, many amateurs seem to think this an exclusive novice province. Not so, not so! It is also open to all general- and technician-class operators, and they make good use of it. I might remind you that although generals have free run of 16 bands, novices are restricted to crystal-controlled, low-power CW on narrow portions of 15, 40 and 80 meters and to phone on 145-147 mc in the 2-meter band.

The 2-meter band was strange territory to me until I recently acquired a

new Heathkit Pawnee (see photo). It's quite a rig. With a ridiculous little antenna consisting of five 19-inch lengths of coat-hanger wire fastened to the chimney with ordinary twine, I received three answers to my first CQ. Two were from novices and the third from a chap who was using the same two-letter call he acquired 43 years ago.

For local rag-chewing 2 meters is simply great, not being bothered by skip interference from DX stations.

DX Awards

Continued from page 40

Filling in the log: In the "Class Award Applied For" blank, write the *number* of the class as listed in the chart on the first page of this article and again below. (However, the full class designation, rather than just the number, will appear on your award certificate.) Use the local date of reception and employ figures (such as 12-1-61). List local standard time, using the 24-hour clock (0000 to 2359 hours). Under the "Station" heading list call letters or other station identification. Don't forget to fill in *all* items for each entry, including "Type of QSL" (indicate whether you received card or letter).

Additional log pages: To list the second 50 countries for a DX Century Award, make up one or more additional log pages, following EI's format.

Classes of awards: DX Awards are offered in the following four classes: **1.** General, 100 Countries (DX Century Award)—verified reception of radio signals of any frequency from 100 different countries. **2.** General, 50 Countries—same as above except in number of countries required. **3.** Medium Frequency—reception of signals between 535 kc and 3 mc from 25 countries. **4.** Low Frequency—reception of signals of 535 kc or lower from ten countries.

Cutoff date: Reception of DX signals as reported in your log must have taken place since Jan. 1, 1950, in order to be credited toward a DX Award. Older reception reports will not be accepted.

Award periods: From time to time EI will announce DX Award Periods. This first period ends March 1, 1962. To be eligible for an award, your completed log must be received on or before that date. If you cannot qualify this time, keep working! Then send in your log during the *next* DX Award Period (to be announced in EI).

Special note: Although intended primarily for SWLers, our awards (for verified *reception* of signals) also will be issued to radio amateurs who qualify. *All* ham QSL's will be accepted as credit toward an award.

Light That Bends

Continued from page 105

sponsored by the Office of Naval Research such an idea is becoming a reality. Since even the smallest TV camera is too large to fit into the mouth, Messrs. Hovanian and Haswell, two researchers assigned to find the right equipment, had their work cut out for them. What was needed was a device that would be small (a half-inch or less in diameter), able to carry an image out of the mouth to a TV camera, flexible enough to allow freedom of motion without distortion, useful even while the drill was operating . . . and safe. The answer was found in tiny (.002-inch) transparent fibers.

Light is transmitted along these fibers via multiple internal reflections, like a ball bouncing back and forth as it travels through a big pipe. To transmit a picture of a whole tooth, thousands of these fibers are bundled together with a low power lens on the end. The image travels about 40 inches through the probe and is picked up by a TV camera, amplified and focused on a screen in full color.

The .002-inch diameter of the fibers holds magnification to about 35 diameters and light transmission efficiency is only 20%. Increasing the diameter of the probe would add to the brightness of the image, but would also make the instrument less useful in tight places.

Individual fibers also break sometimes and show up as black dots on the viewing screen. Panning the probe across the tooth moves the dots around and allows the whole surface to be seen.

Improvements will be made, to be sure, but this first probe does well enough for now. A roomful of student dentists can watch a tooth being filled. Any volunteers?

Soup Up Your SWL Rig

Continued from page 75

The calibrator will now generate signals every 100 kc on the SW dial when energized. Use the CW (BFO) setting on the receiver to make these signals audible.

RF Amplifier. This circuit should be switched in only when the receiver's bandswitch is set to band 4. Tune in a steady signal somewhere in the center of the band with the aid of the S-meter. Peak it up with the *Tune* and *Ant.* knobs on the front panel (C1 and C2). It is important to go back and forth between these controls to find the best setting. Additional peaking of the signal is possible by connecting the lead from S1 with the alligator clip to different points on antenna coil L1. The S-meter indicates the best tap-in point.

Knight-Kit R-100

Continued from page 81

quired. If you've purchased the kit with the S-meter (an optional accessory) the generator alone will suffice.

After alignment, we hooked up an antenna and, at first hearing, it seemed as if every ham in the world had his rig on. Signals were heard all over the bands (the fact that it was on a week end may have had something to do with this).

This Knight receiver passed its tests with flying colors, from a kit project right up to its on-the-air performance. The handsome professional appearance and the relatively low price of $99.95 all contribute to making Allied Radio's Knight-Kit R-100 a good buy.

Accessories available include an S-meter for $12.95, a speaker in a matching enclosure for $9.75, and a 100-kc crystal calibrator kit (for internal mounting) for $10.95.

