BUILD 1-TUBE COMPACTRON FM RECEIVER

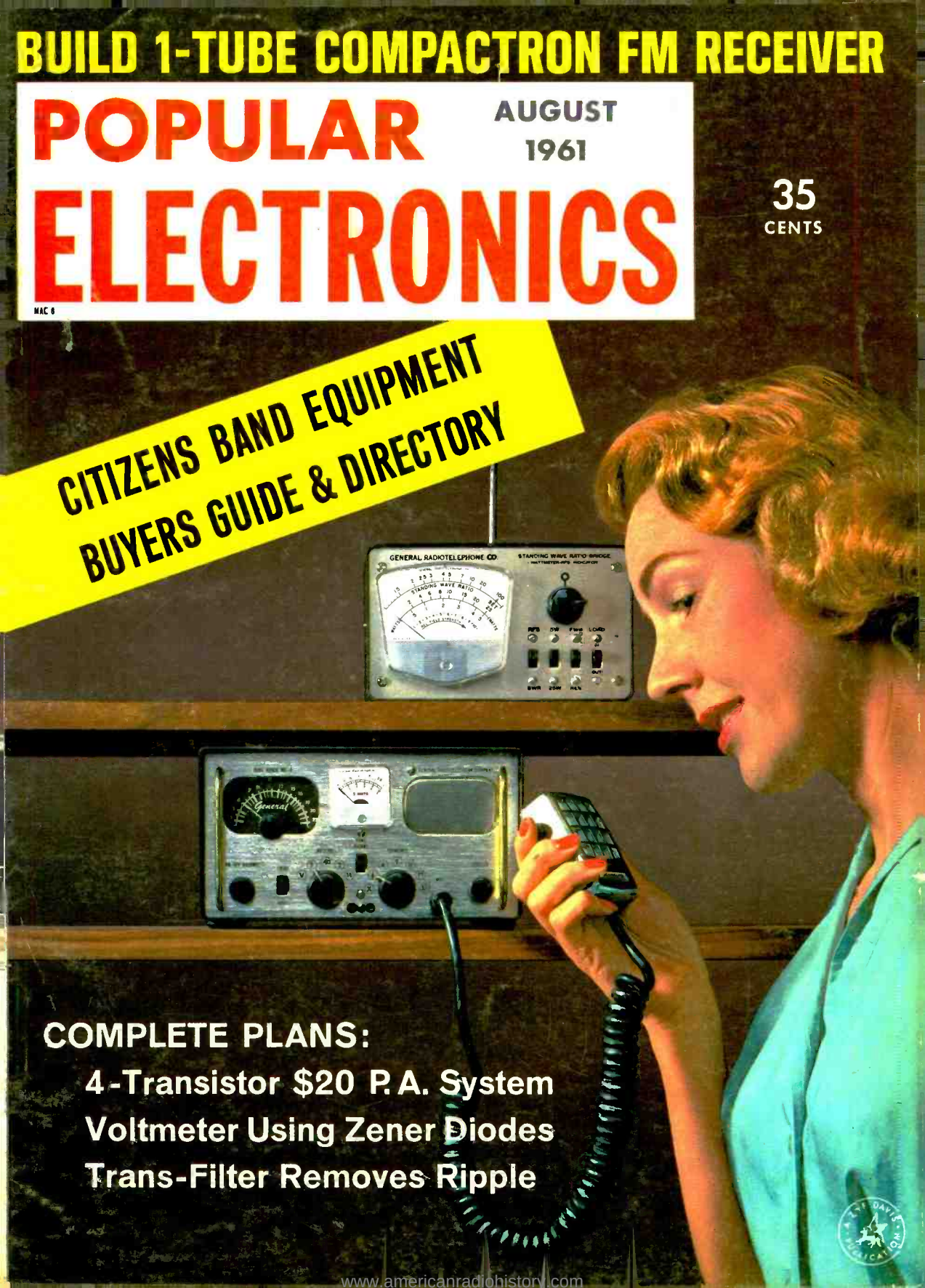
POPULAR ELECTRONICS

AUGUST 1961

35 CENTS

MAC 6

CITIZENS BAND EQUIPMENT BUYERS GUIDE & DIRECTORY



COMPLETE PLANS:

4-Transistor $20 P.A. System

Voltmeter Using Zener Diodes

Trans-Filter Removes Ripple

This is CADRE 2-Way Radio

developed by CADRE INDUSTRIES CORP. for the 27 Mc CITIZENS BAND OPERATION

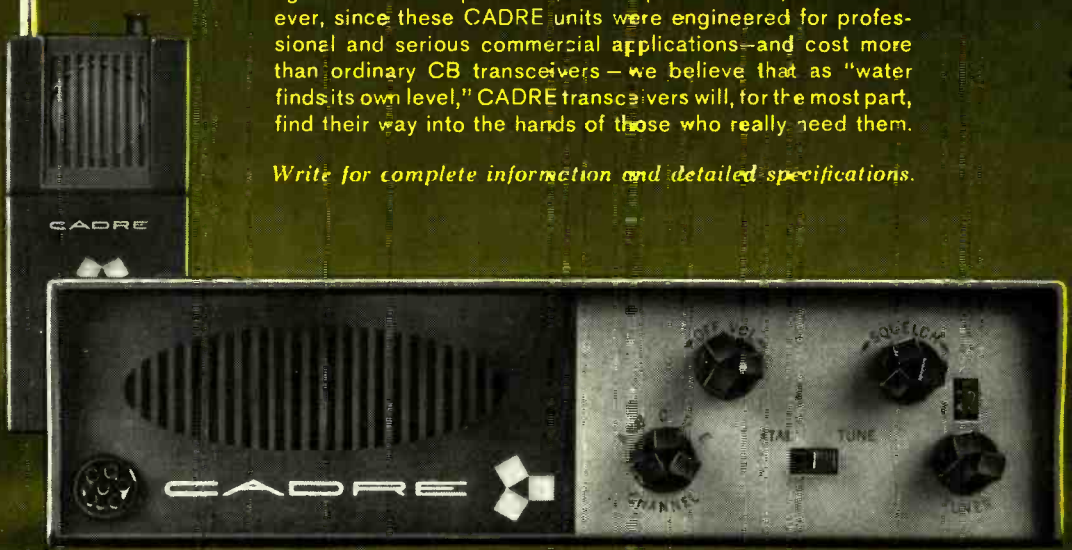
These CADRE units are built to the highest standards of the electronics industry, by a company that has been long established as a prime manufacturer of precision electronic research equipment and computer assemblies. CADRE transceivers are 100% transistorized — compact, lightweight . . . engineered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

The CADRE 5-Watt Transceiver, at $199.95, for example, for offices, homes, cars, trucks, boats, aircraft, etc., measures a mere 11 x 5 x 3", weighs less than 6 pounds! Nevertheless, it offers 5 crystal-controlled transmit-receive channels (may be used on all 22), and a range of 10 miles on land, 20 over water!

The CADRE 100-MW Transceiver, $124.95, fits into a shirt pocket! Weighs 20 ounces, yet receives and transmits on any of the 22 channels . . . efficiently, clearly . . without annoying noise. A perfect "pocket telephone"!

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

Write for complete information and detailed specifications.



CADRE INDUSTRIES CORP., Endicott, N.Y.

Prices appearing in this advertisement are suggested retail prices

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AUGUST 1961

VOLUME 15 NUMBER 2

ZIFF-DAVIS PUBLISHING COMPANY

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Special Citizens Band Features

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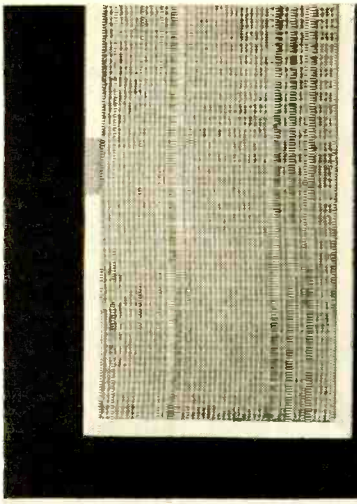

THE A.E.S. Gigolo

ONE OF THE MOST SOUGHT AFTER PRODUCTS IN THE HIGH FIDELITY INDUSTRY

At our present rate of sales and production, A. E. S. will sell nearly 100,000 Gigolos this year.

Imagine, now you can own a speaker with this quality for only $15.00.

TRY IT — WE GUARANTEE IT

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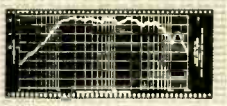
DESCRIPTION:

The Gigolo is constructed with a resonant resistant all wood product of at least ¾" thickness throughout. Its outside dimensions are 24" long, 12" high, 9½" deep. The heavy construction and the fine workmanship suggest a value far exceeding its low, low price. All units sold on 100% MONEY BACK GUARANTEE.

Price $15.00. Unfinished only.

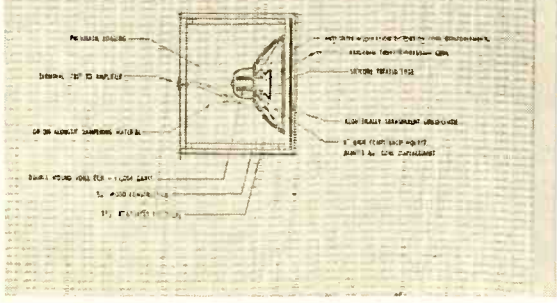
F.O.B. Factory

SPECIFICATIONS:



Frequency response	500	Tone bursts 3500
Maximum frequency response		19-21000 cps
Frequency response —8 db		45-18000 cps
Harmonic distortion		less than 3% 70-21 kc
Impedance curve	within —0	200% of 8 ohms 20-20000 cps
Flux density		11000+ gauss

Frequency response curve run at continuous 10 watts.
Power handling capacity, the Gigolo may be used with small economy amplifiers of very low wattage, as well as with the highest power component amplifier with satisfactory results.



A.E.S., Inc.
3338 Payne Avenue, Cleveland, Ohio

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I understand these units are guaranteed and if I am not satisfied I may return for a full refund of sales price, $15.00 each.

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City and State _____

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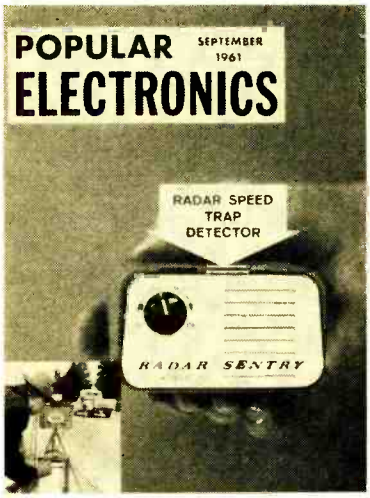

(ON SALE AUGUST 29)

- RADAR SPEED TRAP DETECTOR
  A special report on a new $40.00 device claimed to detect radar speed traps: how it works; how far away it will detect speed traps; and what will happen when the frequency of the speed traps is changed from 2400 to 10,000 mc.

- HYBRID CATHODE MODULATOR
  One tube and two inexpensive transistors form the heart of this easy-to-build gadget, designed for use with transmitters having class "C" keyed finals.

- TRANSISTORIZED A.C. VOLTMETER
  Construction details on a pocket-sized test unit with five ranges from 0.05 to 500 volts, and input impedances from 200,000 ohms to 3 megohms.

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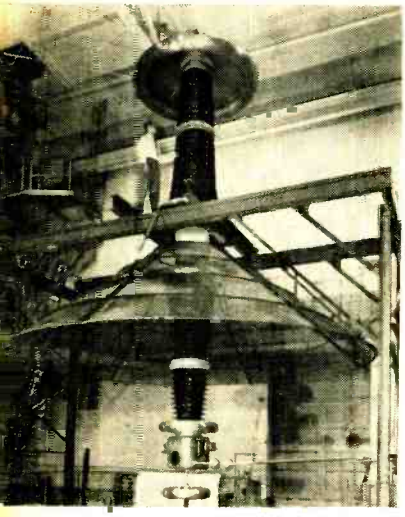
POP'tronics

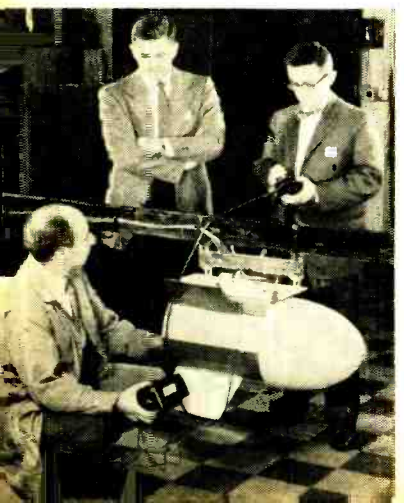
NEWS SCOPE



WORLD'S LARGEST INSULATOR—Six of these units, with specially designed sleet-melting circuits, have been installed at Cutler, Maine, by the General Electric Company. The 26'-high insulator bushings carry the antenna lead-ins for the U. S. Navy's radio station there—the highest powered radio station ever constructed. Each 8500-pound unit, rated at 300 kilovolts, was found to be corona-free when tested at 500 kilovolts at 60 cycles. There is a 500-pound switch at the base of each insulator which normally allows the radio signal to pass through the insulators to the antennas. For de-icing, the switch disconnects the transmitters and switches in a 4160-volt, 800-ampere, 60-cycle current which passes through the antenna wires and melts ice formations. Birds . . . beware!

"SETS OF THE SEVENTIES"—Before the roaring sixties can make their mark in history, the RCA Advanced Design Center is already planning the radio and television sets you and I will be using ten years from now. The young lady on the park bench is admiring a book-sized color TV/stereo radio set with clock timer built into a hinged travel case. Impossible? Today, yes. But RCA has high hopes for tomorrow. Considering the tremendous development taking place in such engineering fields as transistors and micro-modules, a pocket color TV set is a definite possibility for the 1970's.

SOUND CLEANING—Ultrasonic waves are enabling electronic technicians at the New York Naval Shipyard to salvage equipment damaged by smoke and salt water in last December's fire on the aircraft carrier "Constellation." The Westinghouse cleaning unit at left is used on the Constellation's motors, controls, and transformers, as well as on its electronic equipment. Fire damage to the carrier, originally put at $78 million, is now estimated at $48 million; rehabilitation of the ship may be completed by this December.



WEATHER MISSILE—Important weather information will be available almost instantly with a new system for measuring wind direction and velocity at a wide range of altitudes. Called the "Wind Sonde," it features an air-launched missile engineered by Allied Research Associates, subsidiary of the Boeing Airplane Company. Shortly after being launched from its mother aircraft, the missile jettisons its two-stage parachute and begins a rapid fall, controlled by a gyro. Canted fins spin the missile at three cycles per second; spinning is used in conjunction with an accelerometer and a magnetometer to supply wind data via continuous telemetering back to the launching aricraft. The system will be used to study wind characteristics in storms and hurricanes, high altitude wind measurements, and rapid weather calibration at launching sites.

More on page 8

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Gary Harrison, 29 Spencer Drive, N. Kingston, R. I.	1st	12
Louis W. Pavek, 838 Page St., Berkeley 10, Calif.	1st	16
William F. Bratton, Jr., 435 Etna Street, Russell, Ky.	1st	12
Darrell E. Cloce, 25 E. 32nd St., Kansas City, Mo.	1st	12
Thomas J. Hoof, 216 S. Franklin St., Allentown, Pa.	1st	22
P. B. Jernigan, Route 2, Benson, North Carolina	1st	12
Edward R. Barber, 907 S. Winnifred, Tacoma, Wash.	1st	20
Claude Franklin White, Jr., c/o Radio Sta. WJMA, Orange, Va.	1st	12
John M. Morgan, c/o KIRI-TV, 1530 Queen Anne Ave., Seattle, Wash.	1st	9½

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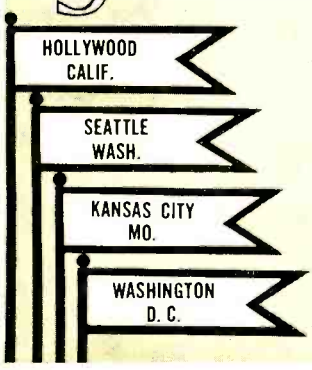

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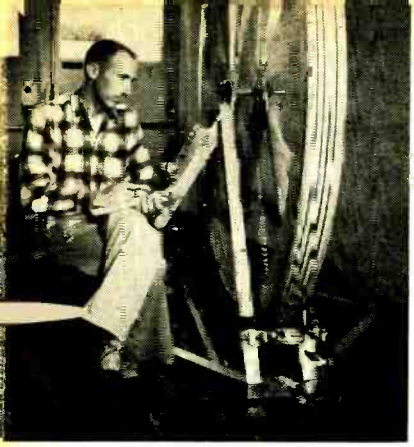

NEWS SCOPE

Continued

CHECKING EARTH'S MAGNETIC PULSES—Oscillations of the earth's magnetic field are now being checked and studied by National Bureau of Standards engineers with the aid of specially designed antennas. Basically loop antennas, each is 6½ feet in diameter, contains 32,000 turns of nylon-coated copper wire, and is coated with Fiberglas for protection and waterproofing. Buried deep in the ground, the antennas are sensitive enough to respond to ultra-low-frequency electromagnetic waves or micro-pulsations. It is now known that magnetic pulsations are much stronger in the auroral zones, and that they are probably associated with the influx of primary electrons into the atmosphere after solar storms.

SIGHTED MISS—A new $1.5-million computer system, called the "Dynamic Simulator," has been designed and built by Sperry Gyroscope Marine Division engineers to probe the misses made by the Polaris submarine navigation system. Actually a "sea and weather" simulator, the computer conjures up information on sea conditions, cloud formation, undersea currents, radio noises, and oceans of figures for a simulated submarine cruise. In addition to its goal of placing the accuracy of navigation on a par with the increasing range of the Polaris missile, the computer will be used to trouble-shoot problems growing out of the operation of the navigation system, to test future instruments such as the Transit satellite system, and to simplify the job of the submarine navigator who is continually faced with the problem of looking for a needle in the world's wettest haystack.

REMOTE SECRETARY—Germany's Telefunken company has come up with a nifty little wireless intercom that will save secretaries many desk-side trips to the boss for dictation. A small earphone and a clip-on transistorized receiver eliminates the need for power cords and other troublesome leads common to most intercom and dictation machines; the receiver houses the antenna and has a rechargeable battery good for 50 hours. Although a transmitter can be picked up by a receiver several rooms away in an office building, each transmitter/receiver pair is tuned to different frequencies so that more than one system can be used in the same building.

BOOBY TRAP SPOTTER—This portable X-ray inspection unit permits a quick "look" inside various kinds of packages, revealing the presence of bombs, booby traps, or—in most cases—alarm clocks. Developed by engineers at Westinghouse Electric Corp., it uses the same principles as the fluoroscope found in a doctor's office, and should be welcomed by the police, postal authorities, prisons (no more files in cakes), and other security offices. In actual use, a package is placed on a low platform and its contents viewed through an eyepiece when a foot switch is stepped on.

BROWNING LABORATORIES ADDS MOBILE UNIT TO CB LINE

Browning Laboratories, Inc., Laconia, N.H., has introduced a new mobile transceiver to complete its line of Citizen's Band radio equipment.

The new Browning unit is known as the Mobilaire and utilizes the same advanced circuitry that has made the Browning S-NINE Transmitter one of the most popular base station units on the market. The receiver circuit has all the Browning features that insure sharp, interference-free reception, even from distant stations. Only high quality, U.S. made components are used in all Browning radio equipment.

Introduction of the Mobilaire unit was brought about principally by demand from present Browning base station equipment owners who asked for a mobile unit with the same basic specifications and features.

Priced at $159.50, Mobilaire is available directly from Browning Laboratories on a "satisfaction guaranteed" basis. Four convenient purchase plans are available and a 5% discount is allowed for cash with order.

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

Hi-Fi Showcase

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

STEREO BALANCE can be brought right on the button with a line of L- and T-pad attenuators introduced by ***Centralab.*** Although no larger than units rated at 2 watts d.c., the new "pads" will handle 5 watts of d.c., 20 watts of audio. Available in all common impedance ratings, the attenuators are furnished complete with a handsome gold anodized dial plate and a black knob. . . . . From ***DeWald Radio*** comes a 35-watt integrated stereo amplifier/preamplifier complete with a blend control for variable channel separation and elimination of the "hole-in-the-middle-effect." The P-1400 also has individual bass and treble controls for each channel, as well as inputs for magnetic or ceramic cartridges, tuner, and tape head. A compact 4½" x 14⅜" x 9", the P-1400 is housed in an attractive black and brushed-brass cabinet. Price, $99.95.

Two new ***Fisher*** amplifier/preamplifier combinations are just the thing for audiophiles who want high-powered amplifiers but lack the space to accommodate separate preamplifier and amplifier chassis. One, the X-101-B, delivers 52 watts of music power on mono, and has a total of 14 inputs as well as 3 speaker outputs and 4 outputs for associated components. A second, the X-202-B, carries a maximum music-power rating of 75 watts (both channels), and is equipped with 16 inputs, 3 speaker outputs, and 7 outputs for associated components. Both models are designed around two pairs of matched 7591 output tubes, and both feature massive output transformers with grain-oriented steel cores. Either model can be housed in Fisher's 10-U mahogany or walnut cabinets, or the MC-2 metal cabinet. Measuring 4$\frac{13}{16}$" x 15⅛" x 10⅞", the

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

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Showcase

(*Continued from page* 10)

X-101-B sells for $189.50; the X-202-B is slightly larger (5¼" x 15⅛" x 12½") and carries a price tag of $249.50.

From ***Heath*** comes a stereo phono console specially designed for the audio enthusiast who demands that his hi-fi system be as attractive as it is good-sounding. Housed in a genuine walnut-frame cabinet measuring 31" x 50½" x 18" are a 4-speed automatic record changer, a 30-watt stereo amplifier, and a built-in "directable sound" stereo speaker system. And it's the "directable sound" that makes this a stereo console with a difference: its two ported speaker enclosures are mounted on vertical axes and can be rotated in opposite directions by equal amounts at the turn of the "director control." The result: sound that can be changed from an apparent single source to room-filling stereo, regardless of cabinet location. The GDW-41W sells for $249.95; two additional models (the GDW-81W and the GDW-91W) are equipped with an FM tuner and an AM/FM tuner, respectively, and carry price tags of $299.95 and $349.95. All prices, incidentally, are f.o.b. Heath's Benton Harbor, Mich., factory.