Stereo FM Adaptor

Continued from page 85

tube sockets, coil cans, and filter capacitor (C21) mounting wafer are best made with chassis punches.

First mount the capacitor's *metal* mounting wafer; but do not install the capacitor itself at this time. Continue with input jack J1, output jacks J2 and J3, and pots R12 and R33. Before mounting power transformer T1, clip short and tape the red-yellow centertap lead. The five aluminum cans which contain coils L2 and L3 and filters, F1, F2 and F3 are fastened to the chassis with mounting clips inserted through the slots of the special adaptor plate which lock into the Y-shaped slots in the side of the can.

L1 is a standard TV width control mounted in a $\frac{5}{16}$" hole. The coil used in this adaptor is about ½" too long to be mounted under the chassis, and therefore must be shortened. Taking care not to damage the winding, pull the mounting clip off the coil form. The tuning slug will come off with it. Apply small amounts of cement solvent to the fiber collar that holds the two terminal lugs. Be careful not to get solvent on the coil windings. The cement holding the collar will soon soften enough to allow the collar to be moved. Slide the collar along the coil form to within $\frac{3}{16}$" of the coil and re-cement. Cut off about ½" of the section now exposed. Re-insert the slug assembly and push the mounting clip back on the form. L1 is now mounted by pushing it through the $\frac{5}{16}$" hole until the mounting clip clicks firmly in place.

Wiring the unit will be greatly simplified if the two large terminal strips are partially wired before they are mounted. Referring to the pictorial, mount a diode, two resistors, and the two capacitors on each of the six-lug terminal strips. Note that both strips have the same wiring except for diode polarity (see pictorial). Use a heat sink when soldering the leads of the diodes. And make sure that the terminal strips you use have their ground lug in the correct place.

The filament leads are installed first. They should be twisted tightly and pressed against the chassis.

Adjustment of the adaptor is not complicated. Plug in the adaptor and turn it on; all of the tube filaments should light. If you have a voltmeter, check the B+ voltage at lug C21D (see pictorial). It should be 235v. ±20%.

Using a shielded cable no more than 2 feet long, connect your tuner's multiplex jack to input jack J1 of the adaptor. Connect the left (J2) and right (J3) output jacks of the adaptor to the left and right channel tuner input jacks of your stereo amplifier. Turn on the tuner and stereo amplifier with all controls set normally.

Set separation control (R12) fully clockwise. A station broadcasting monophonically should sound normal, as though the adaptor were not in the circuit.

Adjust the hum balance pot (R33) for minimum hum.

Turn the slug of L1 in a clockwise position until the bottom of the slug is flush with the bottom of the coil form. Then turn the slug twelve turns in a counterclockwise direction. Set R12 to about one quarter of its rotation from full counterclockwise. Tune in to a station that you are sure is broadcasting stereophonically. One of several things may happen, depending on such factors as signal strength, tuner sensitivity, and alignment of L1 and L2. We will discuss them in the order of their probable occurrence:

● The program material is audible but distorted and noisy; the signal seems to flutter. This condition indicates that the adaptor is detecting the stereo subcarrier but the 19-kc pilot is not synchronizing the adaptor oscillator. To remedy this, turn the slug of L1 up and down through its range. If the alignment of L2 is fairly close, a point should be reached where the noise and flutter disappear and stereo comes through. As L1 is adjusted around this point, the stereo separation will vary and may even switch sides. However, there is a definite point at which the sound is the cleanest and the separation maximum.

If the adjustment of L1 does not

Profiles in Electronic Engineering Technology

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Engineer, Research & Study Division
Vitro Laboratories, Silver Spring, Md.
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achieve proper operation, return the slug to its former position and *slightly* adjust the slug of L2, using a K-Tran alignment tool. (Do not use a metal screwdriver as it may damage the slug.) L2 will need returning by a quarter of a turn *at most* in either direction.

Return to L1 and move its slug in a clockwise direction until the signal distorts; then move the slug in a counterclockwise direction until the signal again distorts. Now set the slug between these two points. If L1 and/or L2 fails to lock in the signal, there may be insufficient signal strength at the tuner's antenna terminals, or inadequate tuner sensitivity.

● The program material is audible but distorted; and there is a great deal of noise; the signal is accompanied by a whistle or howl. The reason and remedy are the same as above.

● The program material is clear and undistorted—but not stereo. There are several possible reasons. Your tuner may have such limited frequency response that it is not able to pass the stereo sub-carrier.

The 38-kc doubler oscillator, V3, may not be functioning. To check this, disconnect the adaptor from the tuner and measure the voltage between ground and the junction of diodes D1 and D2. If 5-9 volts AC is not present, check the components and wiring.

Once L1 and L2 are properly aligned, R12 is adjusted for maximum separation (which is not necessarily its fully clockwise position).

Warning: Under no circumstances should an attempt be made to adjust the three prealigned filters, F1, F2 and F3, or the 38-kc doubler coil, L3. The average serviceman or audiophile does not have the equipment or technique needed for the alignment of these components.

Good Reading

Continued from page 88

& The Bobbs-Merrill Co., New York and Indianapolis. 304 pages. $4.95.