A new ***Jensen*** shelf-model hi-fi speaker system employs a special 10" high-compliance woofer and two direct-radiator tweeters. With a built-in crossover at 2000 cycles, the TF-2 carries a nominal power rating of 20 watts, an impedance of 8 ohms. Two versions of the 13½" x 23¾" x 11⅜" cabinet are available: a do-it-yourself utility model in sanded ¾" gum hardwood priced at $64.50, and an oiled walnut version selling for $79.50. . . . If you're looking for a way to enjoy hi-fi without disturbing others, you'll find a portable phonograph from ***Koss*** made to order. Mounted in a handsome walnut enclosure that lifts out of a rugged leatherette case, the four-speed unit utilizes a four-pole motor and is equipped with a turnover cartridge as well as a pair of Koss stereo headphones. Price, $99.50. . . . Two other new Koss products are the A-1220 stereo amplifier and the T-5 junction box. Transformer-powered for safety, the amplifier is designed for tape-monitoring while re-

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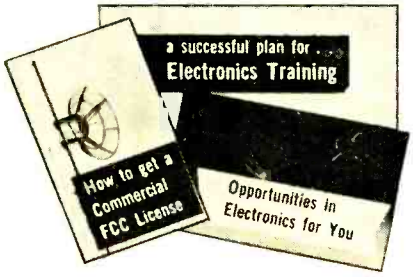

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Name _____ Age _____

Address _____

City _____ Zone _____ State _____

PE-80

Showcase

(*Continued from page 12*)

cording outside a studio and is used in conjunction with a pair of Koss stereo headphones. The junction box, in turn, provides inputs for two sets of stereo headphones and is equipped with separate controls for adjusting the level to the right and left ears. Prices, $34.95 and $7.95, respectively.

Lafayette Radio has come up with a 40-watt stereo amplifier/preamplifier combination which is attractively styled and has some impressive specifications to boot. Total harmonic distortion at 14 watts per channel is less than 0.25%, intermodulation distortion a low 0.34% at 10 watts. As for frequency response, the LA-240 delivers its full rated output ±1 db from 50 to 70,000 cycles. Supplied with a gold-finished cover set off by an ivory-and-gold front panel with gold-metal knobs, the LA-240 is priced at $79.95. . . . Also from Lafayette comes the PA-263 stereo dynamic microphone. Completely flexible, the PA-263 eliminates the need for two microphones during stereo recording and is equipped with a switch for stereo or monaural operation. Two individual dynamic elements with separate transformers effectively achieve two omni-directional patterns 90° apart for full pickup over a 360° area; overall frequency response is 50 to 15,000 cycles. The PA-263 is priced at $17.95, complete with its satin-finished aluminum case.

Available from ***Paco*** as a semi-kit is a bookshelf speaker system which can be assembled in less than an hour. The L-1 measures 15¼" x 9¼" x 8½" and is furnished in unfinished walnut. It can be mounted either vertically or horizontally and offers a frequency response of 50 - 14,000 cycles. The system is priced at $24.95.

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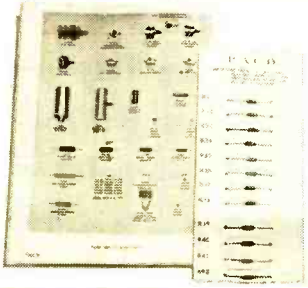
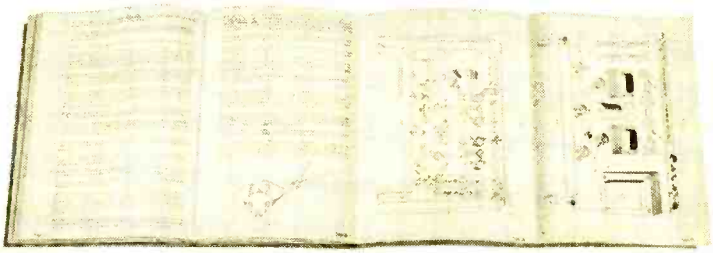


No mistaken identity or endless searching. Parts are clearly pictured and labeled; resistors are neatly mounted and identified!



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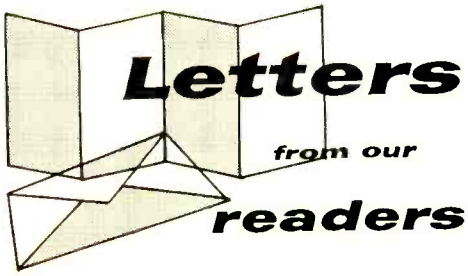
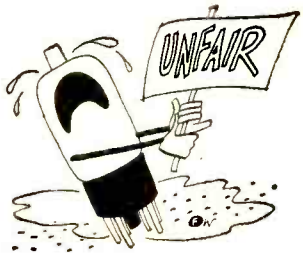


Annoyed Vacuum-Tube Fan

■ While looking through a recent issue of "POP-'tronics" (May 1961), I discovered that the number of articles and construction projects involving semiconductors far exceeded those pertaining to vacuum tubes. May I suggest that in future issues more articles and projects be devoted to tubes. I'm sure that there are many readers who, along with me, would appreciate seeing more devices using these time-tested components. For example, why



not print circuits for the octal tubes mentioned on page 80 of the May issue rather than uses for their broken-off socket bases? This kind of thing is sacrilege!

JON T. HOWARD
Hobart, Ind.

We haven't forgotten tubes, Mr. Howard. Just take a look at the circuit for the FM tuner in the article starting on page 45 of this very issue. It features the "Compactron," General Electric's new multiple vacuum tube. But let's face it—though there are still applications for which tubes are better suited than semiconductors, those little transistors and diodes are revolutionizing the electronics industry. It's only natural for P.E. to reflect their widespread use and the high reader interest in them. And finding uses for old tube bases is no sacrilege—far from it! Ingenious experimenters have been doing just this since the days of the Fleming valve. If you'd like to retaliate, send in a use for old transistor cases—we'll be glad to print that, too.

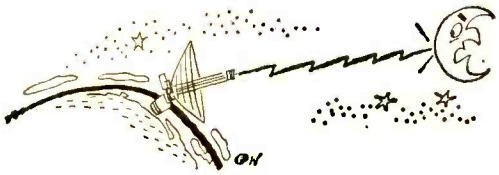
Inverse Square Law

■ Your Mr. Ken Gilmore's article "Radar Explores the Moon" in the May 1961 issue was excellent, but I would like to correct one point. Actually, U.S. radar signals diminish according to the inverse square law. I think that Mr. Gilmore is confusing U.S. radar with Russian radar, which does indeed have signal strengths that vary

Letters

(*Continued from page 16*)

by the fourth power of the increase in distance. The reason for this strange behavior is that in the fall of 1935 the Russian law was changed to provide that all characteristics of their electronic equipment would be at least double those of other



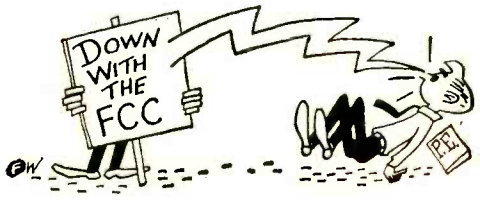
countries. They failed to take into consideration the fact that this would double the exponent of the inverse square law. REALLY, Mr. Gilmore!

CAPTAIN PAUL R. MOTTA
U.S. Army Arctic Test Board

Though somehow we don't feel that you're entirely serious, Captain Motta, we'd like to point out a couple of things. Mr. Gilmore meant (in the second paragraph on page 45 of the May issue) that if you doubled the distance from the radar antenna to the TARGET, *you'd* GET BACK *only 1/16th of the original power. Following the inverse square law, a quarter of the power would be lost going out and another quarter coming back, making the final power 1/16th of the original. Considered in this way, Mr. Gilmore's fourth-power statement is correct. However, the second sentence in that same paragraph is not correct: the term "square root" should be changed to read "one-fourth."*

CB Rag-Chewing

■ I was rather shocked when I read Myron R. Fox's letter entitled "Down With the FCC" in the March 1961 "Letters" column. I'm sure the majority will agree that the FCC has been more than generous in allocating part of the already overcrowded radio spectrum for informal citizens' use. The Citizens Band, Mr. Fox, is not intended for "rag-chewing" or "hamming," but for business



and personal communications. Let me repeat the Editor's suggestion that you consider getting an amateur radio license.

THOMAS I. SHORT, W4RPT
Manager, Southern Ky. Communications Co.
Marietta, Ga.

■ You suggested (on page 16 of your March issue) that Mr. Myron Fox should try amateur

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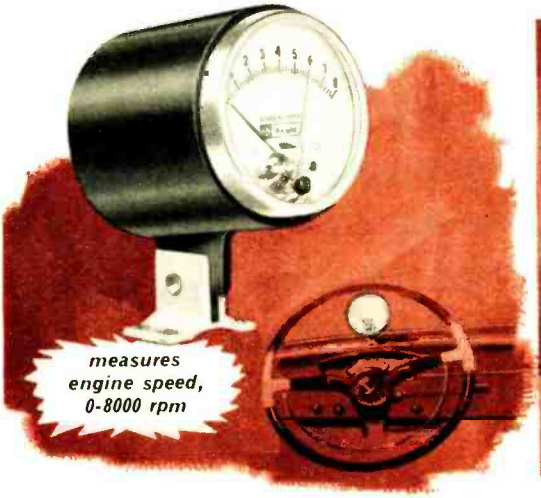

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ALLIED RADIO

Letters

(*Continued from page* 18)

radio. That's fine, but what about the people who don't have the auditory coordination to pass the code test? My answer to the CB problems would be to drop the code requirement for the Technician Class amateur license. I know that most of my rag-chewing CB friends would then go to six meters.

STEVE SOKOL, 6Q0448
Birmingham, Ala.

Mr. Fox's remarks, and our reply to them, have stirred up a real beehive of comment. These two letters are representative of most of those that we've received. If the FCC ever holds a public hearing on the Citizens Band, it should be quite a noisy affair.

R. F. Probe Query

■ In the r.f. probe article in your May 1961 issue ("R.F. Probe Peps Up VTVM"), you mention that the d.c. scale will give the *peak* voltage of the r.f. signal (next to last paragraph). Shouldn't this read *average* voltage?

JAMES P. BOBIS
Chicago, Ill.

You're absolutely right, and thanks for calling it to our attention. To get the peak voltage, you multiply the meter reading by 0.636; to get the r.m.s. voltage, you multiply the reading by 1.11.

1B86 Is Obsolete

■ I've received information that the 1B86 Geiger tube specified in my "Radiation Detector" article (Advanced Experimenter's Corner, January 1961 issue) is now obsolete. But the 30-G, an electrical equivalent of the 1B86, is available from Electronic Products Co., 111 E. Third St., Mount Vernon, N.Y., for $10.00.

JAMES E. PUGH, JR.
Menominee, Mich.

Thanks for the information, Jim. Readers who are having trouble locating the 1B86 will be glad to know about the 30-G. —30—

HOW TO ORDER BACK ISSUES

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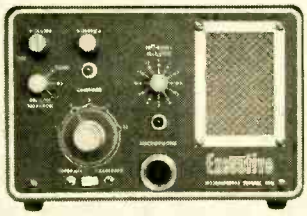

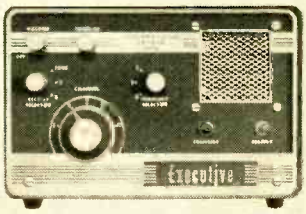

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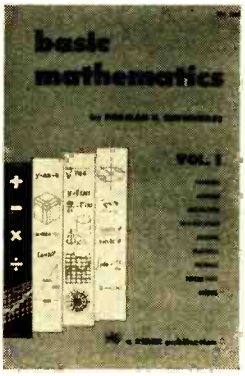

Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York, N. Y. 152 pages. Soft cover. $3.90.

RAPID AUTO RADIO REPAIR *by G. Warren Heath*

Intended to help auto-radio technicians handle repair jobs more efficiently, this servicing guide contains typical schematic diagrams and circuit explanations for all types of auto radios—including standard vacuum-tube, "hybrid," and all-transistor designs. Foreign makes are covered, and so are the new FM and removable portable types. Special circuits, such as the "Eliminoise," "Volumatic," and "Wonder-Bar," are fully discussed, and a complete chapter is de-

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(*Continued from page 22*)

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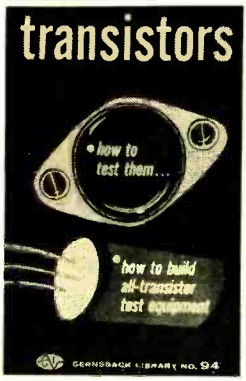
A concise "work-book" for the technician, experimenter and student, *Transistors* is an edited collection of articles which originally appeared in a well-known electronics magazine. The book is divided into two sections, the first of which explains how to build and use transistorized equipment for checking transistors. The second—and larger—section gives construction details on various types of transistorized test equipment, including a harmonic distortion analyzer, TV bar generator, scope calibrator, and many others.



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(*Continued from page 24*)

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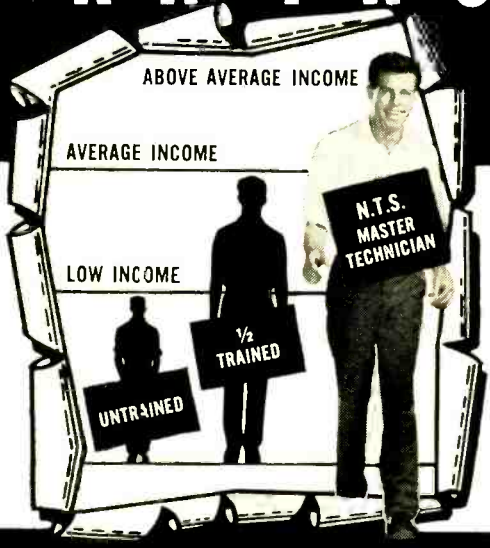

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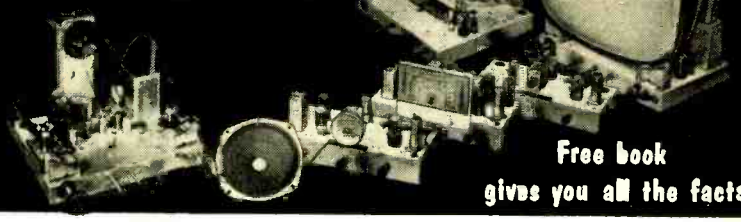

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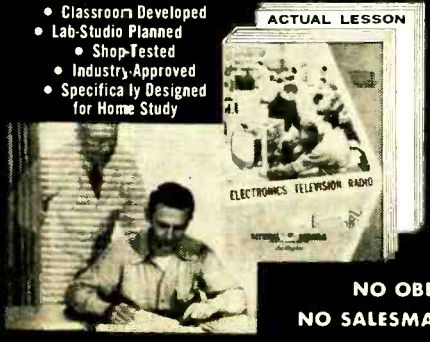

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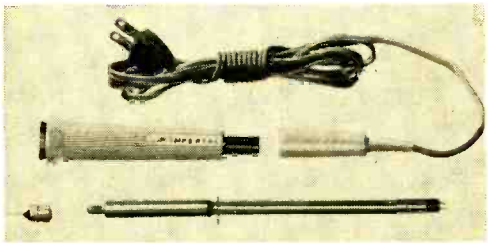
NEW products

FLEXIBLE SOLDERING IRON

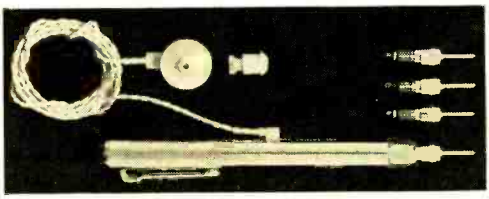
Every component of the "Imperial" soldering iron is interchangeable, and available in a variety of styles. The choice includes three types of cord sets (in three different colors), heat cartridges of 25, 30 or 40 watts, and 42



styles of soldering tips. The "Perma-Cool" handles, said to be the coolest ever developed for production line use, are also available in three colors. Cost of an "Imperial" ranges from about $6.00 to about $7.50, depending on the components selected. (*Unger Electric Tools*, Electronic Div. of Eldon Industries, Inc., 1475 E. El Segundo Blvd., Hawthorne, Calif.)

TRANSISTORIZED SIGNAL TRACER

The "Stethotracer" is a pen-sized, transistorized signal tracer made by *Don Bosco Electronics, Inc.*, 56 Route 10, Hanover, N. J. It detects or demodulates any low-level audio or modulated radio



frequency signal, then amplifies the signal about 1000 times and reproduces it through a high-quality earphone. Use of an optional adapter plug converts the Stethotracer to an oscilloscope or voltmeter preamplifier. Price, $29.95, com-

Opportunities in Electronic Engineering Technology

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YOU CAN OPEN MANY DOORS with CREI Home Study Programs In Electronic Engineering Technology. For example: One CREI Home Study Program helped Robert T. Blanks (above, left), become an Electronics Engineer. Another Program helped Robert I. Trunnell (center), become an Electronics Technician. While John H. Scofield (right)—a Mathematician—is currently studying still a different CREI Program to increase his understanding of electronics and the mathematical principles that apply to it. All are employed by Vitro Laboratories, Silver Spring, Md., Division of Vitro Corporation of America.

Today thousands of advanced electronics personnel—engineering technicians, engineers, administrators, executives—attribute their present high salaries and positions to their home study of CREI's comprehensive Programs in Electronic Engineering Technology. Wherever you go—wherever thorough knowledge of electronic engineering technology is a prime requisite—you'll find CREI Home Study students and alumni welcomed.

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When you enroll in the CREI Home Study Programs, you join more than 20,500 students who are presently working in almost every phase of electronics in all 50 states and most countries in the free world. You study courses to which a number of today's leading engineers and scientists have made substantial contributions. You are guided and assisted by CREI's staff of experienced instructors. Completion of your CREI

Home Study Program depends upon your on-the-job electronics experience, the amount of time you devote to study and the program you choose.

Demand for CREI-prepared men today far exceeds the supply—has exceeded the supply for many years. CREI Home Study Programs are specifically designed to prepare you for responsible positions in the electronic industry. In addition, *CREI Home Study Programs are kept up to date to include latest advancements in electronics.* We invite you to judge the Programs for yourself. Check the thoroughness and completeness of CREI Home Study Programs in the catalog provided upon request. These Programs include:

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Electronic Engineering Technology

Specialized Communications Engineering Technology

Specialized Aeronautical and Navigational Engineering Technology

Specialized Television Engineering Technology

Specialized Servomechanisms and Computer Engineering Technology

Specialized Engineering Mathematics

Automation and Industrial Electronic Engineering Technology

Nuclear Engineering Technology

The high calibre of a CREI Home Study education is attested to by America's biggest corporations, where CREI and alumni attain positions ranging from engineering technicians to engineers to top officials. Such companies are National Broadcasting Company, Pan American Airways, Federal Electric Corporation, The Martin Company, Northwest Telephone Company, Mackay Radio, Florida Power and Light, and many others. These companies not only recognize CREI Home Study educational qualifications but often pay all or part of CREI tuition for their staff members.

CREI Home Study Programs are the product of 34 years of experience; CREI itself was among the first to have its curricula accredited by the Engineers' Council for Professional Development. Each program has been developed with the same painstaking skill and care that CREI put into its World War II electronics courses for the Army Signal Corps, its special radio courses for the Navy, and its post-war group training programs for leading companies in aviation and electronics. For those who can attend day or evening classes in person, CREI maintains a fully accredited ECPD Technical Institute Residence School Program in Washington, D. C.

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Pre-requisite is a high school education or equivalent *plus* basic electronics training and/or practical electronics experience. (Electronics experience and/or training not necessary for Residence School.) If you qualify, send for the latest CREI catalog and full information at no cost. Veterans may apply under the G.I. Bill. If you're doubtful about your qualifications, let us check them for you. Mail coupon to: The Capitol Radio Engineering Institute, Dept. 1208H, 3224 Sixteenth St., N. W., Washington 10, D. C.

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☐ Electronic Engineering Technology
☐ Aero and Navigational Engineering Technology
☐ Automation and Industrial Electronic Engineering Technology
☐ Nuclear Engineering Technology

My educational and electronics experience qualifications are:
(All information held in strict confidence)

Employed by .....

Type of present work .....

Education: Years High School ..... Other .....

Electronics Experience .....

Name ..... Age .....

Address .....

City ..... Zone ..... State .....

Check: ☐ Home Study ☐ Residence School ☐ G.I. Bill

products

(*Continued from page* 28)

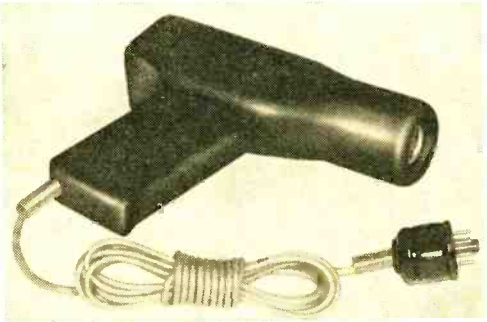
plete with earphone, three interchangeable attenuator probes, r.f. detector-demodulator probe, ground clip-lead and battery.

VTVM KIT

The Model VTV45 vacuum-tube voltmeter is said to have the sensitivity, accuracy, and versatility of a costly laboratory instrument, yet is priced at only $29.95 in kit form. The instrument is also available factory-wired and tested (Model VTV45W) for $54.95. For complete information, write to Dept. A, *General Techniques, Inc.*, 1270 Broadway, New York 1, N. Y.; ask for Bulletin PR.

IGNITION TIMING LIGHT

Designed for use with the Heathkit IO-20 ignition analyzer, the ID-11 ignition timing light accessory plugs directly into the IO-20, producing a bright white light which clearly illuminates timing marks. Speed range is 0-1250 flashes/minute (equivalent to 0-2500 rpm on conventional 4-cycle engines). Housed in a hard-rubber pistol-grip case, the unit measures 6″ x 7½″ x 2″. It sells



for $14.95 in kit form; a factory-wired version is also available for $19.95. (*Heath Co.*, Benton Harbor, Mich.)

TUBE TESTER/VOM

Now being manufactured by *Gold Products, Inc.*, 500 S. Westgate Drive, Addison, Ill., is the Model TC101 combination tube tester and volt-ohmmeter. Called the "Home 'N' Shop Tube and Circuit

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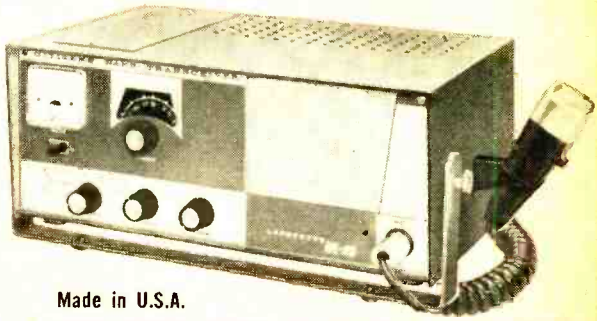

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A highly efficient 2-way communications system operating over a distance of up to 20 miles or more depending on terrain. Features 4 crystal-controlled transmit positions and 4 crystal-controlled receive positions. Tuneable superhet receiver covers all 23 assigned channels. Other highlights include dependable push-to-talk ceramic mike & relay, adjustable squelch control, automatic series gate noise limiter and illuminated dial.