If you have been thinking of stepping out of your ham shack into a commercial radio or TV studio, this book should help to further your ambitions. First of all, it will give you a good working knowledge of the equipment used in modern broadcast studios. Secondly, it will provide you with all necessary information on FCC requirements for commercial stations and their engineers. And it does both jobs very well. No matter how experienced an amateur you may be, you will be on unfamiliar ground when you take your first steps into the professional category. Mr. Noll tries to give you as many familiar landmarks as possible. In any case, here is a good way to find out just *how* serious you are about becoming a professional broadcast engineer.

RADIO CONTROL MANUAL. By Edward L. Safford, Jr. Gernsback Library, New York. 192 pages. $3.20.

The author of this book is a guided missile engineer, but here he is not talking to any potential Wernher von Brauns but to R/C hobbyists who are interested in less lethal matters like model planes and boats. Here is just about everything the hobbyist needs to know: how the basic control systems work, how to build them at least expense, and how to add refinements to a system as you acquire more expertise.

And make note of . . .

ELECTRICITY AND ELECTRONICS—BASIC. Second Edition. By William B. Steinberg and Walter B. Ford. American Technical Society, Chicago. 256 pages. $4.50. This is a welcome updating of a book we reviewed some time ago. As good a basic text on electronics as you may find.

FUNDAMENTALS OF UHF. By Allan Lytel. Rider. 160 pages. $3.90.

UNDERSTANDING CAPACITORS AND THEIR USES. By William F. Mullin. Sams. 96 pages. $1.95.

101 KEY TROUBLESHOOTING WAVEFORMS FOR SYNC CIRCUITS. By Robert G. Middleton. Sams. 128 pages. $2.

ABC'S OF COMPUTERS. By Allan Lytel. Sams. 128 pages. $1.95.

TELEVISION TUBE LOCATION GUIDE. Volume 11. By the Sams Engineering Staff. Sams. App. 85 pages. $1.25.—John Milder

Radio Propagation Reports

Continued from page 51

commercial services. Signals in this range can be bounced more than 2,500 miles on a single hop and to the opposite side of the earth by continued alternate reflection between the ionosphere and earth.

The characteristics of the ionosphere vary at different seasons, different times of day and at different phases of the sunspot cycle. The variations are due largely to the fact that ionospheric ions are created by the sun's ultraviolet radiations.

Although the ionosphere usually is thought of as a reflector of radio waves, this is only partly true. A given segment of it may be a good reflector for waves of a certain frequency, but to those of a higher frequency it's just like a window pane to a light beam. The waves go right on through. The job of the NBS propagation predictions is to tell you what frequency will see the ionosphere as a reflector.

To get its data, the National Bureau of Standards maintains 161 ionosphere sounding stations all over the world. The NBS stations beam signals of various frequencies toward the ionosphere and then receive the echoes or returning skywave. Reports from all stations flow into the bureau's Central Radio Propagation Laboratory at Boulder, Colo., and from them are gathered indications of ionospheric layers in existence at the time, their positions, their reflectance and other data. With this information in hand the laboratory is able to make its predictions.

We've already mentioned that the NBS predictions give you a maximum usable frequency for a DX path. The short-wave listener or ham should get as close to that frequency as possible, either to listen or carry on two-way communications. Signals from point A must hit a definite portion of the ionosphere in order to be received at point B, but they will do so only if they are close to the muf. Signals of higher frequency are likely to go right on through the ionosphere or to be bounced over the receiving point if they are reflected

at all. Lower-frequency signals will be neither reflected nor allowed to pass through. They are simply absorbed by the ionosphere and atmosphere. They *can* be made to skip but so much power is required as to be impractical.

The monthly NBS Basic Radio Propagation Predictions are available at 15¢ each or $1.50 for a year's subscription ($2 foreign) from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. But to use the reports correctly you need a booklet of instructions, National Bureau of Standards Circular 465, which can be had for 30¢ from the GPO.

Figuring out the predictions could not be called an easy job. The charts are detailed and care must be taken. But for the serious SWLer and ham, the result is worth the trouble. Learning exactly what the predictions are and how they are used in itself is an interesting bit of knowledge.

Basically, the monthly predictions consist of a series of wavy lines on grid charts which have time designations along the bottom and latitude markings on the side.

In the instruction booklet is a great circle chart and a map of the world marked off into four zones: W for most of North America, Antarctica and all of Central and South America; I for Europe and Africa; I- Pacific for Alaska, Western Canada and part of the Pacific; E for most of Asia, Oceania, Australia and the Arctic.

To use the predictions, you put a piece of tracing paper over the world map, draw the equator line and then place dots for the transmitter and receiver locations. Putting the paper over the great circle chart, you draw the path from transmitter to receiver and note the midpoint (the exact procedure varies for short paths and long paths). Turning back to the map, you find which zone the midpoint falls into.

Next, you turn to the propagation prediction chart for that zone (W, E, etc.) and place your tracing over the chart. As you slide the tracing back and forth, your midpoint indicator intersects certain of the wavy lines, which are labeled with numbers to indicate megacycles. These numbers are your maximum usable frequencies for various times of the day. You write them all down on a 24-hour work sheet. Later, simply by glancing at the chart, you know the exact muf for a specified DX path at any hour.