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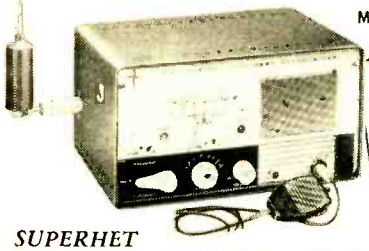

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A compact, precision transmitter and receiver covering up to a 20 mile or more radius, depending upon conditions. The HE-15A features an effective full-wave variable noise limiter, RF jack on front panel, planetary vernier tuning, 5-prong microphone jack for easy relay addition, and 12 tube performance from 4 dual-function tubes, 2 single-function tubes, 2 rectifiers.

HE-19	Telescoping Whip Antenna	Net 3.95
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- Continuously Indicates Transmitter Output
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Check the performance of marine, mobile or fixed transmitter. Features a 200 ua meter movement with variable sensitivity control. Earphones can be plugged in for an aural check of output. Antenna extends from 3¼" to 10¾". Magnet on bottom plate allows easy mounting on car dash or metal surfaces. Size, less antenna, 3⅛W, 2¼H, 2"D.

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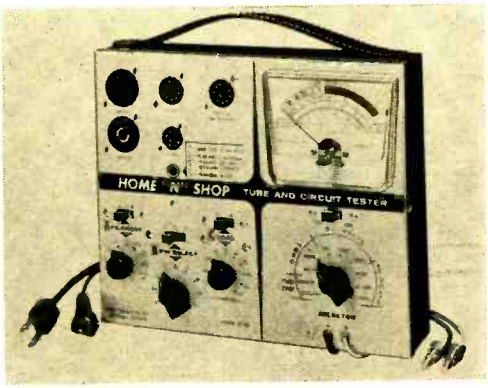
products

(*Continued from page* 30)

Tester," the versatile instrument checks approximately 2000 tube types and has eight voltage and resistance measurement ranges, covering 0 - 1200 volts a.c.

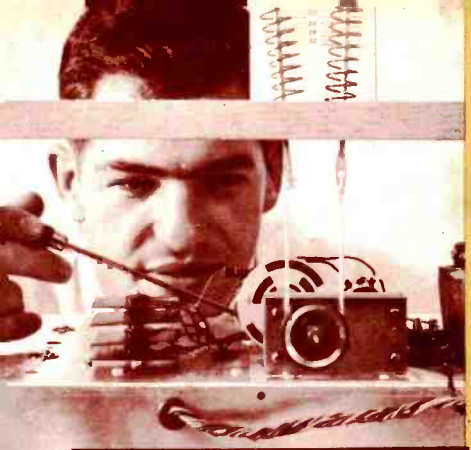


or d.c. and 0 - 5 megohms. The TC101's 1-ma. basic meter movement provides a sensitivity of 1000 ohms per volt. Price, $39.95.

REGENERATIVE RECEIVER KIT

Produced by the Kit-tronics Corporation, the Model RB-10 regenerative broadcast receiver kit consists primarily of a one-tube regenerative detector, a one-tube power amplifier, and a transformer-and-selenium-rectifier power supply. A separate, pre-punched, molded-plastic chassis is provided for each of these units, and the three chassis are bolted together

to make the complete set. The RB-10 kit is available from *Olson's International*, Dep't. K-11, 6509 Whitman Ave., Van Nuys, Calif., for $16.95 including tubes and earphone; a short-wave version of the kit is also available. —30—



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TRAINING AID 2 Build Vacuum Tube Voltmeter. Make tests on series and parallel circuits.

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TRAINING AID 4 Build circuits with pentode tubes, selenium rectifiers, transistors. Build oscillator, check signal phase shift with oscilloscope.

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TRAINING AID 6 Get practical experience with magnetic amplifiers, learn to use modified Prony brake; determine motor torque. Use strobe disc to measure motor speed.

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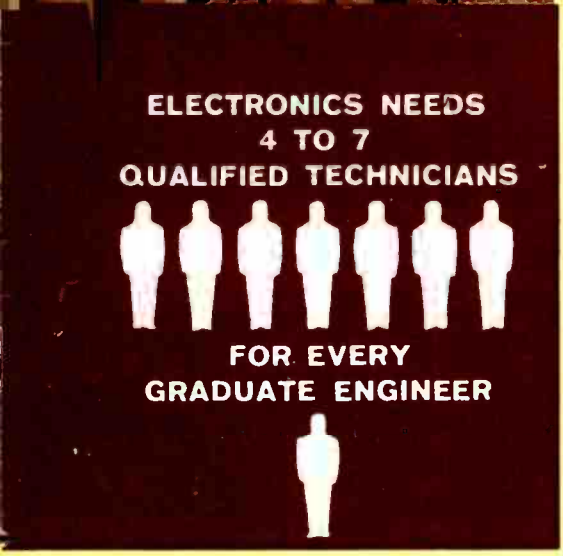

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NOW FOREMAN FOR AN ELECTRONICS FIRM, Thomas R. Favaloro started working even before finishing the NRI course. He is with Technical Appliance Corp., Shelburne, N. Y. In charge of all government and communications divisions. He says, "it is responsible for my whole future."

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

"I ACTUALLY ENJOY GOING TO WORK." That's how Duane E. Bitner, Manchester, N. H., describes his position with Raytheon working on the Hawk Missile System. "I can truthfully say your course gave me my biggest boost."

BUILDING ELECTRONIC CIRCUITS on specially-designed plug-in type chassis, is the work of Robert H. Laurens, Hammonton, N. J. He is an Electronic Technician working on the "Univac" computer. "My NRI training helped me to pass the test to obtain this position."

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*Here's what Mr. D. J. Lubin (4Q0054) of Baltimore, Maryland has to say about the superior performance of the Ray-Tel two-way CB radiotelephone:

"My base station and car are equipped with Ray-Tel. I use this system primarily for business purposes, and I am extremely pleased with the excellent performance and range of both units."

And here's why Mr. Lubin gets performance — because Raytheon spares no expense to give you quality features that defy comparison with other models. Check these features before you buy:

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In the **TRANSMITTER: Power Output** — certified at 2.8 watts. **Modulation** — close to 100%. **Microphone** — rugged carbon button. **Electronic Switching** no troublesome relays. **Pi Network Output** — easy efficient loading. **Standby Switch** — saves battery.

And in **CONSTRUCTION: Tube Clamps, Inspected Solder Joints, Adequate Tie Points, Double Impregnated Transformer, Plated Braced Chassis, Locking Rivets** — guards against corrosion, **Epoxy Coating** — for lasting protection.

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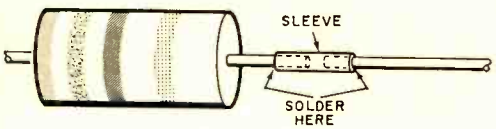
RAYTHEON

Tips and Techniques

SPLICING SLEEVES

The small metal sleeves used to facilitate tying knots securely in fishing leaders are also handy for making splices to short component leads. Insert the short lead into one side of the sleeve and the wire to be spliced onto it into the other side. Solder both leads to the sleeve, and you have a solid, dependable

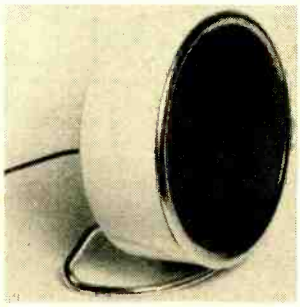


joint. The sleeves are available at most fishing equipment stores for about 50 cents per hundred.

—Harold Burnham, KN4WIQ

CLOCK CASE HOUSES SPEAKER

The case of a discarded alarm clock can make a handsome housing for a small loudspeaker or microphone element. Trim a cardboard "baffle" to fit in place of the clock face and glue on the speaker or mike with Duco cement. Then cover the front of the baffle with grille cloth and mount the assembly in the case, running the connecting cord through a rubber grommet inserted in one of the rear key holes.



—Carl Dunant

WIRING MULTI-GANG SWITCHES

It's useful to have some means of supporting a multi-gang rotary switch while it is being pre-wired. A potentiometer mounting bracket centered near the

news from hallicrafters

littlefone

CB-3 TRANSCEIVER

Only Hallicrafters offers 8-channel convenience and all these quality performance features.

The transmitter . . . output circuit matches 25 to 75 ohm antenna systems. Standardized CR23/U crystals (3rd overtone, series resonant) readily available. Output amplifier adjustable for max. legal input. 100% modulation on positive peaks. Series-tuned 2nd harmonic trap for excellent TV suppression.

The receiver . . . sensitivity less than 1.0 UV for 10 db. signal-to-noise ratio. Electronic squelch works on less than 6 db. signal strength change. 6 kc. selectivity. Image rej. 40 db. min. Audio output over 2 watts. Auto. noise limiter, series and shunt diodes.

citizens band

Before you choose from the countless brands of CB equipment available, consider this fact: Nowhere in the field of communications is a manufacturer's experience, integrity and record of achievement more critical to performance and reliability than in citizen's band. Hallicrafters has produced about 1,000,000 communications units in the past 27 years.

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

Tips

(*Continued from page* 36)

front of a 3″ x 12″ wooden base makes a handy rig for this purpose. Mount the switch on either side of the bracket (the length of the base insures a good counterbalance), and make a slot on some convenient part of the base large enough to accept the lever or button of a toggle or snap-action switch. The switch can then be wired in a stable, flat position.

—*R. B. Wilson*

CLIP LEAD PROTECTOR

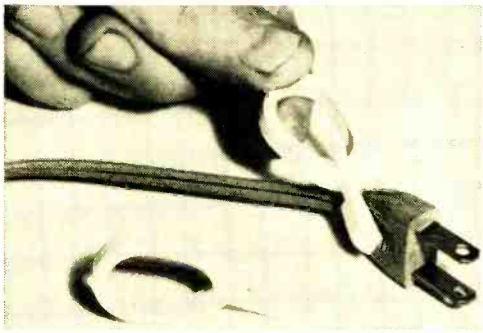
Slipping a plastic or rubber auto distributor nipple over the connection between

a wire and an alligator clip will stiffen the joint and keep it from breaking. You'll have a neater looking job, too.

—*Robert Micals*

PLUG REMOVER

A plastic drapery hanger makes a useful handle for removing small, tight-fitting electrical plugs. Clip the sharp teeth of the hanger onto the stubborn plug



and put your fingers through the loop—you should be able to pull it out with ease.

—*Jerome Cunningham*

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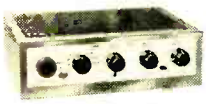
AM Tuner HFT94 Incl. FET
Kit $39.95 Wired $65.95



Stereo Preamplifier HF85
Kit $39.95 Wired $64.95

Stereo Power Amplifiers

	Kit	Wired
100W HF89:	$99.50	$139.50
70W HF87:	$74.95	$114.95
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Incl. FET

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

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& Uni-Probe® Pat. ≡2,790,051
Kit $29.95
Wired $49.95

VTVM ≡221
Kit $25.95 Wired $39.95

DC–5 MC 5" Scope ≡460
Kit $79.95
Wired $129.50

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Kit $44.95 Wired $79.95

Tube Tester ≡625
Kit $34.95 Wired $49.95

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Kit $26.95
Wired $39.95

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Kit $12.90
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Kit $29.95
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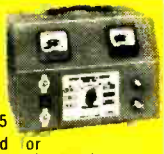
Extra-filtered for transistor equipt. ≡1060
Kit $38.95 Wired $47.95



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BLACK BOXES FOR CIVIL DEFENSE

STATUS REPORT ON NEAR

By KEN GILMORE

IT ALL BEGAN when a missile-detection station not far from the North Pole sounded the alarm. Traveling at the speed of light, the warning flashed to the North American Air Defense Command headquarters in Colorado Springs, Colo. At NORAD, an officer pressed a button, and the alert sped out over the national warning system of the Office of Civil and Defense Mobilization. Seconds later, some 1400 small "black boxes" began squawking raucously in 1400 homes, stores, and offices in the little town of Charlotte, Mich.

The alert, of course, was a test. Instead of running for cover, the town's citizens released 1400 balloons they had ready for the occasion. The hundreds of balloons, all rising together from the town, dramatically illustrated

Battle Creek (Mich.) Enquirer & News photos

Fig. 1. Hundreds of balloons soared into the sky when residents of Charlotte, Mich., received signals over their NEAR receivers. Housewife (right) has her "black box" plugged into wall outlet at bottom left.

the effectiveness of the "black box" warning system (see Fig. 1).

If enemy missiles or bombers ever attack, the system tested last October 11 may save your life and the lives of millions of your fellow citizens. It's called NEAR (*N*ational *E*mergency *A*larm *R*epeater), and it's the closest thing to a really effective nation-wide alarm system yet demonstrated.

"Black Box" Alert. If NEAR is approved and adopted—and the Michigan tests were certainly encouraging—a miniature "black box" slightly larger than a pack of cigarettes will be installed in every home, apartment, office, hospital, store, factory, and school in the country. In case of attack, millions of these "black boxes," set off by a specially coded signal sent over the nation's electric power lines, would alert citizens from coast to coast.

At the same time, air-raid sirens would be automatically set screaming by the same signal. Thus, everyone in or near a building equipped with electricity or within hearing range of a siren would be alerted.

Defense experts estimate that NEAR could warn 99% of our population of an impending raid less than one minute after it had been detected. And by giving our citizens a few precious minutes to take cover, such a warning system could conceivably cut casualties by at least 50%.

Tiny Receivers. The NEAR system operates on a simple, effective, and reliable principle. The alarm is set off by mixing a 240-cycle signal with the regular 60-cycle current on the nation's power lines. The "black boxes" shown in Fig. 2 are actually tiny receivers, tuned to this frequency.

If the system is adopted, you'll plug one into an a.c. outlet in your home and screw it to the wall so that it can't be accidentally disconnected (see Fig. 2). When the special signal comes along the power line, a mechanical reed resonant at 240 cycles will begin to vibrate. This will close a contact and set off a loud buzz which will last for 50 seconds, stop for 10 seconds, sound again for 50 seconds, and so on, for as long as the 240-cycle signal remains on the line.

Vibrating Reed. As you can see from the schematic of the receiver in Fig. 3, capacitor *C1* and coil *L1* form a series *LC* circuit which is resonant at 240 cycles. When a 240-cycle signal comes along, the reed, also resonant at that frequency, begins to vibrate. During its vibration, it momentarily connects diode *D1* and the coil of relay *K1*—a sensitive d.c. relay—across the a.c. line. As a result, the relay closes, starting the 1-rpm synchronous motor.

Fig. 2. Black box receiver (right) plugs into a.c. outlet and can be installed in a few minutes. Flange on receiver is designed to accept face-plate screw of receptacle and holds unit securely in place.

If the signal stops within the first ten seconds, the reed quits vibrating, the relay opens, and a spring returns the motor to its starting point. This provision keeps the alarm from being actuated by 240-cycle transients which could result from lightning or other discharges near power lines. Since such disturbances usually die down within a second or two, they can't set off the alarm.

Complete Cycle. If the signal continues for at least ten seconds, the motor will have turned to a point where cams *A* and *B* close their associated contacts. Cam *A* closes a holding contact which keeps the motor running independently of the vibrating reed. Cam *B*, meanwhile, shorts out capacitor *C1*, thus applying the full line voltage across coil *L1*. With heavy current flowing through it, *L1* sets up a magnetic field strong enough to drive the 120-cycle clapper, which produces a loud, unpleasant buzz.

The motor runs for another fifty seconds, by which time it has completed one revolution and has thus returned to its starting point. Cams *A* and *B* now open. If the actuating signal is still present, the receiver begins another cycle. Alternatively, if the 240-cycle tone is no longer on the line, the motor stops at its original starting point.

Warning Signal. The NEAR alarm signal, which would be set off nationally

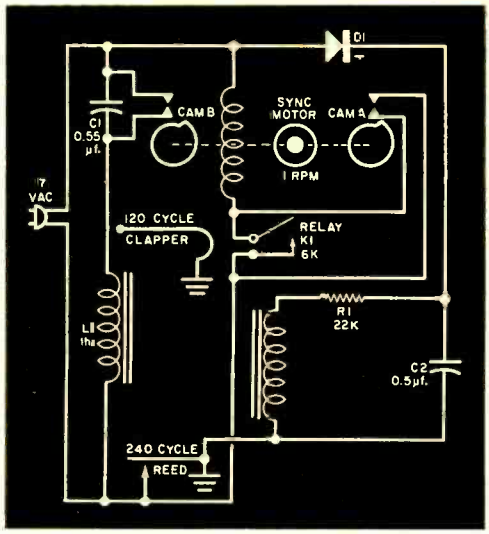
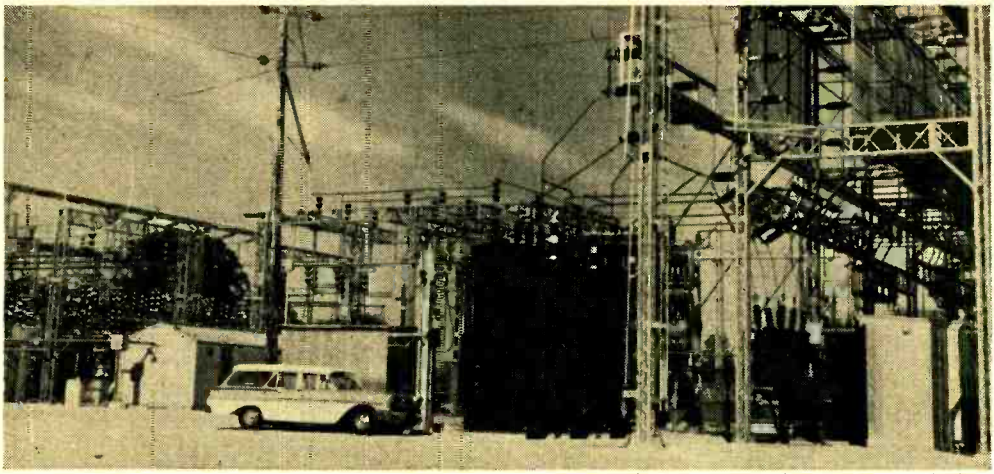


Fig. 3. Schematic diagram of black-box receiver. A 240-cycle signal causes synchronous motor to revolve, turning cams A and B, which activate clapper.

from one central point, is actually generated at local power distribution stations. Figure 4 shows one of the giant inductors used to generate the signal in the Michigan test; a simplified schematic of one type of NEAR transmitter appears in Fig. 5. Note that the secondaries (the *B* windings) have no effect as long as switch *S1* is closed.

To set off the alarm, *S1* must be



Photos on this page courtesy of Midwest Research Institute

Fig. 4. NEAR transmitter (center) generates 240-cycle signal to trigger black-box receivers.

opened. Rectifier *D1* is now in the circuit, so that a flow of d.c. pulses is set up through the transformer secondaries. As a result, the d.c.-biased secondaries generate a signal rich in the fourth harmonic of the power-line frequency—240 cycles. And this 240-cycle warning signal stays on the line as long as *S1* remains open.

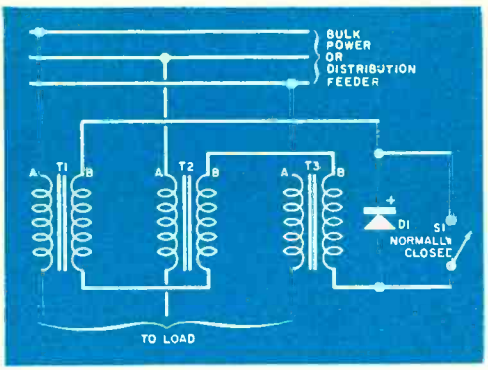
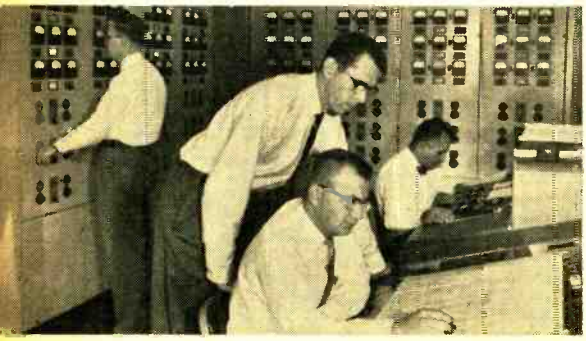


Fig. 5. Simplified diagram of transmitter for NEAR system.

Fig. 6. Technicians analyze network, select NEAR equipment.



The NEAR warning signal, incidentally, is of relatively low amplitude. It averages only about two or three volts on a 117-volt line, and does not interfere with the regular power transmission in any way.

Many Advantages. The NEAR system would be extremely flexible. The signal, for example, could be coded so that it would not trigger home receivers, but special pulse detectors instead. Such detectors, in turn, could sound sirens in isolated local communities or alert local officials to impending danger. What's more, these local devices could be used to warn of hurricanes or other natural disasters without involving the nation-wide system.

In addition to being simple, reliable, and flexible, the NEAR system would be relatively cheap. When and if the receivers are mass-produced, it's likely that you'll be able to buy one for $10.00 or less.

The estimated cost to the government for a nation-wide network of generating stations is between 40 and 50 million dollars—far cheaper than any other system which could warn a comparable number of people. If the system is approved and put into operation, this would be a small price indeed for the millions of lives which would be saved in case of an enemy attack. —30—

INTRODUCING THE COMPACTRON

multi-section tube gives FM TUNER/RECEIVER three-tube performance

By **PHILIP E. HATFIELD,** W9GFS*

BY NOW, just about everyone has heard of the "Compactron." And you'll be seeing more and more of the Compactron, too, for this new multi-function tube in its many forms will soon appear in TV sets, FM multiplex adapters, and dozens of other products. Actually, the Compactron is just what its name (a General Electric trademark) implies: an extremely compact grouping of a number of different "tubes" in a single envelope. There is almost no end to its applications, but the little FM tuner/receiver pictured here represents an ideal introduction to the device.

Since this one-tube unit can be used with earphones, it is just the thing for listening to FM programs late at night when full-scale operation of your hi-fi rig might cause domestic discord. If you want to boost FM programing to full-room volume, simply feed the output from the combination tuner/receiver into your hi-fi set. Reverting to earphone operation again will entail nothing more than changing plugs.

Although it incorporates its own power supply, this compact tuner/receiver can be built for far less than most FM tuners. And it offers the distinct advantage of enabling you to become acquainted with one of the latest developments in the tube field—the Compactron—at the same time.

About the Circuit. You can see from the schematic diagram that the 6D10

*Receiving Tube Dept., General Electric Co.

Compactron is a triple triode (see page 48). It combines the functions of an r.f. amplifier, superregenerative detector, and audio amplifier—all in one envelope.

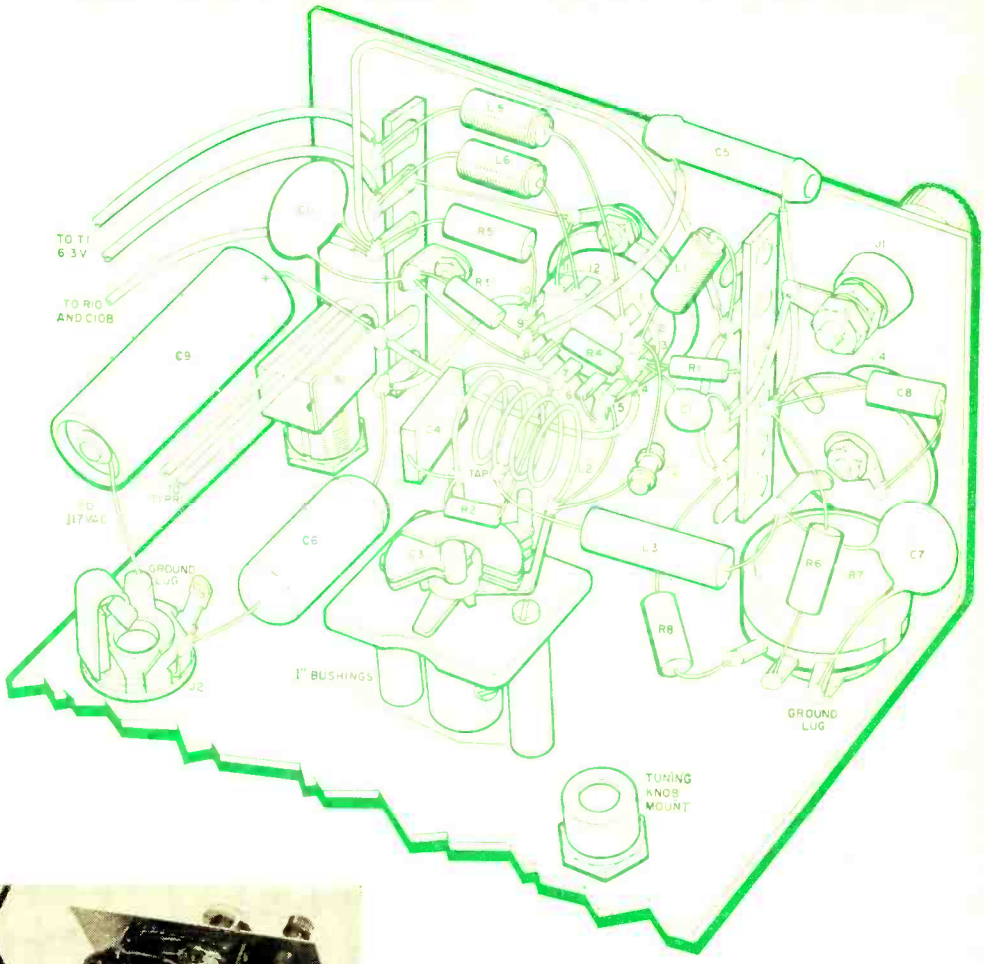
The first section serves as an r.f. amplifier, connected in a grounded-grid circuit. For simplicity, this stage is untuned, since its principal function is to isolate the antenna from the detector.

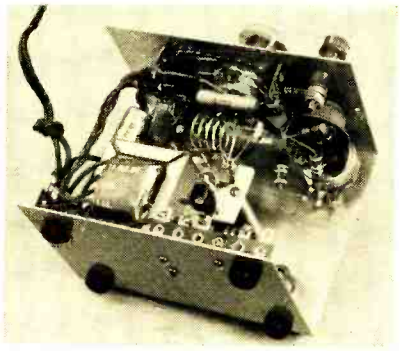
The second stage, a superregenerative detector, oscillates simultaneously at the frequency of the incoming signal and at a frequency slightly above the audible range—the so-called "quench" frequency. If you've ever done much experimenting with ordinary regenerative detectors, it shouldn't take you long to figure out how a superregenerative detector works.

As you no doubt know, an ordinary regenerative detector is most sensitive when it's just on the verge of oscillation. But in the superregenerative circuit, the detector is pulled "in" and "out" of oscillation thousands of times each second at a rate determined by the quench frequency. The result is a circuit so sensitive that you can actually hear the thermal noise of the tube, although this noise disappears when a strong signal is received.

The detector's very high frequency (v.h.f.) oscillation takes place at the same rate as the frequency of the incoming signal; the frequency of this oscillation is determined principally by the values of coil *L2* and variable capacitor *C3*. The lower-frequency oscillation

Pictorial diagrams on these pages show how parts for FM tuner/receiver should be arranged within 3" x 4" x 5" aluminum chassis box; receiver portion of circuit appears at right, above, while power supply (at bottom of chassis box) is shown at left. Note that coupling capacitor C5 has been moved upward slightly in pictorial at right to show pins on socket for Compactron tube.



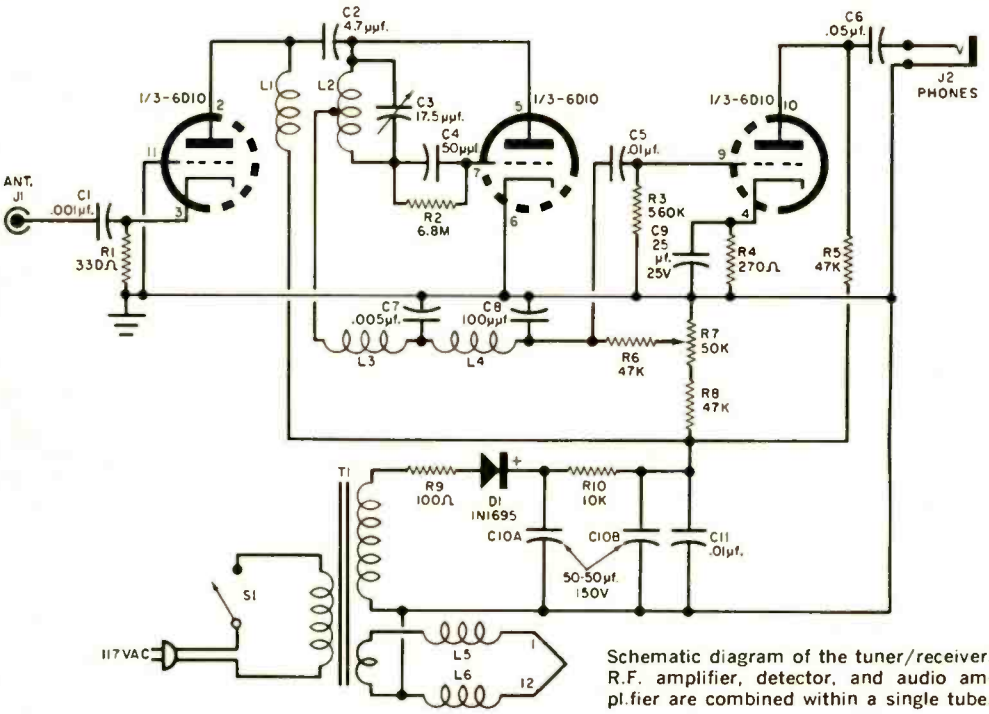


or "quench" frequency is determined chiefly by the values of capacitor *C4* and resistor *R2*, as well as the position of the tap on *L2*. Amplitude of the quench oscillation, in turn, depends on the plate voltage and can be controlled by the setting of potentiometer *R7*.

The output from the detector is fed to a filter consisting of *L3*, *C7*, *L4*, and *C8*, in order to strip the signal of v.h.f. and quench-frequency components. From the filter, it goes to the grid of the Compactron's third triode section, an ordinary resistance-coupled audio amplifier which amplifies the signal to a suitable level for headphone operation. Alternatively, the output from this stage can be fed into an auxiliary audio amplifier.

Putting It Together. The box chosen for the cabinet provides plenty of room for all components, but you'll find that assembly is easier if you follow the sequence outlined here.

Begin by punching and drilling all holes, then mount the Compactron socket, the two adjacent terminal strips, potentiometer *R7*, antenna jack *J1*, and phone jack *J2*. As much wiring as possible should be completed before you mount any additional parts. Variable capacitor *C3* should then be mounted and all wiring completed, with the ex-



Schematic diagram of the tuner/receiver. R.F. amplifier, detector, and audio amplifier are combined within a single tube.

PARTS LIST

C1—0.001-μf. ceramic capacitor
C2—4.7-μμf. ceramic or mica capacitor
C3—17.5-μμf. variable capacitor (Hammarlund HF-15 or equivalent)
C4—50-μμf. mica capacitor
C5, C11—0.01-μf. ceramic capacitor
C6—0.05-μf., 200-volt Mylar or paper capacitor
C7—0.005-μf. ceramic capacitor
C8—100-μμf. ceramic capacitor
C9—25-μf., 25-volt electrolytic capacitor
C10a/C10b—50/50 μf., 150-volt dual electrolytic capacitor
D1—1N1695 diode
J1—Screw-type banana jack
J2—Open-circuit phone jack
L1—Single layer of #30 enameled copper wire close-wound on and wired in parallel with 470,000-ohm, 1-watt resistor, 7/32" diameter and 9/16" long
L2—5 turns of #18 tinned copper wire, ¼" in diameter, spaced to a length of approximately ⅝", tapped at center turn
L3—7-μh. r.f. choke (Ohmite Z-50 or equivalent)
L4—10-mh. r.f. choke (National R-100 or equivalent)
L5, L6—Single layer of #22 enameled copper wire, close-wound on and wired in parallel with 470,000-ohm, 1-watt resistor, 7/32" in diameter, 9/16" long
R1—330-ohm, ½-watt resistor
R2—6.8-megohm, ½-watt resistor
R3—560,000-ohm, ½-watt resistor
R4—270-ohm, ½-watt resistor
R5, R6, R8—47,000-ohm, 1-watt resistor
R7—50,000-ohm potentiometer, linear taper
R9—100-ohm, ½-watt resistor
R10—10,000-ohm, 2-watt resistor
S1—S.p.s.t. toggle switch
T1—Power transformer; primary, 117 volts a.c.; secondaries, 125 volts @ 15 ma. and 6.3 volts @ 0.6 amp. (Stancor PS-8415 or equivalent)
V1—6D10 tube
1—12-pin socket for above (produced by J. H. Mfg. Co., Cinch Mfg. Co., etc.)
1—3" x 4" x 5" utility box (LMB T-F779 or equivalent)
1—Miniature telescoping antenna (Lafayette F-343 or equivalent)
Misc.—Line cord and plug, wire, solder, dial, dial plate, terminal strips, hardware, etc.

ception of that for the power supply.

Note that both the rotor and stator of the variable capacitor must be insulated from the box, and that an insulated shaft extension must be used with a metal dial. The capacitor specified in the Parts List has two holes in the ceramic end-plate that allow the use of "pillars" for mounting. Other capacitors may require a small plastic plate for mounting, with mounting pillars attached to the plate.

Transformer *T1*, switch *S1*, filter capacitor *C10a/C10b*, and the other two terminal strips should now be mounted on the box and the power supply wiring completed. In order for the whip anten-

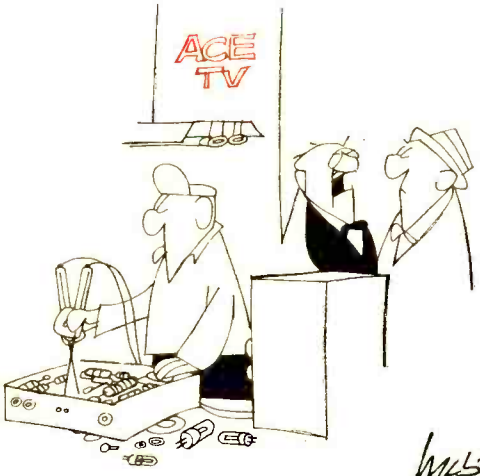
(*Continued on page* 114)

Hobnobbing with Harbaugh

Shop-Warned Customers

"One resistor, coil on the side, heavy on the solder."

"This is as portable as you can get."



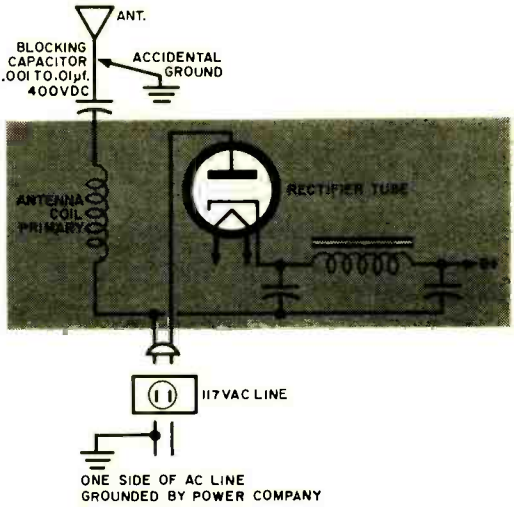
"He's testing some Japanese equipment."

"No, no, Madam, the cord just goes in one ear."

ANTENNA TIPS

SAFETY FIRST

The ordinary a.c.-d.c. broadcast receiver is a very popular—but dangerous—plaything. This is especially true if an attempt has been made to improve reception by adding an external antenna. Very frequently such an antenna is a potential hazard; depending on which way the plug is inserted into the wall outlet, the antenna lead could carry the



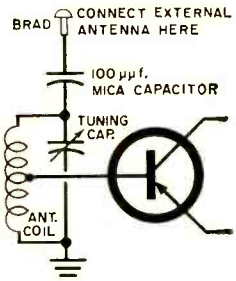
full line voltage. But inserting a small capacitor in series with the external antenna lead will prevent dangerous shocks. The value of the capacitor is not critical—it can be anything from .001 to .01 μf., rated at 400 w.v.d.c. or better.

Old a.c.-d.c. models come equipped with an external antenna terminal which is isolated from the line by such a blocking capacitor. Always check this capacitor for leakage before connecting an external antenna. And remember, even with the capacitor in the circuit, you can still receive a nasty jolt from the a.c. line if you touch the antenna terminal when in contact with a good earth ground.

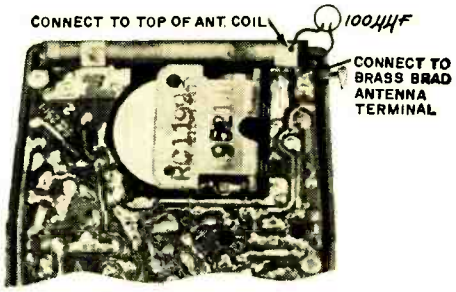
—Eugene F. Coriell

TRANSISTOR RADIO

Have you ever been stuck with a pocket transistor portable and reception too weak for words? If so, take a few minutes and open up that plastic case so a temporary



antenna connection can be made. With a soldering iron point, push a brass brad through the side of the case near the antenna coil, letting the brad project from the case by about 1/8-inch. Solder a 100-μμf. miniature capacitor between the end of the brad in the case and the ungrounded end of the antenna coil. When traveling, take along a hank



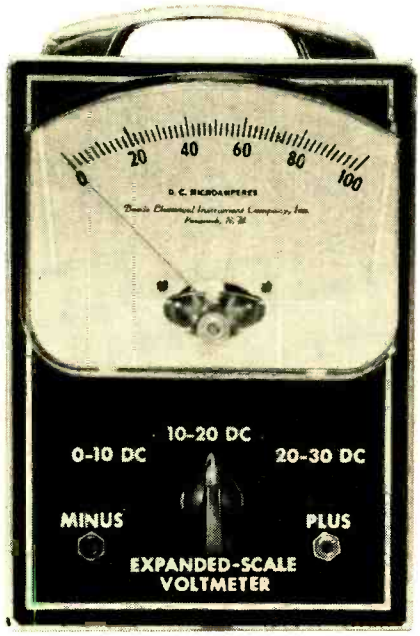
of wire with a miniature alligator clip on the end. Then, if reception is too weak with the built-in antenna, clip on the hank of wire and listen to those broadcast signals come rolling in.

—Homer L. Davidson

EXPANDED SCALE VOLTMETER

Ingenious device employs three zener diodes, makes possible accurate, low-voltage d.c. measurements

By DOROTHY LOUISE ZACHARY



NOT SO LONG AGO, an expanded-scale voltmeter was a piece of equipment too expensive for the average experimenter to consider buying. Recent developments in semiconductors have changed the situation, however. The 0-30 volt expanded-scale voltmeter described here, designed around the now-familiar zener diode regulators, can be built at moderate cost—even though it rivals in performance commercial models costing much more. Each of the unit's three ranges (0-10, 10-20 and 20-30 volts d.c.) is spread out over the full scale of the 4½"-wide panel meter.

The Diodes. The design of the voltmeter is based on the properties of the zener or "breakdown" diode. When a voltage source is connected to such a diode in the reverse direction (positive to cathode), current flow through the diode is negligible as long as the voltage is below a certain critical point.

If the source voltage is raised above this point, the diode "breaks down," passing a current which is determined by the value of the excess voltage and the resistance of the rest of the circuit. As the source voltage is further increased, the current flow through the

diode increases proportionally to the excess voltage, but the voltage across the diode remains at the breakdown point—as long as the diode's rated power-handling capacity is not exceeded.

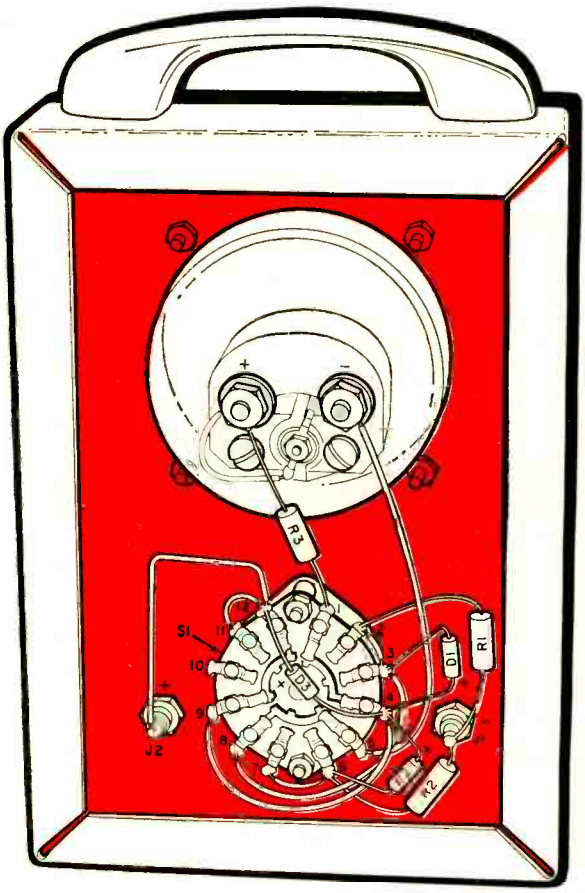
Zener diodes are available with breakdown ratings ranging from under 3 to about 200 volts. The two types used in this instrument are rated at 10 and 20 volts. (For more complete information on zener diodes, see the article beginning on page 76 of the June 1961 issue of POPULAR ELECTRONICS.)

The Circuit. Meter *M1*, a 0-100 d.c. microammeter, is converted to a 0-10 d.c. voltmeter by means of a 100,000-ohm series resistor (*R3*). Resistors *R1* and *R2* are current-limiting units, serving to protect diodes *D1*, *D2* and *D3*; the 2000-ohm resistance of *R1* or *R2* is low compared with that of *M1* with its series resistor—so *R1* and *R2* have a negligible effect on the meter reading. The equivalent circuit for each of the three positions of range switch *S1* is shown at the bottom of page 53.

When switch *S1* is in the 0-10 volt position, *M1* (neglecting the very small voltage drop across *R1*) reads the voltage across input jacks *J1* and *J2*. Diode *D1* has no effect on the circuit for voltages below 10, since it does not conduct. At voltages higher than 10, *D1* "breaks down," maintaining a 10-volt drop across its leads and locking *M1* at a reading of 10 volts. Resistor *R2* and diode *D2*, though in the circuit, have no effect because *D2* is a 20-volt diode—remaining a non-conductor throughout the 0-10 volt range.

With the switch in the 10-20 volt position, no current flows through meter *M1* for voltages less than 10 appearing across *J1* and *J2*, since neither diode conducts. For voltages between 10 and 20, *D1* is in its "break-down" state and maintains a 10-volt drop across its leads, although *D2*, the 20-volt diode, is still in a non-conducting state; the meter, therefore, reads the excess over 10 volts across *J1* and *J2*. When voltages of 20 or higher appear across the input jacks, diode *D2* also "breaks down" and maintains a 20-volt drop; in this case, *M1* sees only the voltage difference between *D1* and *D2* (10 volts) and remains locked at its maximum reading.

When *S1* is in the 20-30 volt position, the circuit is the same as in the previous case except that an additional 10-volt diode (*D3*) is placed in series with the lead from *J2*. This has the effect of "offsetting" the measurement by 10 volts. In other words, no current flows through *M1* for input voltages of less than 20, while for voltages between 20 and 30, the meter reads the excess over 20 volts. When the input voltage

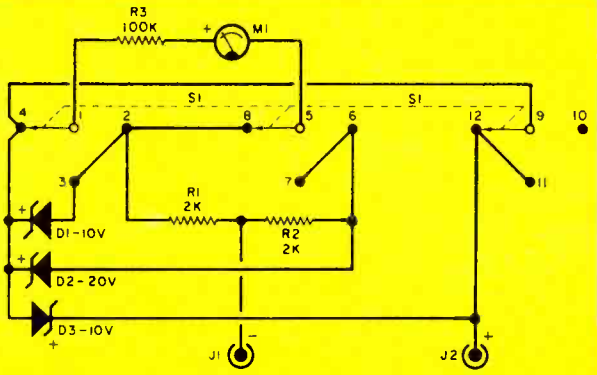


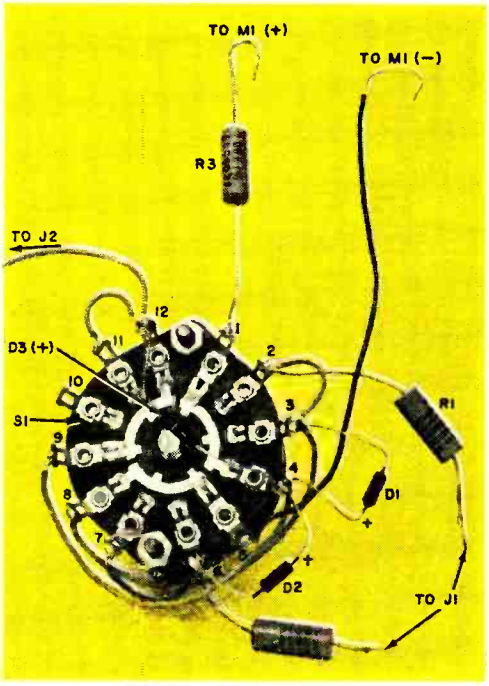
PARTS LIST

D1, D3—10-volt zener diode, ¾-watt, 10% (Motorola 3/4M10Z10 or equivalent)
D2—20-volt zener diode, ¾-watt, 10% (Motorola 3/4M20Z10 or equivalent)
J1, J2—Insulated tip jack (one red, one black)
M1—0-100 d.c. microammeter (Beede Model 230 or equivalent)
R1, R2—2000-ohm, 1-watt, 1% precision resistor (either deposited-carbon or wire-wound)
R3—100,000-ohm, 1-watt, 1% precision resistor (either deposited carbon or wire-wound)
S1—3-pole, 3-position rotary switch
1—2" x 7" x 5" aluminum chassis (Bud AC-402 or equivalent)

The three zener diodes in the expanded-scale voltmeter (D1, D2 and D3) are protected from excess current by resistors R1 and R2.