We happen to have at hand some old NBS predictions for March 1961. By following the above procedure, we find that at 1600 hours on any day that month our muf for a New York-California path was 21 mc. By 2000 hours it changed to 23 mc.

As a general guide to the ham and SWLer, the best band for most of the year is 20 meters (14 megacycles). Especially during the present, when sunspot activity is still high, this band includes the best frequencies for F2 and sporadic E reflection. The 21- and 28-megacycle bands are also good at this time but activity here is limited mainly to the daytime. The 7-megacycle band (40 meters) will give exciting results during dawn and dusk throughout the winter, as will the 3.5-mc band.

But, despite all the scientific data gathered on radio-wave propagation, it is still unpredictable enough to make DXing a fine—and interesting—art.

Hi-Fi Record Guide

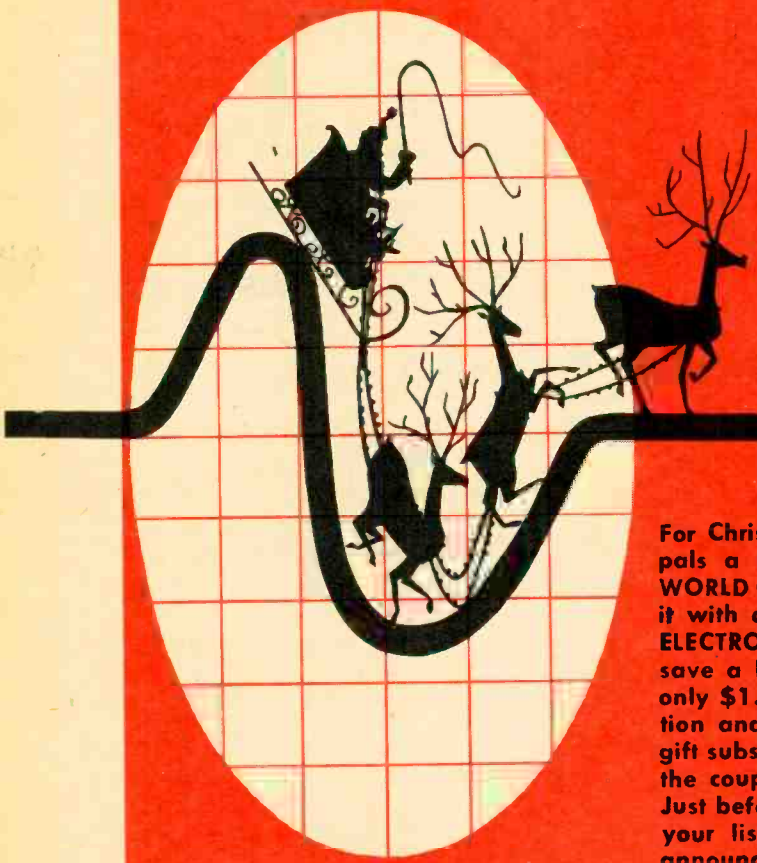
Continued from page 87

More Americana is offered in Stan Freberg Presents The United States of America. This Freberg's-eye-view of the early history of our country makes up a funny record indeed. Its humor is irreverent, but it also hammers home a few truths that are not always self-evident, and it can be listened to more than once without boredom setting in.

The most successful martial music of our era is the Richard Rodgers score to TV's Victory at Sea. We are now up to Volume 3, carrying us through more of the War in the Pacific with excitement and tension, and recording of brilliance.

A different type of excitement is generated by Dizzy Gillespie and his orchestra in Gillespiana, a suite that was

[*Continued on page* 117]



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Feedback

Continued from page 4

It is unfortunate that your publication has received false information regarding place of manufacture of General Electric radios. In your September issue you said General Electric has radios built in Japan for sale in the U. S. under the GE label.

The truth of the matter is that all radios sold under the General Electric label in the U. S. are manufactured (at) Utica, N. Y. As evidence of our continuing faith in our ability to compete both with foreign and domestic competitors, we have completed a substantial enlargement of our manufacturing facilities.

. . . Your readers can be assured that when they purchase a General Electric radio they are supporting American industry.

R. C. Wilson
General Manager
Radio Receiver Dept.
General Electric
Utica, N. Y.

EI offers apologies to GE. Several U. S. firms do have electronic equipment made in Japan for sale here under their own labels but GE does not.

An hour ago I bought the September issue and read OUR SECOND WAR WITH JAPAN. I wish this article could be printed on every front page in the country. EI is the *best* in its field.

Gary Barniak
Chicago, Ill.

● *CB Whip*

I would like to congratulate you and author Herbert Friedman on the outstanding article you did on getting MORE FROM YOUR MOBILE WHIP (Sept. '61 EI). Most magazines have forgotten that their journals are supposed to be for the amateur and layman. Your article explained the vertical whip in a down-to-earth, sensible manner. In my opinion there was more useful information in those two pages than in *two* antenna handbooks.