Hook up range switch S1 as shown in photo below before installing it in the chassis according to pictorial diagram shown at left.

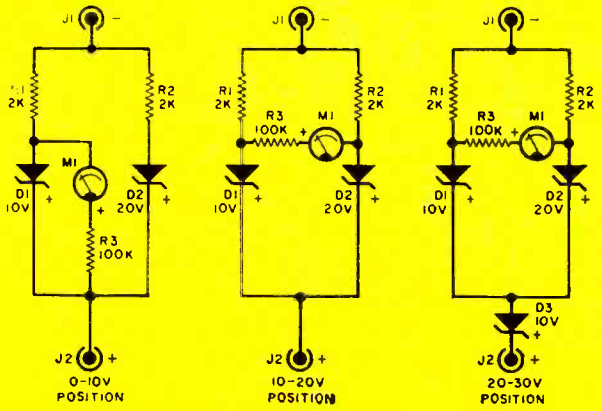




reaches 30 or above, *M1* locks at its maximum reading.

Construction. There's room to spare in the 2″ x 7″ x 5″ aluminum chassis used to house the parts, but you'll find it convenient to make all connections to switch *S1* before mounting it. And although parts layout and placement are not at all critical, it's essential to observe the proper polarity when wiring in the diodes (*D1*, *D2* and *D3*) and meter (*M1*). A chromium handle of the type used for kitchen cabinet drawers may be screwed to the top of the meter, making it easier to carry around.

Reading the Meter. Since mentally converting *M1*'s 0-100 scale to measure 0-10 volts is a simple matter (you just divide all readings by 10), it's not really necessary to make a new meter scale for this application. Remember to add 10 volts to all measurements taken on the 10-20 volt range and 20 volts to all measurements on the 20-30 volt range, and you won't have any trouble. —30—



Equivalent circuits for each of the three positions of the range switch. "Offsetting" diode D3 is placed in the circuit only when S1 is in the 20-30 volt position.

TRANSISTORIZED PA SYSTEM

UPI

Portable public-address system packs amplifier, speakers, microphone, and batteries in one compact case

By LOU GARNER

HERE'S an easy-to-build, portable public address (p.a.) system that can be used anywhere—indoors or out. Designed to operate from either dry batteries or a 12-volt automobile electrical system, the unit has enough "sock" to handle fairly large groups of people.

Because it is completely self-contained and easily set up in a matter of minutes, the system is ideal for rental to commercial groups and organizations. At typical rental fees of $10 to $25 an evening, it can pay for itself in just a few "jobs." Afterward, the fees are all profit, except for occasional battery replacement. And there's the extra "bonus" of having the system available for personal or charity uses whenever you want.

CONSTRUCTION

Assembled from standard components, the complete p.a. system is made up of several semi-independent units—an amplifier, a power pack, a microphone, two speaker/baffle assemblies, a microphone stand (or base), and various accessory cables. For transport or storage, these units are all mounted within the speaker/baffle assemblies which, hooked together, also serve as a portable carrying case—see Fig. 1. On location and in use, the various units are separated, placed in position, and interconnected with the cables.

If you work at an average pace, you should have no difficulty assembling the amplifier in two or three evenings and the remainder of the equipment in another evening or two—about a week altogether. Working full time, you should be able to assemble the entire system in a couple of days.

The Amplifier. The "heart" of the system is a transistorized audio amplifier,

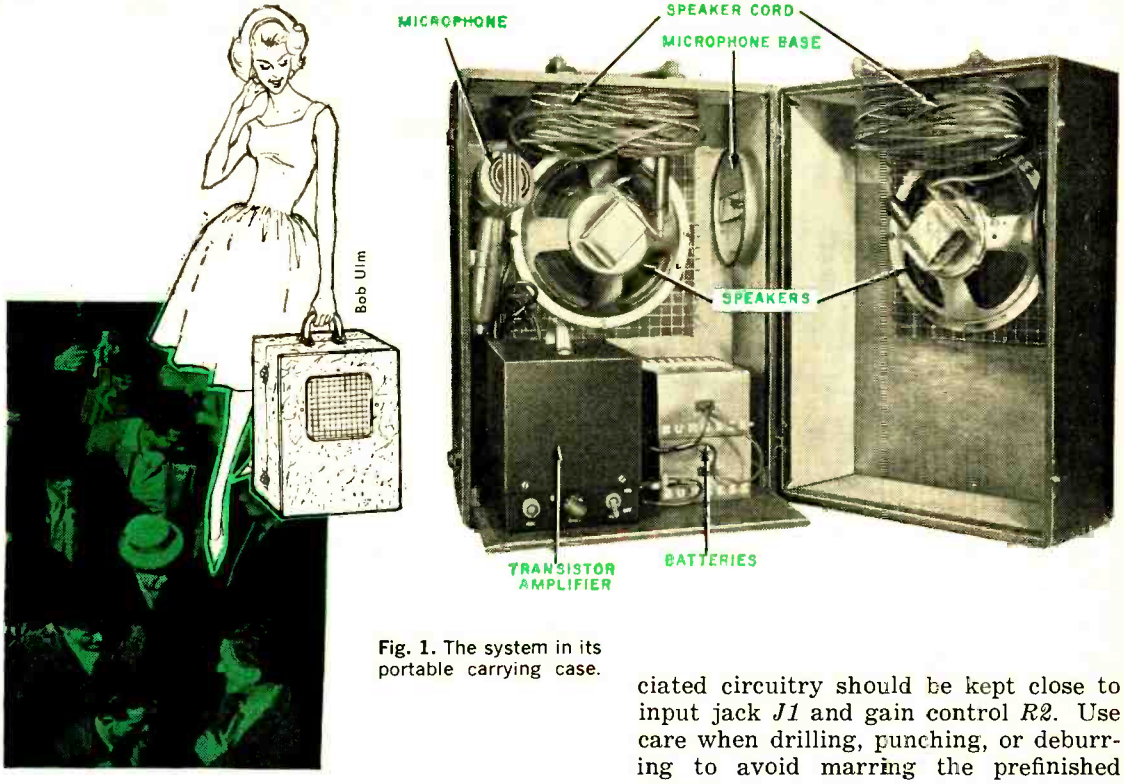


Fig. 1. The system in its portable carrying case.

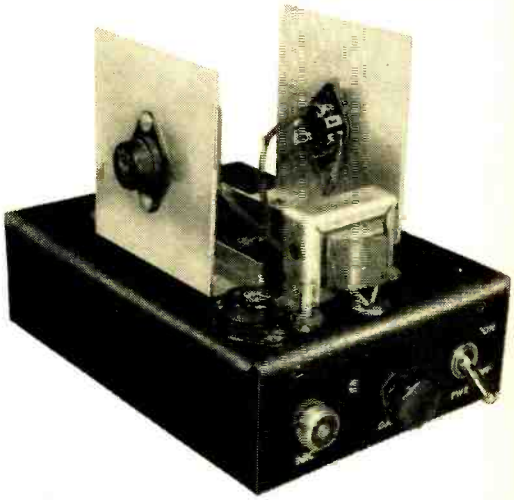
and most builders will want to assemble this unit first. Layout, wiring, and general construction details are given in Figs. 1, 2, 3, 4 and 6, while the schematic diagram appears in Fig. 5.

The amplifier is assembled on a miniature (7″ x 6″ x 5″) amplifier foundation which includes a perforated metal cover. The cover is removed and holes are drilled and punched in the chassis for mounting the various components. Mount input jack *J1*, gain control *R2*, and switch *S1* at one end of the chassis (see Fig. 3), and the speaker output jacks (*J3* and *J4*) at the opposite end. Power receptacle *J2* and the fuse clip are mounted on one side apron.

Holes for mounting all other components, including driver and output transformers *T1* and *T2*, the output transistor heat sinks, driver transistor *Q2*, the socket for transistor *Q1*, and any necessary terminal strips and ground lugs are drilled in the top of the chassis. Layout is not overly critical except in the preamp and driver stages; here, transistors *Q1* and *Q2* and their associated circuitry should be kept close to input jack *J1* and gain control *R2*. Use care when drilling, punching, or deburring to avoid marring the prefinished chassis.

With the drilling and other machine work completed, decals can be applied to identify the various controls and jacks. After application, these nameplates should be protected with two or

Fig. 2 Top view of the amplifier chassis.



three coats of clear plastic or lacquer. Allow ample time between coats for drying.

Driver transistor *Q2* is mounted on the main chassis and insulated from it with a piece of mica or thin Teflon (see Fig. 3). Output transistors *Q3* and *Q4* are mounted on small aluminum subchassis—measuring approximately 3¼" square—which serve as heat sinks and which are insulated from each other and from the main chassis. Be sure to use fiber shoulder and flat washers with the mounting screws for transistor *Q2* and the two heat sinks for transistors *Q3* and *Q4*.

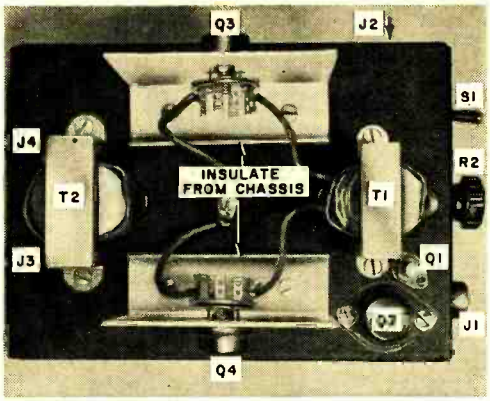


Fig. 3. Overall view of top of chassis, showing location of principal parts and associated wiring.

AMPLIFIER PARTS LIST

C1—0.01-μf., 200-volt paper capacitor
C2—100-μf., 15-volt electrolytic capacitor
F1—3-amp fuse (Littelfuse 3AG or equivalent)
J1—Microphone jack (Amphenol 75-PC1M or equivalent)
J2—Two-contact socket (Cinch-Jones S-302-AB or equivalent)
J3, J4—Closed-circuit phone jack (Switchcraft 12A or equivalent)
Q1—2N109 transistor
Q2, Q3, Q4—2N301 transistor
R1—39,000 ohms
R2—2-megohm potentiometer, audio taper
R3—100 ohms
R4—470,000 ohms
R5—6.8 ohms, 1 watt
R6—470 ohms, 2 watts
R7—10 ohms, 2 watts
(All resistors ½ watt unless otherwise noted)
S1—D.p.s.t. toggle switch (both poles in parallel)
T1—Input (driver) transformer; primary, 100 ohms; secondary, 200 ohms CT (Argonne AR-504 or equivalent)
T2—Output transformer; primary, 48 ohms CT; secondary, 3.2 ohms (Argonne AR-503 or equivalent)
1—Miniature amplifier foundation, 7" x 6" x 5" (Bud CA-1754 or equivalent)
2—"L"-shaped subchassis, approximately 3¼" x 3¼" x 1"—see text
1—Fuse holder (Littelfuse 357001 or equivalent)
Misc.—Transistor sockets, knob, ½" rubber grommets, ¼" plywood, ground lugs, terminal strips, fiber shoulder washers, clamps, brackets, screws, nuts, washers, decals, wire, solder, etc.

Accessories

1—Crystal or high-impedance dynamic microphone (Lafayette PA-24, PA-43, or equivalent)
1—Coaxial microphone connector (Amphenol 75-MC1F or equivalent)
1—Portable p.a. case (Lafayette PA-51WX or equivalent)
2—8" to 12" speakers, 8-ohm voice coil (Utah Type SP or equivalent)
2—Phone plugs (Switchcraft 240 or equivalent)
2—6-volt batteries (Burgess 2F4 or equivalent)
2—Battery plugs
2—Two-contact plugs (Cinch-Jones P-302-CCT or equivalent)
1—Charger plug for car (Schauer A-8412 or equivalent)
1—100' length of twin-conductor "zip" cord
1—3' length of ⅛" x ¾" aluminum strapping

Since it is a portable unit, the completed system may be subject to considerable vibration and shock. For this reason, you'll find it worthwhile to use lock washers under all mounting nuts.

Wiring is strictly point-to-point, as shown in Fig. 4. The only critical areas are the preamp and driver stages, where leads should be kept as short and direct as possible. Pay particular attention to transformer color-coding and to the polarity of capacitor *C2*.

When the wiring is completed, double-check for possible errors, unsoldered joints, and accidental shorts. Install the knob, fuse, and transistor *Q1*, and set the amplifier to one side while you assemble the rest of the system.

Carrying Case. Portable carrying cases of the type shown in Fig. 1 are available through most supply houses in a variety of shapes and sizes. The most popular type is a luggage-like box which separates into two halves, each of which becomes a small speaker baffle. All standard types are completely finished and come equipped with handles, clips, and decorative grille cloth.

The PM speakers are mounted with ornamental head screws, lock washers, and hex nuts. Although 8" speakers were used in the model, almost any size speakers will do as long as they fit in your case. (The case specified in the Parts List is for 12" speakers.)

A 15' to 20' length of twin "zip" cord is pre-attached to each set of speaker voice coil terminals and terminated in a plug to match the amplifier output jacks

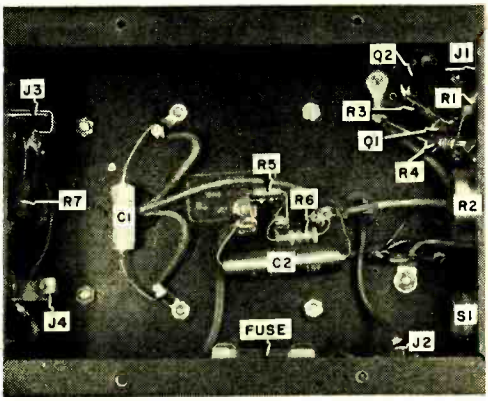


Fig. 4. Underside of chassis. Amplifier utilizes comparatively few parts and is fairly easy to wire.

(*J3* and *J4*). Proper speaker "phasing" is very important to insure that the sound produced by the two units reinforces rather than cancels. If your speakers are made by the same manufacturer, be sure that the corresponding voice-coil terminals connect to the "hot" side of the plug. If speakers of different manufacture are employed, check their phasing by temporarily connecting a flashlight cell across their terminals. Watch the cone movement for a given d.c. polarity and connect the speakers so that both cones move in the *same*

HOW IT WORKS

As shown in the schematic diagram, *pnp* transistors are used in a three-stage audio amplifier. Preamplifier/driver stages *Q1* and *Q2* form a modified Darlington circuit—two transistors in a high-gain, direct-coupled configuration. Base bias for *Q1* is furnished by a voltage divider made up of *gain* control *R2* and fixed resistor *R4*. In addition to supplying bias current, *R4* also provides a small amount of degenerative feedback, reducing distortion and improving overall frequency response.

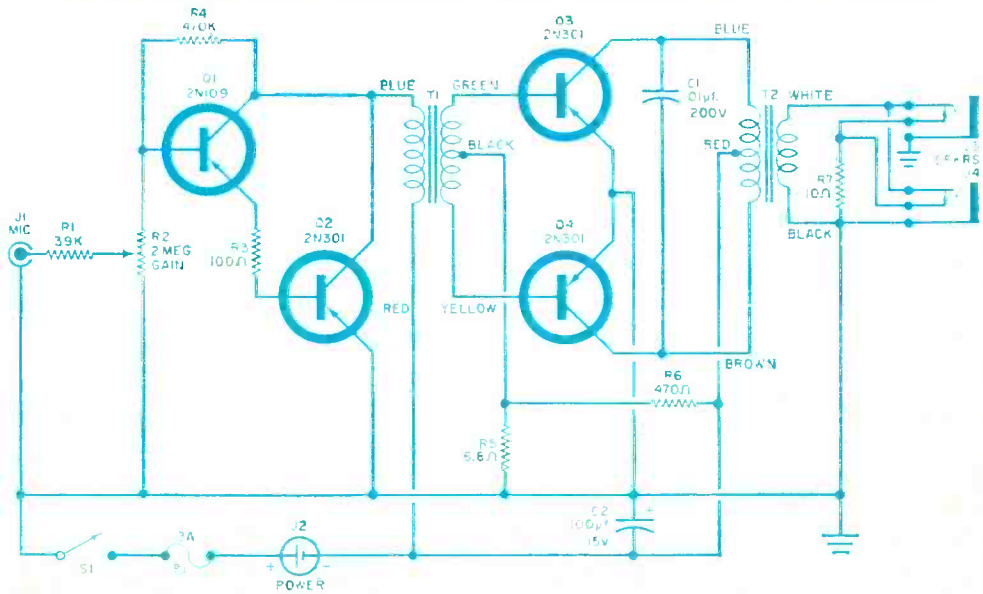
Base bias for *Q2* is provided by *Q1*'s emitter current through series resistor *R3*. Resistor *R3* has a dual role: it limits *Q2*'s base current, preventing excessive collector currents; and it supplies degenerative feedback which increases *Q1*'s input impedance. Input resistor *R1* serves as an isolation and series-limiting device for the signal source (microphone).

The amplified output signal from *Q1* and *Q2* is coupled through phase-inverting transformer *T1* to the class-AB push-pull power amplifier, *Q3/Q4*. Base bias current for the output stage is obtained from voltage divider *R5/R6*. Capacitor *C1*, connected across *T2*'s primary, bypasses high-frequency signals and thus reduces the effects of output stage distortion.

Output transformer *T2* matches the power stage to its load, fixed resistor *R7* and/or the speaker voice coils. Use of a built-in load resistor (*R7*) and closed-circuit output jacks permits the amplifier to be operated with *either* one or two speakers, or to be checked on the workbench without an external load.

Operating power is supplied from an external 12-volt source through *J2*, controlled s.p.s.t. toggle switch *S1*, and bypassed by *C2*; a standard d.p.s.t. switch was used in the model for *S1*, with both poles wired in parallel to increase their current-handling capacity. A fuse has been included to protect the amplifier and the power source.

Fig. 5. Schematic diagram of p.a. amplifier. System operates from any 12-volt d.c. source.



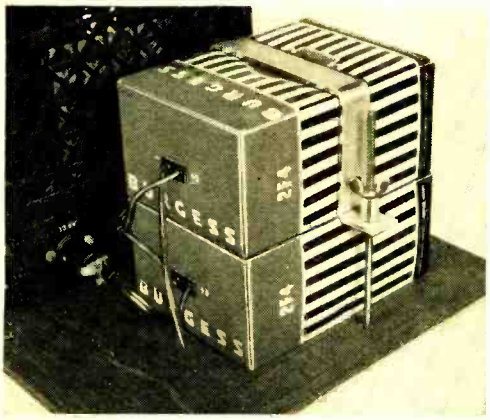


Fig. 6. Bracket-and-bolt assembly holds two series-connected 6-volt batteries securely in place.

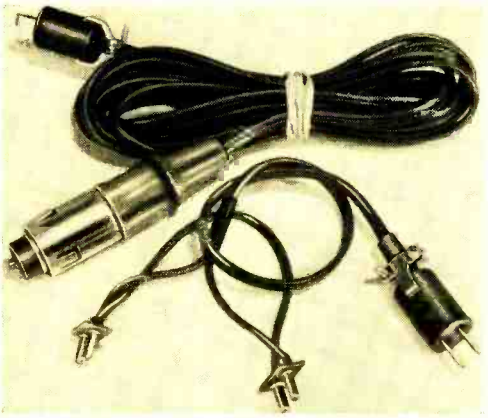


Fig. 7. Alternate cables permit powering amplifier from batteries or car cigarette-lighter receptacle.

direction with a given d.c. polarity.

Handmade brackets formed of bar aluminum or heavy sheet metal should be mounted inside the case with wood screws to serve as "holders" for the coiled speaker cables. Install a heavy-duty fuse clip or hand-formed bracket inside the case for the microphone. Similarly, clamps, brackets, or other devices should be provided for mounting extension cables, the microphone stand (or base), or other accessories.

Power Supply. The system can be powered from any well-filtered 12-volt d.c. source—dry batteries, a line-operated d.c. power supply, or the electrical system of a modern automobile. The source chosen should be able to supply peak currents of 2 to 3 amperes, although the normal "no-signal" current drain is considerably less.

A suitable self-contained power source is a pair of Burgess 2F4, TW1, or S461 dry batteries wired in series to supply 12 volts (see Fig. 6). A Burgess TW2 12-volt battery will do, but it will not give as long a service as the various 6-volt combinations.

Actual battery life will vary considerably with use. However, a pair of 2F4 batteries should permit operation for well over a hundred hours, if used in periods ranging from one to four hours.

Accessories. Among the accessory items needed to complete the system are a microphone, a microphone stand or base, an extension microphone cord (equipped with suitable connectors at each end), and connector cords for the power supply.

A standard crystal or high-impedance dynamic microphone should be used. For best results, choose a high-output mike; the more expensive "studio quality" mikes, with their very low output levels, will not give as good results. Naturally, the microphone leads or extension cords should be shielded in all cases.

The author prepared two power cables, one equipped with plugs to match 2F4 batteries, the other with a "charger plug" designed to fit the cigarette lighter receptacle of an automobile (see Fig. 7). Both were terminated in a plug to fit the amplifier's power supply socket (*J2*). With both cables available, the system can be connected quickly to either an auto electrical system or to its own built-in power source.

If you assemble an "auto plug" for use with your own system, be sure to check the polarity of your car's electrical system. (Since 1955, all American auto manufacturers have standardized on a negative ground.)

Final Details. Both the amplifier and batteries are mounted on a piece of ¼" plywood cut to fit the bottom of the carrying case. The amplifier is held in place by sheet metal screws driven through the plywood base into the bottom lip of the chassis; the batteries are supported by long bolts, wing nuts, and a bracket formed of ¾" x ⅛" aluminum bar stock, as shown in Fig. 6.

(*Continued on page* 128)

Across the Ham Bands

By
HERB S. BRIER
W9EGQ

YOUR ANTENNA SYSTEM

IF YOU ASK a group of hams what the three most important pieces of station equipment are, the newly licensed ones will probably reply: "The transmitter, receiver and antenna." More experienced hams, however, will say "antenna, receiver, and transmitter," since they know by experience that no ham station is any better than its antenna system.

The antenna system is truly the gateway through which your transmitted signal starts its perilous journey through the atmosphere on its way to distant amateurs. Accordingly, this month we'll talk about some typical antennas and then give construction details on a wide-range antenna coupler to improve the efficiency of your system.

Single-Wire Antenna. If we feed r.f. energy into a wire which is an appreciable fraction of a wavelength long, the wire becomes an antenna and radiates most of the energy fed into it. The easiest way to use such an antenna is to connect one end to your transmitter and run the other end out the shack window to a nearby tree, garage, or other support, connecting the transmitter cabinet to the nearest ground. For operation on frequencies from 3500 kc. and higher, an overall length of approximately 85 feet is suitable, although longer lengths may be used.

A single-wire antenna is recommended only if you cannot put up a better one. Such an antenna, with its lack of directionality, will radiate much of your precious r.f. into nearby trees, utility wires, rain gutters and the like. In addition, most of the r.f. that escapes these booby traps is usually radiated into space at angles which do not make for reliable long-distance communications.

Center-Fed Dipole. For far better results, your antenna should be of the dipole type, well elevated above the ground, and fed through a transmission line. Aim for a minimum height of 30 feet (40 to 50 feet is better), at the feed connection. To support the antenna, use a TV antenna mast or a guyed "two by four" on the roof. Bring the ends of the antenna down to about 10 or 15 feet above the ground, if necessary, to anchor them. This construction produces the well-known "inverted-V" antenna, which many users insist outperforms an antenna of uniform height.

If you cut the antenna according to

"Novice Station of the Month"

The winning entry in the August Novice photo contest, chosen because it's a fine example of a complete but inexpensive station, shows the rig of Charles Belavitz, WV2ONH, Roselle Park, N. J. Chuck receives on a Heathkit AR-3 helped along by a QF-1 Q-Multiplier, while his Heathkit DX-40 transmitter feeds either a 40-meter dipole or a 15-meter, 1-element beam. He contacted some 500 other hams in 35 states and Canada in seven months as a Novice—and he'll be able to use his equipment (which cost less than $150.00) when he becomes a General.

Chuck will receive a one-year free subscription to P.E. for his photo, and so can you for one of yours. Send along information about yourself and your equipment with the picture of your Novice station (preferably showing you at the controls) to Herb S. Brier, W9EGQ, c/o POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana. Non-winning photos will also be published as space permits.

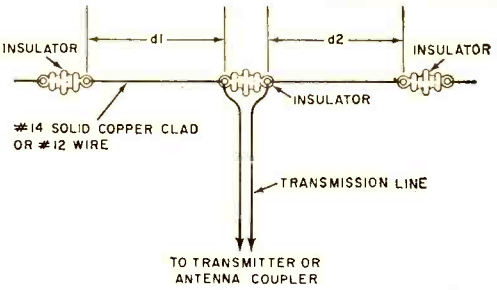
the formula: length in feet equals 468,000 divided by the frequency in kilocycles (125 feet for the 80-meter Novice band and 65 feet for the 40-meter Novice band), 52- or 75-ohm coaxial or twin-lead transmission line will closely match its center impedance. The resulting ½-wave, matched-impedance, center-fed dipole will work very well on the ham band for which it is designed; see the diagram on this page for details. On other bands, the very large mismatch between the antenna and the transmission line causes most of the r.f. power to be absorbed into the line, heating its solid dielectric material; little power reaches the antenna. A 40-meter, ½-wave dipole, however, works quite well as a 3/2-wave dipole on 15 meters.

All-Band Version. Many "all-band" antennas of various degrees of efficiency and complexity have been developed. (See "All-Band Trap Antenna," page 144, POPULAR ELECTRONICS, October, 1959.) However, for simplicity and efficiency, the one I have been using for the past 18 months is hard to beat. It's similar to the antenna described above, except that the solid-dielectric transmission line is replaced by 375- to 450-ohm, air-insulated TV twin-lead. (This material is available under various trade names, one source being Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill., Catalog No. 47 T 578.)

In this application, the transmission line operates with an average SWR of approximately 8 to 1 on all bands. Its inherent losses, however, are so low that, even multiplied several times as a result of unmatched operation, they're still lower than those of a matched, solid dielectric line of the same length.

The length of the transmission line isn't critical, but run it away from the antenna at a right angle. Keep the line from touching buildings and other objects with standard TV stand-off insulators, and bring it into your shack through an insulated TV lead-in tube.

Theoretically, the antenna should be ½-wave long for the lowest frequency you intend to operate on, but it's possible to take liberties with this length if you don't have too much room. For example, although my present antenna theoretically is 22 feet too short for the low-frequency end of the 3500-kc. band, it works well over this entire band and on the higher frequency ham bands.



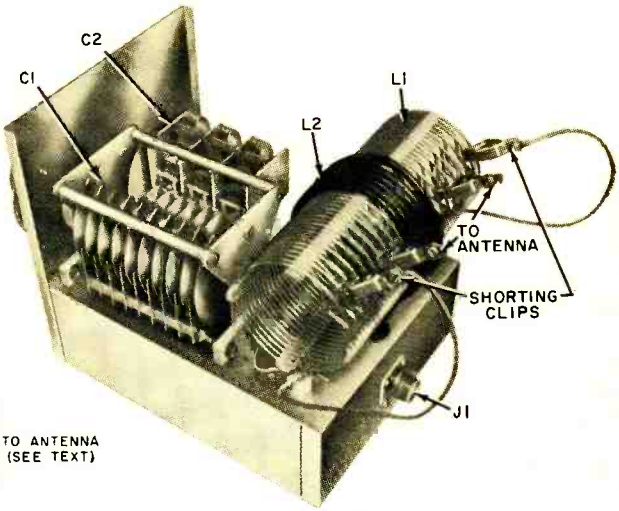
Both a single-band, center-fed dipole antenna and an all-band version may be put together as shown here. For single-band operation, the sum of dimensions d1 and d2 should be about a half-wavelength at the operating frequency. For all-band applications, d1 plus d2 should be about a half-wavelength at the lowest frequency to be used. The length of a half-wavelength in feet may be obtained by dividing the frequency (in kc.) into 468,000. Feed the single-band antenna with 52- or 75-ohm coaxial or twin-lead transmission line; use 375- to 450-ohm air-insulated twin-lead for the all-band version. The length of the line is not critical, but keep it free of nearby objects.

WIDE-RANGE ANTENNA COUPLER

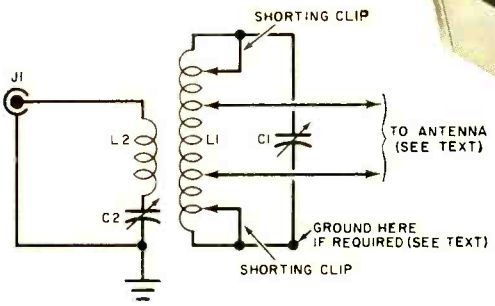
The antenna coupler described here will match your transmitter efficiently to its antenna and suppress undesired harmonic radiation at the same time. This simple unit will feed power into almost any antenna designed for ham frequencies between 3500 kc. and 29,700 kc., and will handle power levels up to 250 watts.

Construction. The coupler fits comfortably on a standard 2″ x 7″ x 9″ aluminum chassis; its front panel is formed from a 1½″ x 7″ x 7″ open-ended chassis with one side removed. Variable capacitor *C1* is a 100-$\mu\mu$f. war-surplus unit with 0.07″ spacing in the model shown; however a midget double-spaced variable capacitor, such as the Hammarlund MC-100-SX, may be used equally well. Insulate the capacitor from the chassis and use an insulated coupling between its shaft and dial. Variable capacitor *C2* can be mounted directly on the chassis.

Coil *L1* contains 45 turns of No. 14 wire, 2½″ in diameter, wound 8 turns to the inch. It is mounted on two 1½″-high ceramic insulators. Place two large solder lugs under the coil-mounting



This simple antenna coupler almost fills a 2" x 7" x 9" chassis. The capacitor specified for C1 in the Parts List, however, takes up less room than the war-surplus unit the author actually used. Be sure that you insulate C1 from the chassis and front panel.



PARTS LIST

C1—100-μμf., double-spaced variable capacitor (Hammarlund MC-100-SX or equivalent—see text)
C2—3-gang, receiving-type variable capacitor, approximately 350 μμf. per section
J1—Chassis-type coaxial connector (Amphenol 83-1R or equivalent)
L1—45 turns of #14 wire, 2½" diameter, 8 turns per inch (B&W 3906-1 coil stock or equivalent)
L2—5 turns of insulated wire close-wound on center of L1—see text
1—2" x 7" x 9" aluminum chassis (Bud AC-406 or equivalent)
1—1½" x 7" x 7" open-ended aluminum chassis (Bud CB-41 or equivalent—see text)
4—Copper alligator clips
Misc.—Insulated tie point (2-terminal), insulated shaft coupling for C1, stand-off insulators, solder lugs, screws, wire, etc.

screws to accommodate the No. 14 solid wires to *C1* and the 5"-long, heavy, flexible leads to the shorting clips. With a narrow screwdriver, push in every other coil turn near the top to permit making connections without shorting out adjacent turns.

Coil *L2* consists of five turns of well-insulated wire wound around the center of *L1*. Anchor its ends to a 2-terminal insulated tie point mounted inside the chassis under the coil. Connect one terminal to the three stator sections of *C2* in parallel, and connect the other one to the center terminal of *J1*.

Adjustment. Connect the coupler to the transmitter via a convenient length of RG-58/U or RG-8/U coaxial cable, and insert a 52-ohm SWR bridge (see "SWR Bridge," page 82, September, 1960) in the line.

For feeding a single-wire antenna, ground the end of the coil connected to the rotor (frame) of *C1*, and start making adjustments with the antenna clipped on about two-thirds of the way up the coil from the grounded end. For a coaxial-fed antenna, leave the ground in place and connect the shield of the transmission line to the grounded end of the coil; the inner conductor is connected about a quarter of the way up the coil. For balanced, 2-wire antennas, remove the ground connection and tap the feed lines an equal distance from the center on each side of the coil—the unconnected clips in the photograph of the coupler are shown positioned in this way.

On 80 meters, you'll find that you have to tap on the shorting clips close to the ends of *L1*. For each doubling of frequency, approximately half of *L1*'s active turns are shorted out.

Tune your transmitter to resonance in the usual manner, then adjust *C1, C2,* and the taps on *L1* for lowest SWR. Finally, adjust the transmitter tuning for rated plate current.

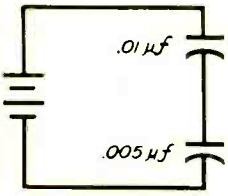
If you don't have an SWR bridge, adjust the coupler for maximum r.f. in the antenna at rated transmitter plate current.

(Continued on page 121)

A CAPACIQUIZ

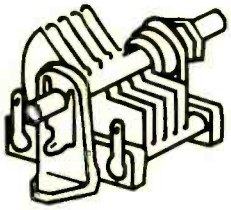
By ROBERT P. BALIN

No one can really understand electronics unless he knows what factors determine capacitance and how a capacitor really works. How many of the questions illustrated below can you answer correctly? (See page 118 for answers.)



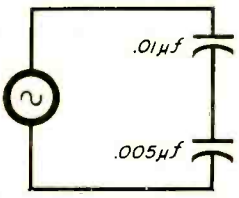
1 When charged, the smallest of the two capacitors shown at left will have the largest voltage across it.

TRUE FALSE



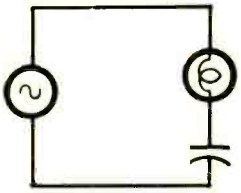
2 The tuning capacitor will be wide open when you tune in a radio station on the low end of the band.

TRUE FALSE



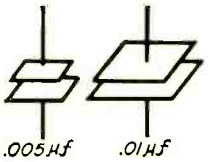
3 The total capacitance of the two capacitors in series is always less than that of the smallest one.

TRUE FALSE



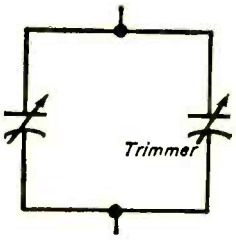
4 The lamp in this circuit will light because the capacitor can pass a.c. current.

TRUE FALSE



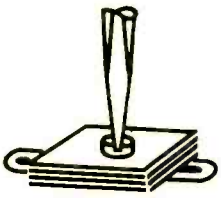
5 A small capacitor cannot be charged to as high a voltage as a large capacitor.

TRUE FALSE



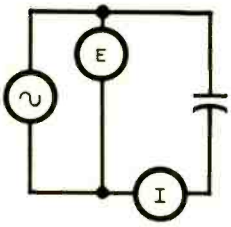
6 Because it is connected in parallel with the main tuning capacitor, a trimmer has its greatest effect at the high end of the band.

TRUE FALSE



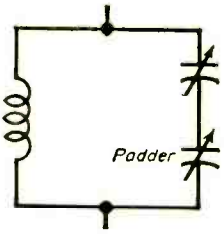
7 Tightening the adjusting screw on a compression-type capacitor will decrease its capacitance.

TRUE FALSE



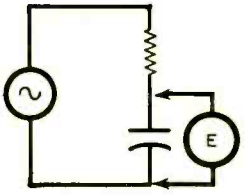
8 The current (I) into the capacitor is at its maximum when the sine-wave voltage (E) is practically zero.

TRUE FALSE



9 Because it is in series with the main tuning capacitor, a padder has its greatest effect at the low end of the band.

TRUE FALSE



10 The voltage (E) across the capacitor increases as the frequency of the source voltage is increased.

TRUE FALSE

THE TRANS-FILTER

Inexpensive transistorized filter greatly reduces power supply ripple voltage

By FORREST H. FRANTZ, Sr.

TRANSISTORIZED auto radios and other battery-operated devices requiring well-filtered, low-voltage d.c. at relatively high currents are often difficult to power in the laboratory or shop. Power supplies designed for operating ordinary, vibrator-type auto radios on the test bench are sometimes used, but their filtering systems generally leave much to be desired.

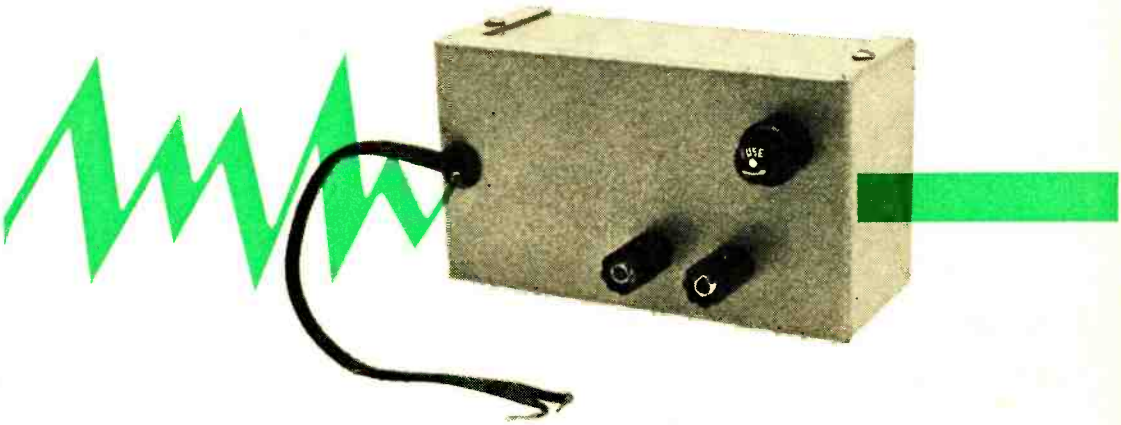
If you have such a power supply and would like to improve its filtering, the "Trans-Filter" is for you. Used with any power supply or motor-generator set delivering less than 20 volts, this little transistorized filter will handle current drains of up to 3 amperes continuously.

The table at right shows the effect of the Trans-Filter on the r.m.s. ripple output of a typical power supply at different voltages and currents. Notice that without the Trans-Filter the ripple level increases rapidly as current drain is increased. With the filter, however, the ripple level is always held to a very low value.

About the Circuit. Two paralleled 2N307A power transistors (*Q1* and *Q2*) are connected in an emitter-follower circuit (the counterpart of the vacuum-tube cathode follower). Base bias for *Q1* and *Q2* is obtained from the power supply with which the Trans-Filter is used, through dropping resistor *R1*. Base capacitor *C1*, in combination with *R1*, acts as a filter—smoothing out the ripple in the bias voltage.

This circuit has the advantage of effectively multiplying the value of base

Power Supply Output		Ripple Voltage (volts r.m.s.)	
Volts, D.C.	Amperes	Normal	Transfiltered
6	0.6	0.09	0.002
15	1.5	0.27	0.008
6	1.2	0.17	0.004
15	3.0	0.62	0.015



capacitor *C1*. The effective filter capacitance seen across resistor *R2* is on the order of 80,000 μf., and very low ripple voltages are obtained at the output—even with high load currents. Regulation under varying load conditions is also good.

The parallel transistors have an output current capability of 4 amperes (intermittent duty). This should be adequate for most requirements, but it may be increased by adding more transistors. To double the current capability, add two more 2N307A's in parallel with the original two, reduce load resistor *R2* to 470 ohms, and change *F1* from a 4- to an 8-ampere fuse.

Since base bias for the transistors is obtained from the power supply itself, the output voltage of the Trans-Filter will always be close to the input voltage. A small loss in the filter, on the order of 1 - 2 volts—depending on the current load, is caused by the resistance of *Q1* and *Q2*. Maximum input voltage is about 20 volts.

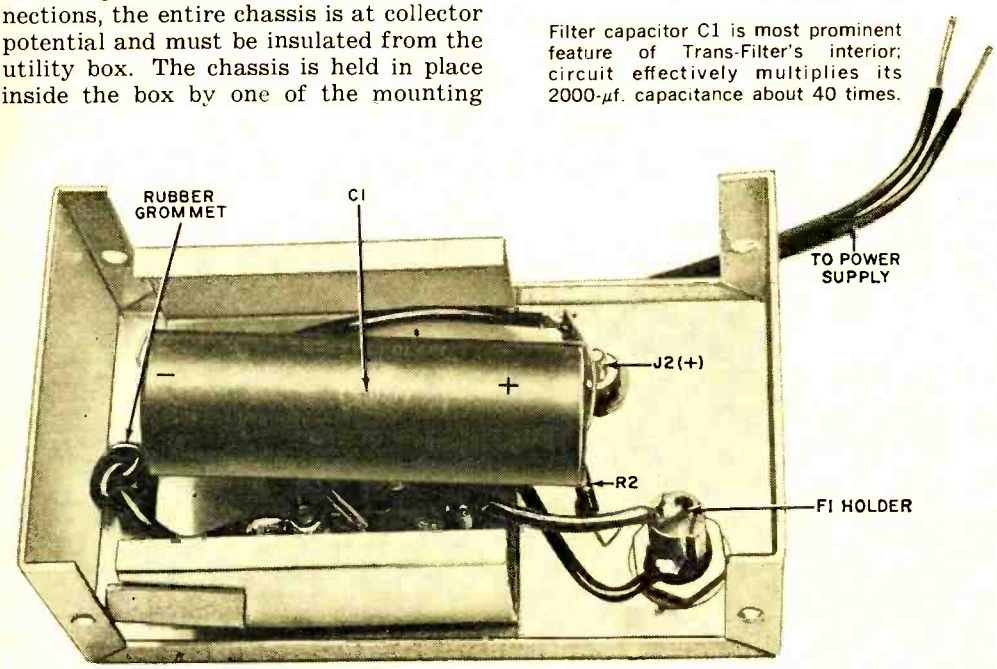
Construction. The Trans-Filter is built in a 5¼" x 3" x 2⅛" aluminum utility box, but transistors *Q1* and *Q2* are mounted on a separate 1¼" x 2¾" x 2⅝" aluminum chassis which serves as a heat sink. Since the transistor mounting nuts are also the collector connections, the entire chassis is at collector potential and must be insulated from the utility box. The chassis is held in place inside the box by one of the mounting nuts for jack *J1*. Two fiber shoulder washers prevent electrical contact between the chassis and the jack.

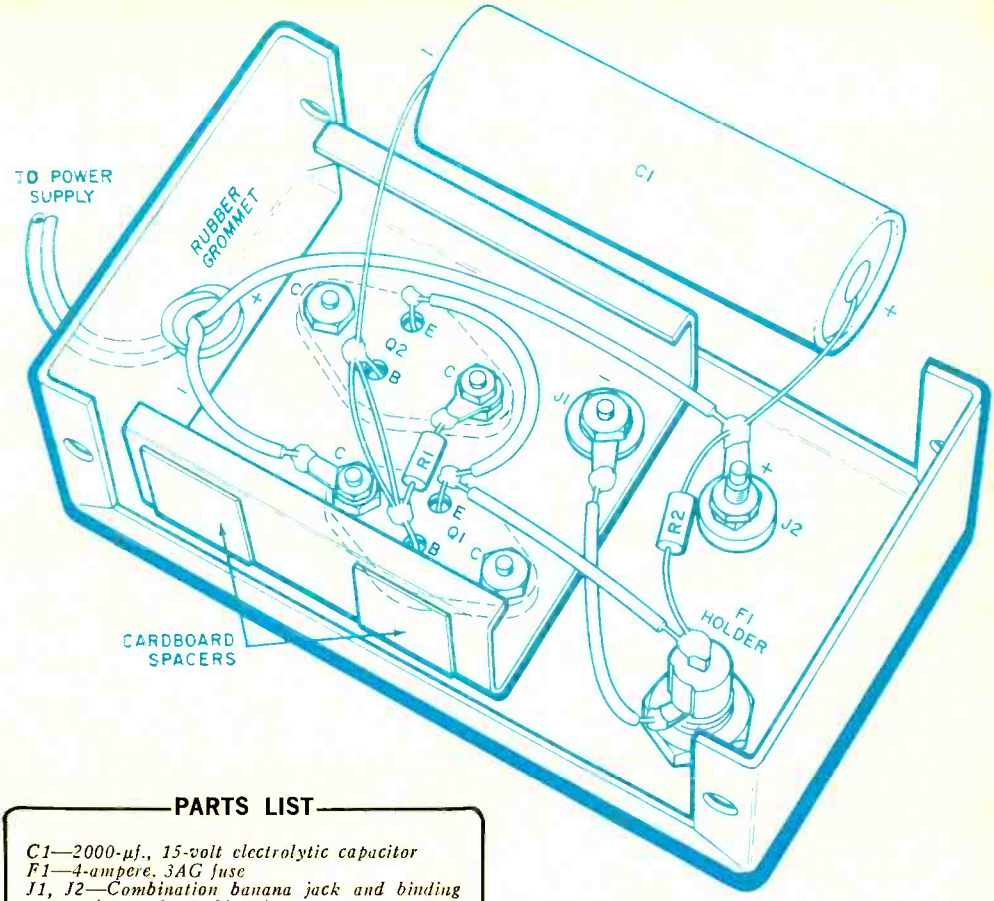
The exact positions of the parts are not important; simply follow the general layout shown in the photographs and pictorial diagram. When drilling the transistor mounting holes, however, be sure that the openings for the base and emitter leads are large enough so that the leads do not touch the chassis.

Similarly, take care that the chassis mounting hole is large enough to accommodate the flanges of the shoulder washers which will "sandwich" it, preventing a short to *J1*. This hole should be located so that the chassis is centered between the open ends of the box. Otherwise, the box cover might contact the chassis when the box is assembled. As a further precaution, cement two ¾" x 1" cardboard spacers to each side of the chassis.

After all mounting holes have been drilled and the transistors, input jacks, fuse holder, and rubber grommet have been installed, slip one fiber shoulder washer over the threads of *J1* (shoulder up) and put the chassis in place, followed by the other washer (shoulder down). Next, slide on a soldering lug

Filter capacitor C1 is most prominent feature of Trans-Filter's interior; circuit effectively multiplies its 2000-μf. capacitance about 40 times.