M. F. Daidone, W2LYZ
Long Island City, N. Y.

● *Lo Blow*

A friend and I have been arguing about the relative service and maintenance costs for television and hi-fi. I think a TV set is likely to cost more because sooner or later you have to buy a new picture tube and that takes a big bite out of your pocketbook. I can't think of anything comparable that might go wrong with a hi-fi set. What is the worst thing that can happen to a hi-fi system?

John Reed
Boston, Mass.

Elvis Presley.

● *Commuter's Query*

I am looking for a personal transistor radio that I could use while riding on a train, bus or car. Do you know who makes a good one? And what kind of reception could I expect?

John D. Clement
Inglewood, Calif.

We know several companies which make good transistor radios, John, but they weren't designed for use in trains, busses or cars. You could use any of the more sensitive jobs with 8-10 transistors, but don't expect too much. Without a non-directional outside antenna, noise suppressors, etc., you're apt to get a lot of noise and fading.

● *In Between*

I have just read your article in the April issue on DXing IN BETWEEN. I would appreciate any advice on equipment that gets the 30-50 mc band.

Ted A. Bridges
Camden, Tenn.

We're glad you asked. Plans for a 30-50 rig are in your hands right now . . . elsewhere in this issue. *(See page 66.)*

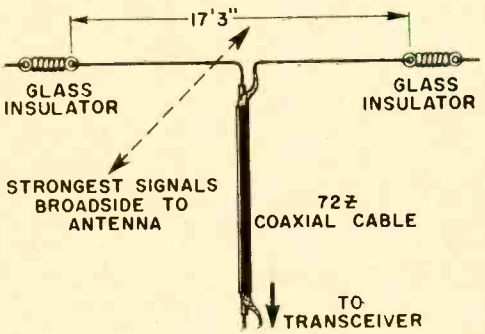
CB Corner

Continued from page 59

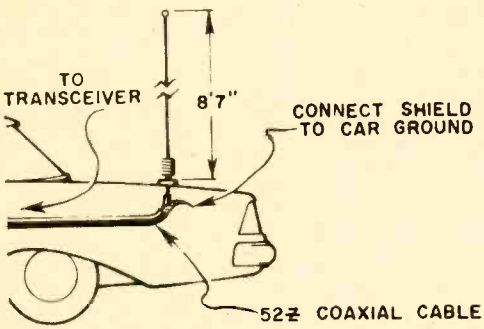
social doings). The reason behind the FCC's stand: clubs, they figure, can have a hand in self-policing the band. And that is what the FCC needs.

—o—

Antenna Lengths . . . "What is the length of the CB antenna?" asks Arthur Ericson of Petersburg, Ill. Let's start by considering the basic antenna, the half-wave dipole. All other types are variations of it. Determining its length in



feet is simple with the standard "468 formula." Just divide the frequency (27 mc) into 468. You get 17.33 feet, or about 17 feet 3 inches (you use a length slightly shorter than the formula gives because the *center* of the CB band is a little higher than 27 mc). This half-wave dipole (see top diagram) is for fixed station use only.



The mobile whip is customarily a quarter-wavelength positioned vertically. To get its length, cut the half-wave

dimension in two. The answer is 8 feet 7 inches (see lower diagram).

The base of the quarter-wave antenna must work against ground (which electrically restores the missing quarter-wave when compared with the half-wave model). The ground in mobile units is the metal surface of the automobile. In fixed-station use it is the drooping radials known as a ground plane.

Either of these antennas will yield reasonably good service in the CB band. Higher performance is possible with the more complex, elaborate arrays that are available in knocked-down form.

—o—

CB Without Power . . . Watch for a powerless or free-power CB rig—no batteries, no solar cells, no power line. George W. Bryan, Jr., an electronics engineer, has been granted a patent on a unique handie-talkie that's energized by the human voice. The physical impact of sound waves on the device is converted into electrical energy—enough to meet the modest power requirements of the transistorized circuit. The experimental model has a range of more than 100 yards. Bryan believes that, with further refinements, this distance can be extended a mile or two (comparable to existing CB hand-held sets).

30-50 Special

Continued from page 70

VTVM and set its meter needle to the zero center position. Reconnect the leads across C17 as before. The meter should read off-zero. Now adjust T3's top slug for zero reading. The final adjustment for zero center is made on the lowest VTVM range.

Oscillator RF Alignment is next. Connect the generator to the antenna terminals; set C3's plates to full mesh and connect the VTVM across C17 as above. Feed in a 30 mc signal and adjust L3 for highest meter reading.

Reset generator to 50 megacycles and fully open C3. Adjust C4 for maximum meter indication. Repeat the procedure once or twice. If your listening is in a particular section of the band, you can peak the receiver to this area.

The final tracking adjustment is made by compressing or expanding L2 for maximum meter reading across C17.

If the receiver oscillates when placed in the cabinet (part of the band appears "blocked out"), remove V1's shield.

If you don't have the required RF Generator and VTVM, a local radio-TV shop should be able to do the alignment for a nominal fee.

The antenna can be a piece of outdoor wire, a 6-meter amateur antenna or you can make a whip or dipole cut for 40 megacycles. (See the ARRL handbook for details.) A TV antenna will serve, although it may be directional.