The transistors are mounted on a separate chassis which also serves as a heat sink. Chassis must be insulated from the case; cardboard spacers prevent shorts to cover.

PARTS LIST

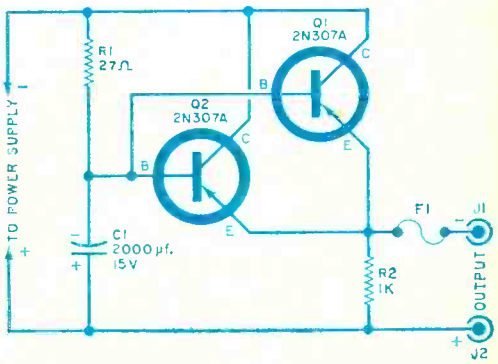
C1—2000-μf., 15-volt electrolytic capacitor
F1—4-ampere, 3AG fuse
J1, J2—Combination banana jack and binding post (one red, one black)
Q1, Q2—2N307A transistor
R1—27-ohm, ½-watt resistor
R2—1000-ohm, ½-watt resistor
1—5¼" x 3" x 2⅛" aluminum utility box (Bud CU-2106A or equivalent)
1—1¼" x 2¾" x 2⅝" aluminum open-end chassis (Bud CB-1623 or equivalent)
1—Fuse extractor post, 3AG size (Littelfuse 342012 or equivalent)
Misc.—Fiber shoulder washers, soldering lugs, zip cord, etc.

for the connection to *J1* and tighten a nut over the whole assembly.

Check with an ohmmeter to be sure that there is no continuity between the soldering lug and the chassis or the box. If the tops of the transistors touch the box, bend out the chassis slightly.

The wiring may now be completed as shown on the schematic and pictorial diagrams. No special problems should be encountered, but remember that excess soldering heat will damage the transistors. Also be sure to observe the

(*Continued on page* 120)



Two paralleled 2N307A transistors are shown in the schematic, but current-carrying capacity may be increased by adding two more 2N307A's and reducing value of R2.

Transistor Topics

By LOU GARNER

IF WE EXCLUDE expensive laboratory instruments, commercially available transistor testers can be grouped into three broad classes—inexpensive "checkers" selling for under $20, units priced from $20 to $60, and transistor "analyzers" which range from about $60 to $100.

As a general rule, the instruments in all three price ranges will check both *npn* and *pnp* types, indicate whether a transistor is "open" or "shorted," determine whether a unit is excessively "leaky," and give some indication of relative gain. Beyond these basic checks, however, the accuracy of tests, the versatility of the instrument, and its ability to check other important parameters are generally proportional to its cost.

Among the lower priced instruments, one of the most useful is the new *Model IT-10* manufactured by the Heath Company (Benton Harbor, Mich.). Selling in kit form for only $6.95 (plus postage), the IT-10 can be easily assembled into a self-contained unit measuring 3¾" x 3⅛" x 3⅛" overall and weighing only 12 ounces. A built-in "universal" transistor socket is provided as well as jacks for external leads, thus permitting checks of semiconductor diodes and transistors.

In operation, leakage tests are made first by applying a 3-volt bias to the transistor's emitter and collector electrodes, base open, and measuring the resulting emitter current. Afterwards, the gain test is made using essentially the same technique, but with a fixed base bias applied. The transistor's relative gain is indicated by the difference between the "leakage" and "gain" meter readings. Diode tests are made by checking "forward" and "reverse" currents with a fixed bias.

As is evident from the schematic diagram of the unit in Fig. 1, the test setups for high- and low-power transistors are quite similar. When "Lo" power units are checked, base bias is supplied through 100,000- and 2200-ohm resistors

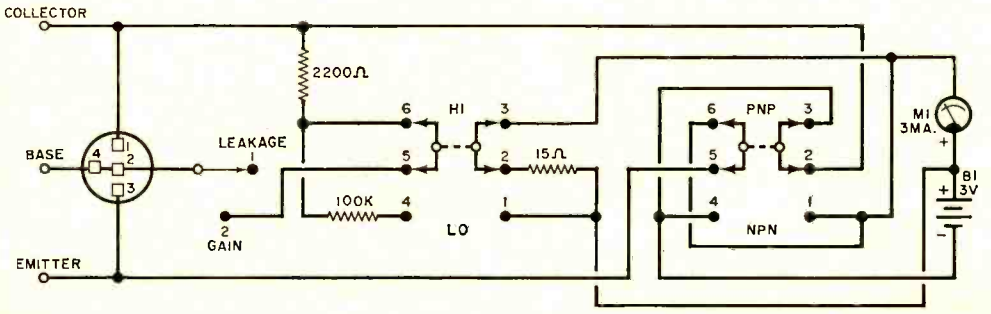


Fig. 1. Schematic diagram of Heath IT-10 transistor checker. A low-cost instrument, it will also check semiconductor diodes.

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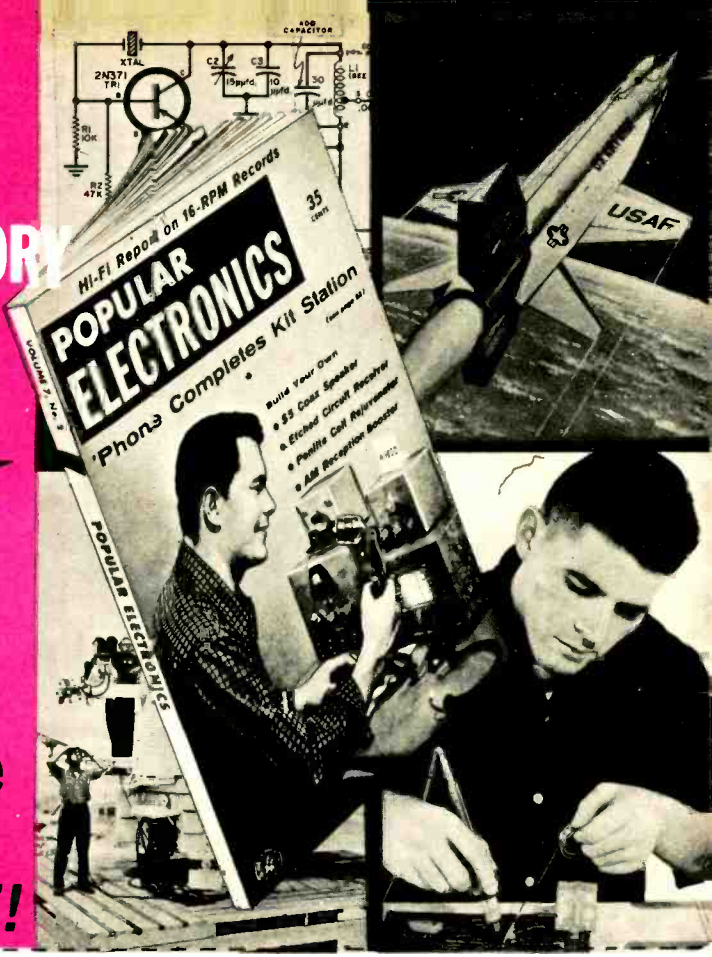

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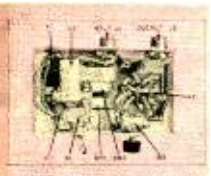

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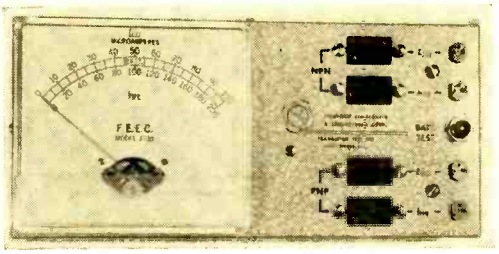


Fig. 2. Model 1100 transistor tester by Frederick Electronics is typical of units in medium-price category.

connected in series, and the meter is used alone. When "Hi" power types are checked, a larger base bias current is supplied through a single 2200-ohm resistor, and a 15-ohm resistor is shunted across the meter to increase its range. A cross-connected d.p.d.t. switch reverses d.c. polarities for checking *npn* or *pnp* types.

Since the meter in the IT-10 is calibrated in arbitrary units, a fair amount of experience is required to evaluate transistor quality accurately. But as a general-purpose checker, the Heath IT-10 is an excellent unit for the hobbyist or service technician.

In the medium price range, one of the handiest of available instruments is the *Model 1100* transistor test set manufactured by the Frederick Electronics & Engineering Corp. (P.O. Box 63, Frederick, Md.). Shown in Fig. 2, this instrument sells for $45 (F.O.B. Frederick, Md.), measures 9½" x 4½" x 3" and weighs 3 pounds. It is powered by three self-contained, size-D flashlight cells which should give several hundred hours of service.

In one sense, the Model 1100 is a "high-speed" tester and thus is roughly analogous to the multiple-socket tube checkers popular with many service shops. Only one control is provided—a push-button *battery test* switch. All tests are made simply by inserting the transistor in one of four pairs of sockets.

Like other testers, the Model 1100 will indicate whether a transistor is "open" or "shorted." In addition, it provides a reasonably accurate measurement of d.c. I_{CO} (leakage) and h_{FE} (*beta* or gain). Two sockets are provided for each of these two basic tests and for both *npn* and *pnp* transistors. In each case, one socket is a miniature "universal" type, and the other is a special type which permits full-length leads to be inserted

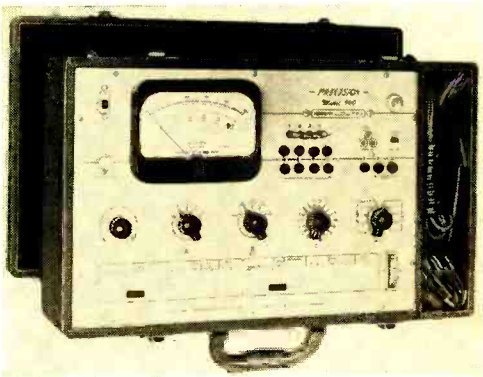


Fig. 3. Model 960 tester by Precision Apparatus is a versatile unit suitable for industrial applications.

for quick tests. Leakage currents of up to 100 μa. and *beta* figures of up to 200 are indicated directly on a large (4½") meter. The circuit design is self-compensating to correct for possible errors in *beta* measurement when high leakage is present, and to prevent accidental damage either to the transistors or to the instrument through misuse.

The Model 1100 is just the thing for production line tests, inspection of incoming lots of transistors, and on-the-spot maintenance work, as well as hobbyist or service applications where transistors must be checked quickly with a minimum of setup time or effort.

Typical of the higher priced instruments, the Precision *Model 960,* shown in Fig. 3, nearly duplicates in a semiconductor test instrument the familiar concept of a high-quality, service-type tube tester. Manufactured by the Precision Apparatus Co., Inc. (70-31 84th St., Glendale 27, L.I., N. Y.), it sells for a little over $100 and is available through most parts distributors.

Like its tube-tester counterpart, the Model 960 is line-operated and housed in a luggage-style portable carrying case. Suitable for d.c. tests of I_{CBO}, *beta* (gain), leakage, shorts, and opens, it will check low-, medium-, and high-power transistors of both *npn* and *pnp* types as well as tetrode units. In ad-

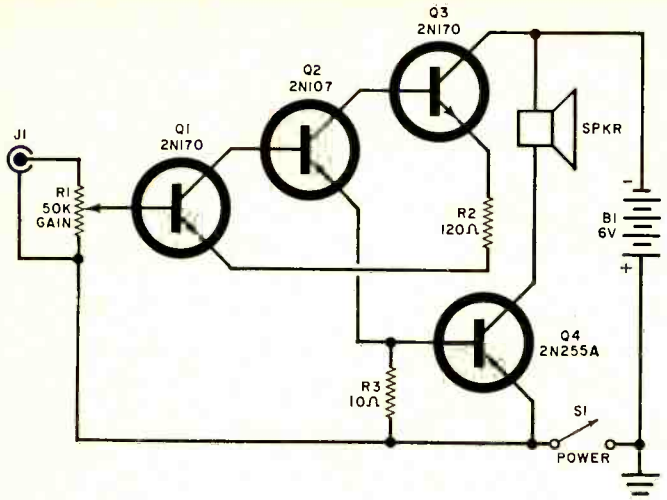


Fig. 4. Novel amplifier circuit submitted by readers Dale Koch and Don Logan is direct-coupled throughout and employs only a handful of components.

dition, it can be used for forward and reverse current tests of most types of crystal diodes.

Unlike lower priced instruments which check all transistors with the same bias voltage, the Model 960 is designed to provide a variety of bias voltages, and currents, permitting accurate tests at optimum operating conditions for each individual transistor. The control adjustments needed for each test setup are easily made by following a built-in roll chart similar to the roll charts furnished with quality tube testers. Both miniature and power transistor sockets are provided as well as external clip leads.

All in all, the Model 960 is an excellent instrument for the larger service shops, advanced hobbyists, and industrial users. What's more, it makes a fine companion instrument for the lower-priced testers used for field tests and quick on-the-spot checks.

Readers' Circuit. Team effort generally pays off when it comes to developing off-beat circuits. As an example, our featured circuit this month, shown in Fig. 4, is the joint submission of readers Dale Koch and Don Logan (8538 E. Hellman, So. San Gabriel, Calif.). Don says that it is a modification of the 3-transistor radio receiver circuit featured in the *G.E. Transistor Manual.* In the form shown, the circuit is a general-purpose audio amplifier, suitable for use with high-output phono cartridges and tuners, or as a "booster" amplifier for small receivers.

Referring to the diagram, *Q1, Q2,* and *Q3* are small-signal units, and *Q4* is a power transistor. Both *Q1* and *Q3* are *npn* types such as the 2N170, *Q2* is a *pnp* 2N107, and *Q4* may be any standard *pnp* power transistor, such as the 2N255A or 2N307. Jack *J1* is a standard RCA phono jack, *R1* is a small 50,000-ohm potentiometer (audio taper), and *R2* and *R3* are ½-watt resistors. S.p.s.t. switch *S1* can be ganged to *R1* or it can be a separate toggle or slide switch. A variety of speakers can be used, depending on availability and individual preferences—PM speakers from 4″ to 12″ in diameter with 3.2- to 8-ohm voice coils are suitable. In general, the larger the speaker and the heavier the magnet, the more efficient the system.

In operation, *Q3* is used not so much as a gain device but as a controlled resistor. The input and second transistors, *Q1* and *Q2,* respectively, form a direct-coupled complementary amplifier, with *Q2* serving as an emitter-follower driver for the common-emitter power output stage, *Q4.* The power stage, in turn, is direct-coupled to the speaker voice coil.

The amplifier circuit can be assembled on an etched circuit board, a conventional metal chassis, or a fiber or Bakelite mounting board. Layout and lead dress aren't critical, but good wiring practice should be followed. The power supply battery, *B1,* can consist of four flashlight cells connected in series or a 6-volt lantern battery such as the Burgess TW1 or F4P1.

If you have trouble obtaining satis-

(*Continued on page* 116)

The Knack of Buying CB EQUIPMENT

By JOHN R. GRIGGS
W6KW/11W4275

Know what's in your equipment and you'll know what to expect out of it

"WHAT SHOULD I LOOK FOR in choosing a Citizens Band transceiver? And how will I know I'm getting a good set?"

These are typical of questions asked many times of dealers and technicians, and they are not easy to answer. One reason is that potential CB users may have different requirements in mind. Furthermore, personal preference can be a strong factor in determining whether a receiver will be fixed or tunable, how many channels a rig will have, the type of power supply, and so on. And cost also enters into the ultimate decision.

But the real problem lies in the buyer's lack of knowledge about the relative effectiveness of one make of transceiver as compared to another. And there's no better road to understanding than comparing the various circuits used in the many makes of CB sets.

THE TRANSCEIVER

Figure 1 shows a block diagram of a typical CB transceiver having a superheterodyne receiver. How well each section performs its particular functions will depend in large measure upon the type and design of the various circuits employed.

In general, the transmitter section of a CB set is fairly simple. It consists of an r.f. oscillator and r.f. amplifier (such as a 6CX8), and utilizes the power supply and audio system of the receiver section. Because of this very simplicity, many CB transmitters are similar in design. Output efficiency varies from make to make, however, and can range from 20 to 65%. Even so, this is not as important as it may seem. While it is desirable to get every watt out of a CB transmitter within the FCC 5-watt input maximum, it actually requires a four-fold increase in transmitter power to make a really noticeable signal improvement at a receiver.

Of much greater concern to the CB user is the effectiveness of the receiver section. Operating range, especially in receiving signals from such low-power

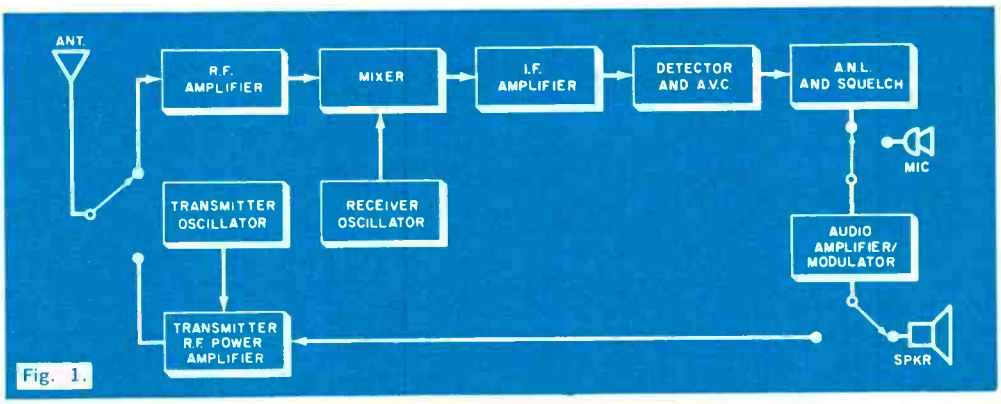


Fig. 1.

transmitters, is largely dependent on the sensitivity of the receiver. Operating effectiveness—the ability to receive a signal satisfactorily through noise and interference—depends on the receiver's selectivity and ability to reject or limit noise. From these basic considerations it is obvious that the receiver portion of a CB set should bear close scrutiny.

RECEIVER SECTION

It should be stated first, perhaps, that there are some CB transceivers on the market that do *not* contain all of the functions shown in Fig. 1, and described below. For example, some sets do not use an r.f. amplifier for the receiver, and others may not include a noise limiter or squelch circuit. Needless to say, the performance of such sets may leave something to be desired.

R.F. Amplifiers. The lack of an r.f. amplifier in the receiver will reduce both the sensitivity and selectivity of a CB transceiver, thereby effectively decreasing its range and also admitting unnecessary interference from adjacent channels or image frequencies. However, because so many laymen still judge a receiver by "what it brings in" rather than by what it keeps out, it is comparatively easy to be misled into believing that an r.f. amplifier is "unnecessary."

Some of the CB sets on the market today include what is termed an "untuned" r.f. amplifier in which only the plate circuit is tuned. In actual fact, this is more properly an impedance-matching device than an amplifier, since the most effective r.f. amplifier for CB purposes will have *both* a tuned input and a tuned output circuit. Furthermore, the input circuit should be separate from the pi-network or "tank circuit" of the transmitter if maximum sensitivity and signal-to-noise ratio are to be obtained. (Some CB sets use the pi-network as a common tuned antenna circuit for both receiver and transmitter, but at the expense of receiver sensitivity.)

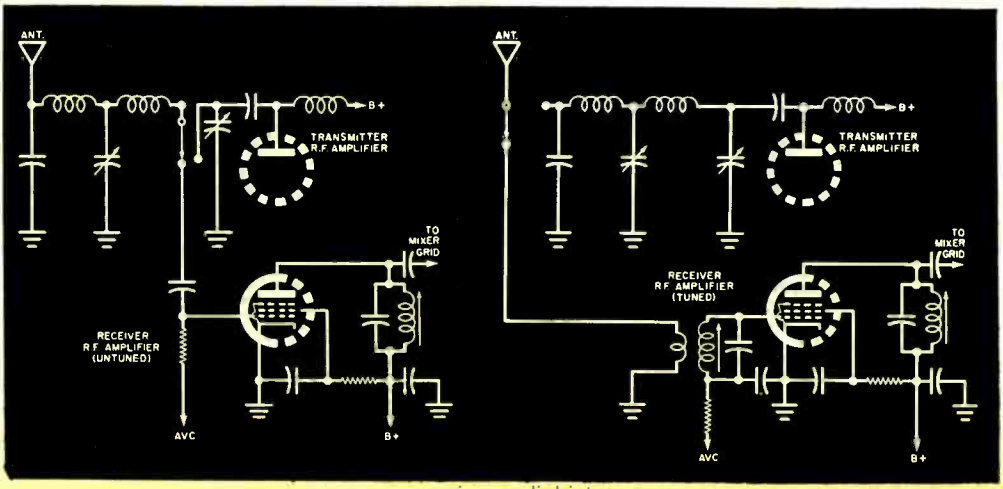
Figure 2 shows the schematic diagrams of both (A) an "untuned" and (B) a tuned r.f. amplifier. As you might expect, the tuned circuit will be the more sensitive one, and its increased selectivity will aid considerably in the rejection of unwanted signals. (A true indication of the selectivity afforded by a receiver is the number of tuned circuits between the antenna and the detector—the more there are, the better the selectivity.)

Mixers. The function of a mixer circuit is to "mix" the incoming signal with that supplied by the local oscillator, and produce a signal at the intermediate frequency—actually the difference frequency between the signal and the local oscillator. In CB sets the mixer circuits vary somewhat, but most models employ triode-pentode tubes such as 6U8-A's as a combination oscillator/mixer (see Fig. 3.) However, in a mixer circuit it is the conversion gain that is important, and this is often established more by the actual circuit values than by the particular circuit.

Mixer noise, which sounds like a hiss in the audio output, is generated by minute changes in the mixer's plate current and can be sufficiently strong to mask weak signals. It cannot be eliminated, but it can be minimized by the use of an r.f. amplifier ahead of the mixer. Too high an injection signal from

Fig. 2(A). Untuned r.f. stage.

Fig. 2(B). Tuned r.f. stage.



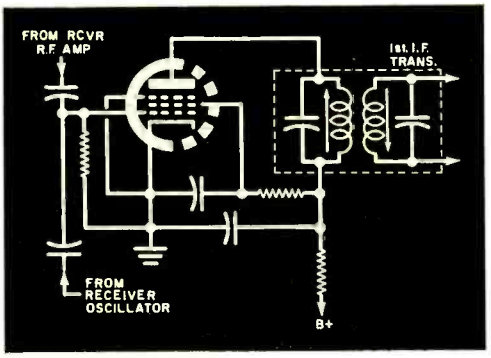


Fig. 3. Receiver mixer.

the local oscillator can also mask the desired signals and increase the set's susceptibility to noise. And improper bias voltages or too high a screen voltage can result in inferior mixer performance.