Set S2 to FM and tune in a station. If the signal sounds distorted, the station is probably using AM modulation and S2 should be set to AM.

It may take a while to get the hang of the Public Service Band. Transmissions are short and to the point—but the thrill of immediacy is worth the effort.

The Listener

Continued from page 48

also clip various versions of the same story out of your local papers. Soon you'll have enough pieces to put together a total picture.

—o—

Clubs . . . The country's oldest DX organization is the Newark News Radio Club (215 Market St., Newark 1, N. J.). But the fastest-growing club currently is the American Short Wave Listeners Club (46C Parkway Village, Cranford, N. J.). Part of the reason is the fact that the group's SW editor, Robert Newhart, has a working knowledge of five languages: English, Spanish, Portuguese, French and Swedish. You can get the club's SWL bulletin for 15¢.

—o—

Really Rare DX . . . Where's Windhoek? It's the capital of South West Africa, a mandate of South Africa. This country threatens to become another hot-spot, but that is not the reason it

[*Continued on page* 119]

Hi-Fi Record Guide

Continued from page 112

composed for the great trumpeter by Boris Schifrin, a pianist from the Argentine who plays jazz well enough to be a member of Dizzy's Quintet. The five movements of Gillespiana are ingenious and varied.

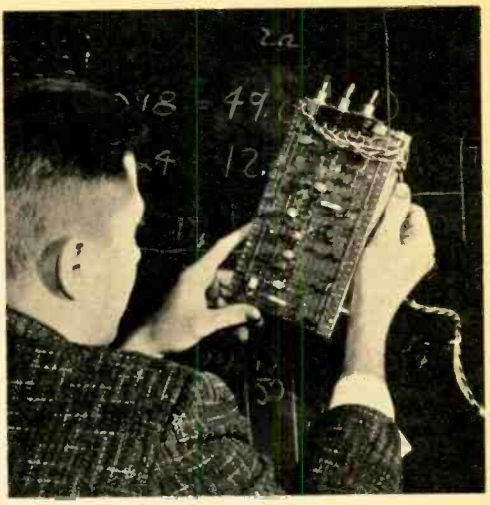
In Dreamstreet, Erroll Garner plays with more freedom and vitality than he has for some time. Two of the ten tracks are original material while the others are Garner versions of the standards.

The admirers of Art Tatum have found new fortune in recently discovered tapes of an evening's playing by the late genius of the jazz keyboard. In The Complete Art Tatum Piano Discoveries, he is heard in interpretations of 24 standard tunes.

Jazz trombonist Kid Ory dates back to the days of Buddy Bolden, King Oliver and Jerry Roll Morton, yet here he is still playing trombone with power and enthusiasm. The two records of Kid Ory! Favorites! comprise a basic library of 17 Dixieland compositions.

Records discussed in this column, with monaural discs listed first and stereo versions just below:

The Sound of Stokowski and Wagner *Stokowski, Sym. of the Air*	RCA Victor LM-2555	$ 4.98
	LSC-2555	5.98
Thomson: The River; The Plow *Stokowski, Sym. of the Air*	Vanguard VRS-1071	4.98
	VSD-2095	5.98
Beethoven: Emperor Concerto *Cliburn—Reiner*	RCA Victor LM-2562	4.98
	LSC-2562	5.98
Prokofiev: Third Concerto; Ravel: Concerto *Browning—Leinsdorf*	Capitol P-8545	4.98
	SP-8545	5.98
Beethoven: Ninth Symphony *Kleiber, Vienna Philharmonic*	Richmond 19083	1.98
Civil War Songs of the North *Tennessee Ernie Ford*	Capitol T-1539	3.98
	ST-1539	4.98
Civil War Songs of the South *Tennessee Ernie Ford*	Capitol T-1540	3.98
	ST-1540	4.98
Stan Freberg Presents The United States *Freberg and Cast*	Capitol W-1573	4.98
	SW-1573	5.98
Rodgers: Victory at Sea, Vol. 3 *Bennett, Victory at Sea Orch.*	RCA Victor LM-2523	4.98
	LSC-2523	5.98
Gillespiana *Dizzy Gillespie and Orch.*	Verve V-8394	4.98
	V6-8394	5.98
Dreamstreet *Erroll Garner*	ABC-Paramount ABC-365	3.98
	SABC-365	4.98
Complete Art Tatum Discoveries *Art Tatum*	20th Fox TCF-102-2	7.96
	STCF-102-2	9.96
Kid Ory! Favorites! *Kid Ory and Orch.*	Good Time Jazz M-12041/2	9.96
	S-12041/2	11.96



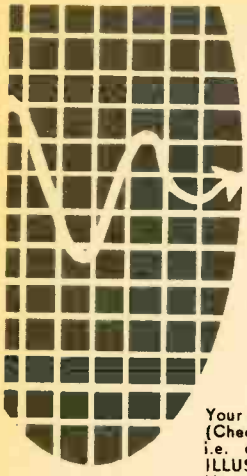
New Amplification Principle

TWO scientists at the Stanford Research Institute, Menlo Park, Calif., have come up with a transistorized hi-fi amplifier based on a principle never before used in the audio field. The men, Hewitt Crane and Philip Merritt, claim a high degree of efficiency for their brainchild, which is based on a modulated-carrier principle.

They reasoned that if transistor circuits were used for on-off switching (a job which they do exceedingly well), the ratio of on-time to off-time could be controlled (modulated) to produce linear amplification over a wide range . . . in fact, right down to DC. The amplifier's output actually is a series of pulses (on-off, on-off, etc.) that achieves reproduction by having longer or shorter "on" periods. A square-loop ferrite core modulator is used as part of the circuit.

At present, the high cost of the switching transistors required in the output stage may limit the wide use of this amplifier in highly competitive commercial audio fields. However, transistor technology is developing to the point where the price should come down to the audiophile's level in the near future.

The lightweight amplifier also may be used in satellites.



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The Listener

Continued from page 116

is such rare, rare DX. The reason lies in the fact that there are *no* short-wave broadcast stations in South West Africa and the aeradio at Windhoek and a marine station at Walvis Bay reach only a few miles.

The only way to get a QSL out of SW Africa is via an aircraft passing over. Planes flying from Africa's West Coast (especially Luanda in Angola) to Johannesburg pass this way. Although they have low-power transmitters, that magnificent antenna height gives a real reach to their signals. Since the planes give regular position reports, DXing comes down to camping on the right frequencies (13304.5 kc at mid-day and 8820 kc later) and waiting. Fortunately, most airlines verify. The aircraft involved here belong to BOAC, so address your report either to their office in Johannesburg or to the home office in London.

—o—

Note . . . All those interested in broadcast band changes should subscribe to the FCC BC-12 lists put out by Seabrooke Printing, 514 Tenth St. NW, Washington 4, D. C.

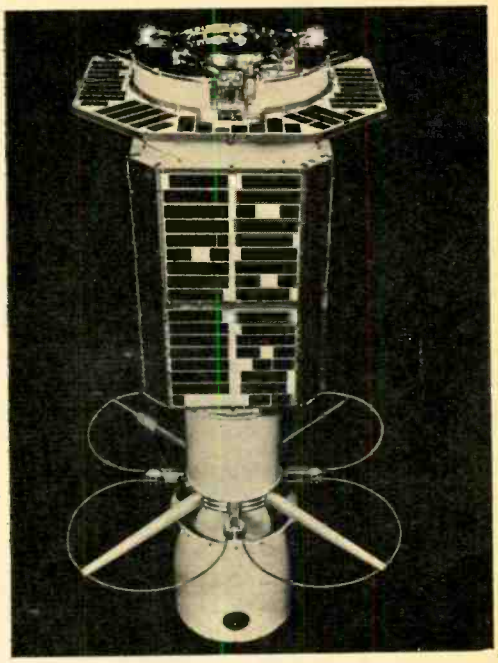
Tech Editor's Test Bench

Continued from page 60

Allied Radio was also on the market with a few kits, but the field didn't really get going until after the war.

What does the popularity of kits mean? To me, it's a sign that the average guy wants to get involved in the technology around him. Sure, there have been lots of gags about hams, hi-fi addicts and the other do-it-yourself bugs. But I say more power to them! This is a complicated world and it is too easy to be swamped by today's technology—to be convinced that everything technical is so complicated as to be beyond the grasp of the common man. Kit building, I believe, is a step in the direction of greater understanding of this expanding electronic world.

Gamma Eye On High



HOW heavy is gamma radiation in outer space? To get an answer, America put a special satellite—Explorer XI, shown above—into orbit. The 82-pound "street light" contains a gamma ray telescope pointing out the top. A scintillation counter tallies rays detected by the 'scope and transmits its information (on 107.97 mc) to earth via four loop antennas at the bottom. The rectangles on the column are solar cells.

No one has been able to count gamma rays in space because those that come our way are mauled by the earth's atmosphere and never reach the ground. In the atmosphere, we know gamma rays are emitted when a loose proton hits an atomic nucleus and excites it. In subsiding into its normal state, the nucleus emits a gamma ray (if more excited, it emits particles). Scientists now want to know whether the same thing happens in space. The answer will give us an idea of nuclear activity way out there, and gamma rays also are clues to the basic elements in our universe.

Gamma rays are electromagnetic in character but are of shorter wavelength than light, ultraviolet or X rays.

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	1LC5	.59
	1LD5	.60
	1LG5	.69
	1LN5	.59
	1R5	.62
	1S2A	.76
	1S4	.59
	1S5	.51
	1T4	.58
	1U4	.57
	1U5	.50
	1V2	.50
	1X2B	.82
	2AF4	.95
	2D21	1.20
	2EN5	.45
	3A3	.76
	3A4	.60
	3AF4	1.02
	3AL5	.42
	3AU6	.51
	3AV6	.41
	3BA6	.51
	3BC5	.54
	3BE6	.52
	3BN6	.76
	3BU8	.78
	3BY6	.55
	3BZ6	.55
	3CB6	.54
	3CF6	.60
	3CS6	.52
	3DG4	.85
	3DN6	.60
	3DT6	.50
	3Q4	.63
	3Q5	.80
	3S4	.61
	3V4	.58
	4AU6	.54
	4BA6	.51
	4BC5	.58
	4BC8	.96
	4BN6	.75
	4BQ7	1.01
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	4BZ6	.58
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	5T4	.79
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	5U4	.60
	5U8	.81
	5V3	.90
	5V6	.56
	5X8	.78
	5Y3	.46
	5Y4	.59
	6A8G	1.20
	6AB4	.46
	6AC5	1.05
	6AC7	.96
	6AF3	.73
	6AF4	.97
	6AG5	.68
	6AH4	.81
	6AH6	.99
	6AK5	.95
	6AL5	.47
	6AL7	1.43
	6AM4	1.50
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	6AQ5	.53
	6AR5	.55
	6AS5	.60
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	6AT6	.43
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	6J6	.67
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	6K6	.63
	6L6	1.06
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	6S4	.51
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	7F8	.90
	7Y4	.69
	8AU8	.83
	8AW8	.93
	8BH8	.90
	8BN8	.75
	8BQ5	.60
	8CG7	.62
	8CM7	.68
	8CN7	.97
	8CS7	.74
	8CX8	.93
	8EB8	.94
	8SN7	.66
	9CL8	.79
	11CY7	.75
	12A4	.60
	12AB5	.55
	12AC6	.49
	12AD6	.57
	12AE6	.43
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	12AJ6	.46
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	12AL8	.95
	12AQ5	.60
	12AT6	.43
	12AT7	.76
	12AU6	.51
	12AU7	.60
	12AV6	.41
	12AV7	.75
	12AX4	.67
	12AX7	.63
	12AY7	1.44
	12AZ7	.86
	12B4	.63
	12BA6	.50
	12BA7	.84
	12BD6	.50
	12BE6	.53
	12BF6	.44
	12BH7	.77
	12BK5	1.00
	12BL6	.56
	12BQ6	1.06
	12BY7	.77
	12BZ7	.75
	12C5	.56
	12CN5	.56
	12CR6	.54
	12CU5	.58
	12CU6	1.06
	12CX6	.54
	12D4	.69
	12DB5	.69
	12DE8	.75
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	12DM7	.67
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	12EL8	.50
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	12EN6	.78
	12EZ8	.53
	12F8	.66
	12FA6	.79
	12FM6	.43
	12FR8	.91
	12FX8	.85
	12GC8	1.06
	12J8	.84
	12K5	.65
	12L6	.58
	12S8	.62
	12SA7	.82
	12SF5	.50
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	12SH7	.49
	12SJ7	.67
	12SK7	.74
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	12SQ7	.78
	12U7	.62
	12V6	.53
	12W6	.69
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	17BQ6	1.09
	17D4	.69
	17DQ6	1.06
	17L6	.58
	17W6	.70
	18FW6	.49
	18FX6	.53
	18FY6	.50
	19AU4	.83
	19BG6	1.39
	19T8	.80
	19V8	.79
	21EX6	1.49
	25AV5	.83
	25AX4	.70
	25BK5	.91
	25BQ6	1.11
	25C5	.53
	25CA5	.59
	25CD6	1.44
	25CU6	1.11
	25DN6	1.42
	25EH5	.55
	25L6	.57
	25W4	.68
	25Z6	.66
	32ET5	.55
	32L7	.90
	35B5	.60
	35C5	.51
	35L6	.57
	35W4	.42
	35Z5	.60
	36AM3	.36
	50B5	.60
	50C5	.53
	50EH5	.55
	50L6	.61
	5763	1.00
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	7025	.69
	84/6Z4	.46
	807	.70
	117Z3	.61
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	6DQ6	1.10
	6DT6	.53
	6DT8	.79
	6EA8	.79
	6EB5	.72
	6EB8	.94
	6EM5	.76
	6EM7	.82
	6EU8	.79
	6EW6	.57
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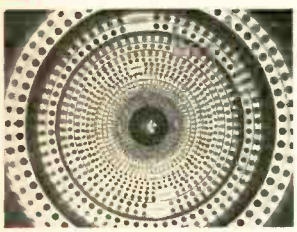

A RARE VIEW! This inside view of a ballistic missile is seldom seen by a civilian. It's a sight that greatly impressed Mr. Lafeber.

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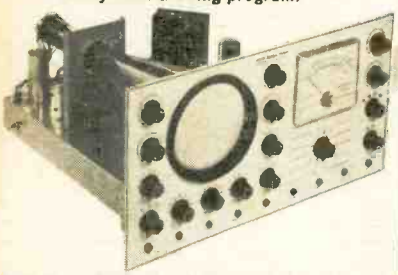

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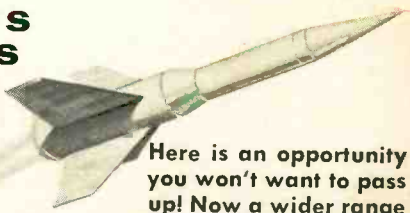

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