In short, it is difficult to outline how a mixer circuit can be judged from circuit inspection alone. But if the schematic provides information on the various voltages supplied to the mixer elements, it is possible to obtain an idea of the performance that might be expected. In general, the 6U8-A mixer screen voltage should be 50 to 75 volts, and its plate voltage 180 to 270 volts; the grid bias voltage should be about —3 volts, and the signal injection voltage from the local oscillator should be in the range of 1 to 6 volts.

Local Oscillator. Frequency stability is perhaps the most important characteristic desired in the local oscillator, whether it's tunable or crystal-controlled. Contrary to some popular opinion, most of the tunable oscillators encountered in CB transceivers are fairly stable. Furthermore, stability of a crystal-controlled oscillator is *not* assured simply because it uses a quartz crystal.

Many articles have appeared on this subject, stressing the fact that the frequency marked on a quartz crystal is not necessarily the frequency produced by the oscillator in which it is used. This apparent discrepancy is explained by the fact that crystals must be "ground" for a particular oscillator circuit, and therefore are not interchangeable with crystals intended for a set made by another manufacturer. In fact, most sets use third overtone crystals which are quite critical as to circuitry.

This is only part of the story, however, for even crystals offered expressly for a given set by someone other than the set manufacturer may also be off-frequency by many kilocycles. The net effect—in a fixed-tuned or channel-switching set—will be to place the receiver off-frequency to the extent that it will no longer receive on the desired channel.

Frequency stability is achieved by correct layout and design, and the use of special capacitors having the proper temperature coefficient to counteract any shift in oscillator circuit constants due to thermal changes. A good oscillator will be mechanically rugged and well ventilated to minimize heating effects.

Further, the use of low plate voltage in the oscillator circuit can also be effective in minimizing frequency drift, although some types of oscillator circuits are "too stiff" to function properly at such voltages. Some CB sets avoid such troubles through use of both a fixed and a tunable oscillator circuit (as shown in Fig. 4). Others make use of the Jones harmonic oscillator in Fig. 5,

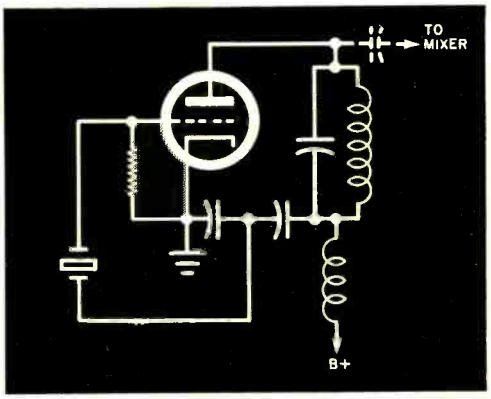


Fig. 5. A Jones oscillator.

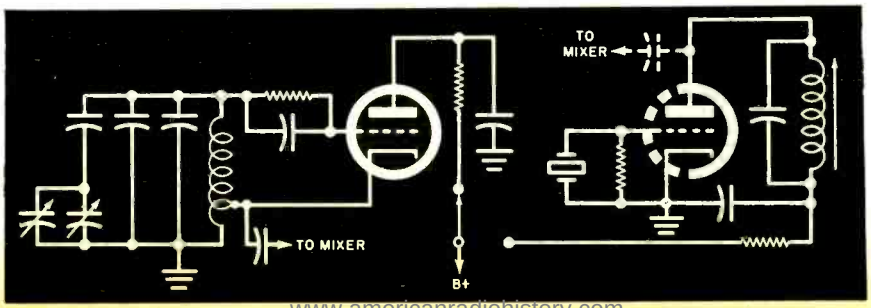


Fig. 4. Receiver oscillators.

which will oscillate at plate voltages below 15 volts and is very stable.

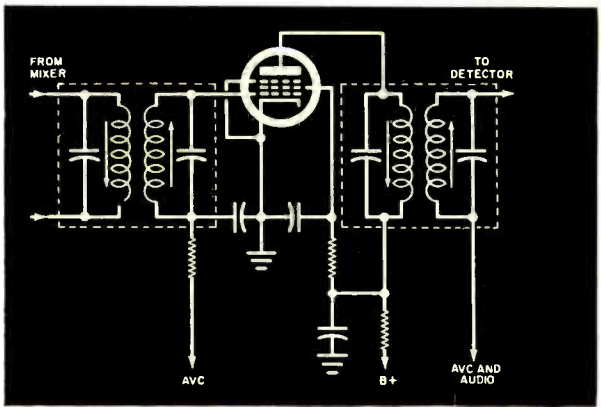
Either of these circuits can be employed as a tunable or crystal-controlled oscillator. The tubes shown are triodes, since triode-pentode tubes are widely used in CB oscillator-mixer combinations.

I.F. Amplifiers. One of the most important sections of a CB receiver is its intermediate-frequency amplifier. This generally consists of one or two stages of the type shown in Fig. 6. Naturally, the i.f. amplifier provides gain but—equally important—it also helps determine the selectivity of the set. If you have ever picked up another station down the block only 20 kc. away when you were trying to hear a weak signal, you'll know how lack of selectivity can disrupt communications.

In general, the selectivity of a single-conversion receiver will not be adequate without at least *two* i.f. stages. The intermediate frequency itself is also important. For example, two i.f. stages at 1650 kc. will provide superior selectivity over that of a single i.f. stage at 455 kc., but two i.f. stages at 455 kc. will be superior to two at 1650 kc. Basically, the lower the intermediate frequency, the better the adjacent-channel selectivity. Conversely, the higher the frequency, the wider the pass band, and the less the adjacent-channel selectivity. Thus, as far as adjacent-channel selectivity is concerned, i.f. amplifiers operating at the lower frequencies, such as 262 or 455 kc., are preferable.

Unfortunately, however, at the 27-mc. CB frequency another problem appears—image interference. This problem is handled best by i.f. amplifiers operating at higher frequencies—1650 or 2000 kc. Image interference can arise when a signal outside the Citizens Band appears at a frequency which is different from the desired CB signal by twice the intermediate frequency. The lower the i.f., therefore, the closer the undesired image signal to the CB signal frequency.

Because an r.f. tuner is not very selective at 27 mc., it will not prove effective at rejecting the unwanted signal. Furthermore, the unwanted signal appears at a frequency that differs from the local oscillator signal by the same difference in frequency as the desired signal. For this reason, an image signal is produced at the identical i.f. passed by the i.f. amplifier through the receiver.



Let's assume, for example, that a CB set is tuned to Channel 14, 27.125 mc., and that the local oscillator frequency is 455 kc. above that, or 27.580 mc. This means that an image signal appearing at 28.035 mc. will also differ from the local oscillator frequency by 455 kc., and will be heard. (Here, the image frequency would be caused by a legitimate signal appearing in the 10-meter amateur band.)

Image interference can be greatly reduced when the i.f. frequency is high—1650 kc., say. In this case, the image signal would be 3300 kc. away from the desired signal and well down the selectivity response curve of the r.f. stage, thereby reducing the image to an insignificant level.

As you might guess from the above discussion, the most desirable operation is obtained with dual conversion. This means that the signal frequency is first converted to an intermediate frequency that is fairly high, such as 1650 kc., and then converted a second time to a lower intermediate frequency such as 455 kc. The first conversion frequency discriminates against images, and the second provides a high degree of adjacent-channel selectivity.

Automatic Noise Limiter. Because CB sets are widely employed in mobile installations, and because ignition noise can be troublesome at the 27-mc. CB frequency, some circuit is necessary to limit noise. There are a number of ANL circuits for CB sets, but the "series gate"

Fig. 6. I.F. stage.

Fig. 8. Shunt noise limiter.

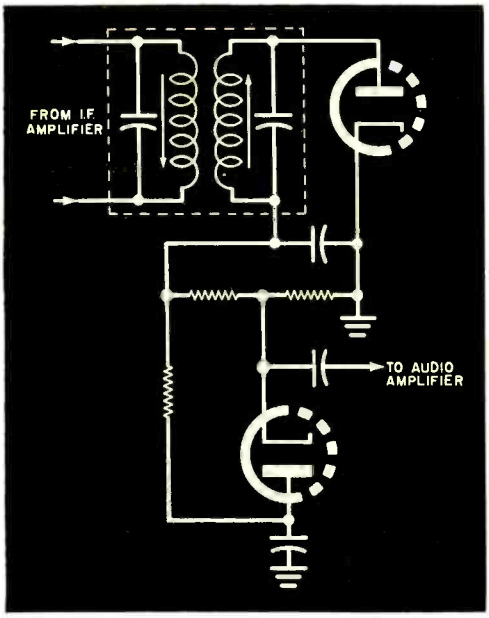
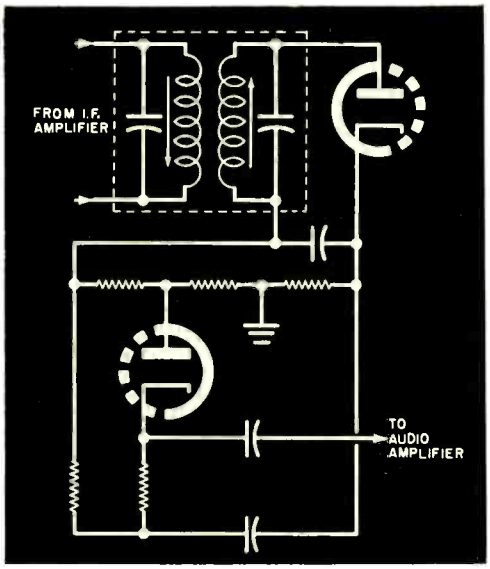


Fig. 7. Series gate noise limiter.



and "shunt" types shown in Fig. 7 and Fig. 8 are most popular.

Both of these circuits are fairly effective, but of principal concern in each case is the designer's choice of resistor and capacitor values. These values should be chosen to permit a 100% modulated signal to pass, as well as to effectively limit to 100% any noise pulses that are in excess of that level.

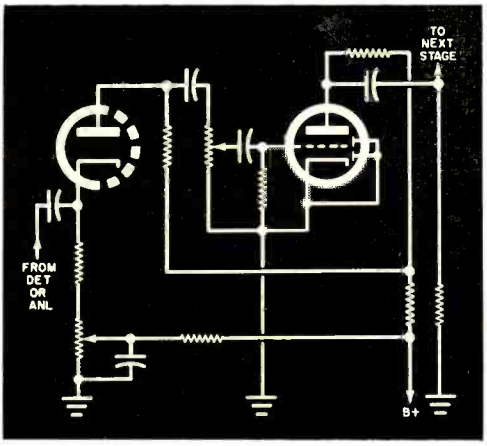
Because the general design of the set also affects the choice of such values, it is not possible to learn from circuit study alone whether maximum ANL performance has been achieved. This is perhaps best determined by actual test and comparison under noisy operating conditions.

Squelch. Background noise during standby operation can be eliminated by means of a "squelch" circuit. Such a circuit serves as an electronic "switch" to effectively cut off all audio output from a receiver, except when a signal that exceeds a preset level serves to "turn on" the set, permitting audio output to be heard.

There are a number of squelch circuits used in various CB sets, and their performance varies widely. Unfortunately, some have an undesirable lag or time delay, usually caused by improper choice of *RC* values. Needless to say, it is rather difficult to adjust a squelch circuit to the proper level if the time lag is excessive.

Many squelch circuits utilize the relatively simple back-biased control provided by a diode as shown in Fig. 9; others use the twin noise squelch cir-

Fig. 9. Back-biased squelch.



cuit (Fig. 10) as a combination squelch and noise limiter. While a few makes boast a more elaborate audio squelch circuit, it seldom accomplishes sufficient improvement in operation to justify the additional expense.

AUDIO SECTIONS

Most audio sections in CB transceivers perform a double purpose—not only do they serve as an audio amplifier for the receiver, but they act as a microphone speech amplifier during transmission. The change between functions is usually accomplished by relay or direct switching. In most CB sets, the gain of the audio system is preset for transmitting but, of course, is adjustable for receiving. Frequency response is designed for the speech range, or approximately 300 to 3000 cycles; a higher frequency response range would result in unnecessary and illegal bandwidth of the transmitted signal.

The power output stage produces an output of 2 to 3 watts, which is enough to drive the speaker adequately and is also of sufficient level to modulate the r.f. amplifier of the transmitter. For 100% modulation, this stage is commonly required to deliver an audio signal that will be approximately one-half that of the r.f. transmitter's input power. Hence, 2.5 watts of audio will normally modulate to 100% an r.f. transmitter stage operating at 5 watts input, the limit permitted for CB use.

If the audio level exceeds this ratio, overmodulation will result, causing excessive distortion and "splatter." Too low an audio level, on the other hand, will cause under-modulation, thereby reducing the range and effectiveness of the transmitter.

POWER SUPPLIES

Common to both the receiver and transmitter sections of a Citizens Band transceiver is the power supply which provides plate, screen, and heater voltages to the tubes in the set. Some power supplies operate only on 117 volts a.c., whereas others may operate (with vibrators or transistors) on d.c. as well as a.c. If a set is to be used interchangeably between fixed and mobile

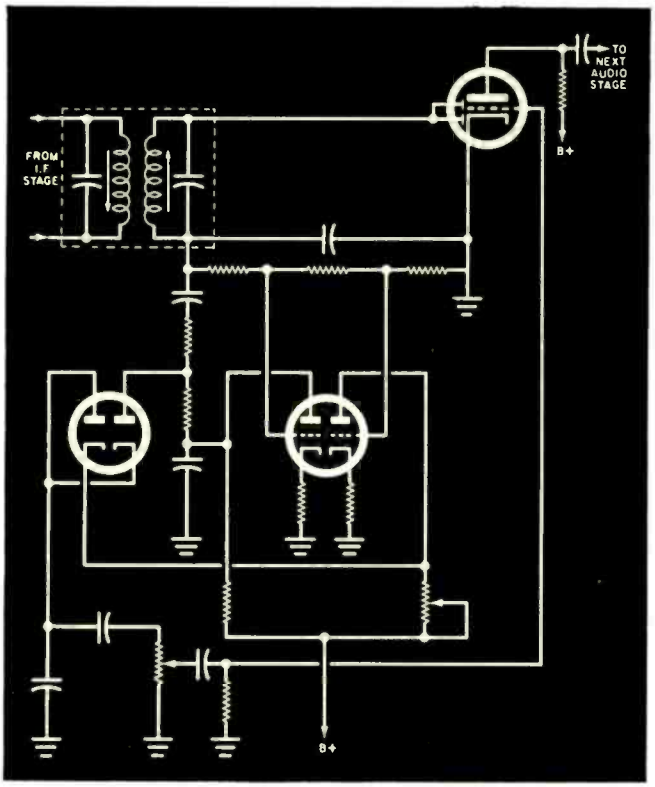


Fig. 10. Twin noise squelch (TNS).

operation, one having a combination-type power supply is recommended, since it will operate on both 117 volts a.c. and 6 or 12 volts d.c. Most versatile, of course, is the universal 3-way power supply which functions on all three voltages.

Vibrator power supplies are quite suitable for CB operation and are generally lower in cost than transistorized power supplies. Because of their lower efficiency, however, vibrator supplies usually place a heavier current drain on the battery, and they also require more maintenance. If battery drain is a prime consideration, a transistorized supply is to be preferred. In either case, silicon diode rectifiers are desirable because of their long life.

A few makes of CB sets provide foolproof methods for switching from a.c. to d.c. operation (or vice-versa) by merely changing power cables. Others require changes to be made internally, and these are best left to a technician.

TRANSMITTER SECTION

The transmitter portion of most CB sets consists of two r.f. stages which are separate from the receiver. These are (1) a crystal-controlled oscillator and (2) an r.f. power output stage. All other CB transmitter sections, such as the power supply, the audio system, and the switching circuit, are common to the receiver.

Transmitter Oscillator. The transmitter oscillator must be crystal-controlled in order to comply with FCC regulations concerning frequency control of a CB transmitter. This is to insure that the transmitted signal will be on the desired frequency.

Unfortunately, as stated earlier in the receiver oscillator section, crystals in themselves do not guarantee a given frequency. Transmitter crystals from different sets may look alike and have similar channel number or frequency markings. But, if used, they will generally result in off-frequency operation due to differences in oscillator circuit design, and will probably cause the operator to receive an FCC citation!

Furthermore, transmitter and receiver crystals are *not* interchangeable, since they are "ground" to different frequencies and usually differ in their mode of operation as well. For example, transmitter crystals are often "ground" to a fundamental frequency that is one-half that of the transmitter frequency, and the oscillator then serves to double the crystal's frequency to the desired CB frequency. Receiver crystals often are "third overtone" crystals which function somewhat differently and require a different oscillator circuit.

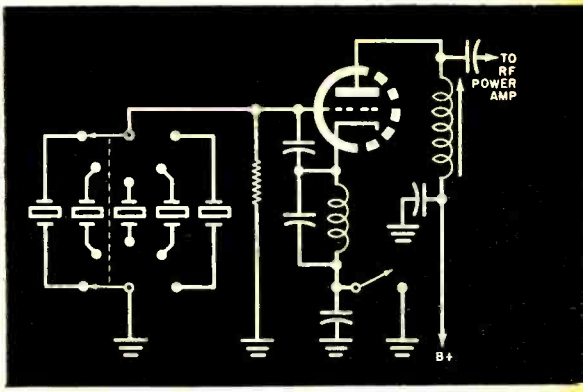


Fig. 11. Transmitter oscillator.

The transmitter oscillator must produce sufficient power output at the desired frequency to drive the following r.f. power amplifier with good efficiency to the required power level. Therefore, where a receiver oscillator may use only 30 volts plate voltage, the transmitter oscillator should operate at 200 volts plate voltage in order to produce the driving power needed. Figure 11 shows a typical transmitter oscillator.

Although most transmitter oscillators function satisfactorily, it's a good idea to examine the schematic diagram in order to determine how the crystals are switched into the circuit, since this will affect their frequency. It will come as a surprise to many CB operators, perhaps, that in most CB sets the crystal-switching circuit *itself* is capable of putting the transmitter far off frequency. Because only one side of each crystal is switched instead of *both* sides, the accumulated crystal-case capacitance and other stray circuit capacitances can result in the lowering of all transmitter crystal frequencies by as much as 2.5 kc.—about twice the frequency tolerance permitted by the FCC!

When a CB'er buys a set with crystals for only one channel, then buys more crystals for several channels and tests

them individually in the set, the test will show that each crystal is on frequency and within tolerance. *But* when all of the set's channels are filled with the proper crystals, their cumulative capacitive loading on the oscillator circuit *may lower* the frequency of *all* the crystals.

Tests have shown that a single-switched, six-channel set will suffer a lowering of the frequency of *each* crystal by about 400 cycles with the insertion of each crystal into the crystal socket assembly. When all six are in place, the frequency of *each* crystal is then lowered by six times 400 cycles, or 2400 cycles! With *both* sides of each crystal switched, however, the lowering of each crystal frequency is only about 50 cycles for each crystal addition, or a total of 300 cycles when all six channels are filled.

R.F. Power Amplifier. The output stage of a CB transmitter section is an r.f. power amplifier which amplifies the signal generated by the transmitter oscillator to the desired 5-watt level. Most CB sets utilize a triode-pentode 6CX8 tube for both oscillator and r.f. power amplifier functions, but others employ separate tubes for these two functions. It is the author's experience that a separate tube (if wisely selected by the designer) makes for a more efficient r.f. power amplifier, thereby providing a higher output power. Models that employ a 6AQ5, 12AQ5, or a 5763 as the r.f. power amplifier will generally be among the more efficient sets.

To get efficiency in a power amplifier requires that the oscillator provide a sufficiently strong signal at the grid of the amplifier to drive its output to the desired level even when modulation is applied to the amplifier. The value of voltage usually applied to the r.f. amplifier grid in a CB set is in the range of −25 to −35 volts, and this may be shown in the schematic diagram.

The plate and screen voltages are, of course, chosen by the designer to insure that the maximum input power to the amplifier will not exceed the legal 5 watts input limit. This is usually done through the designer's choice of a screen dropping resistor which controls the amount of plate current drawn by the power amplifier. In one model employing a 6AQ5, the plate voltage during transmit is 215 volts, and a 75,000-ohm series dropping resistor reduces the screen voltage to 120 volts. Thus, by suitable control of the screen voltage, the plate current is held down to 23 ma., which means that the input is 4.94 watts.

In some instances, CB transmitters are used on other bands where more power is permitted and it is possible to raise the power to 10 or 12 watts by using a much lower value screen dropping resistor. Some models, however, have too low a plate voltage to permit any significant increase in power.

Output Coupling Circuits. The r.f. power amplifier will deliver its rated power only when its plate circuit is tuned to the oscillator frequency. To transfer the power into an antenna, the output coupling circuit must be adjusted or tuned to match the loading effect of the antenna. Citizens Band transmitters generally employ one of two circuits to accomplish both the tuning of the r.f. power amplifier and antenna loading.

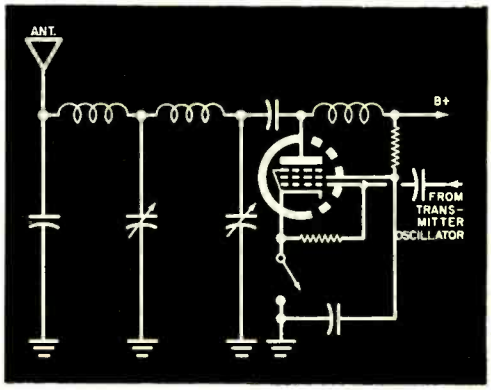


Fig. 12. Pi-network output.

One of these circuits is known as the pi-network coupler (see Fig. 12) and is a simple, effective means of matching the relatively high output impedance (e.g., 5000 ohms) of the amplifier to the low impedance (50 ohms) of a typical antenna. Because it has only two controls, (one for tuning the amplifier, the other for loading it), it is easy to adjust. It has a transformation ratio of better than 100 to 1 and therefore is capable of matching a 5000-ohm amplifier load to 1/100 of that, or 50 ohms, with good efficiency. It will also match antenna loads above 50 ohms. But perhaps

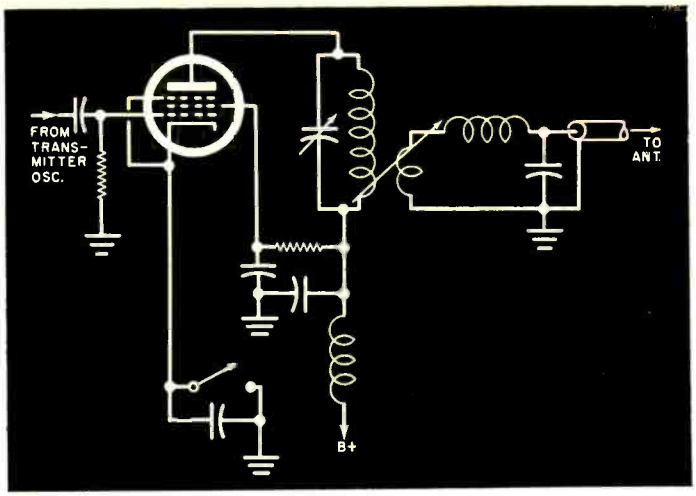


Fig. 13. Link-coupled output with TVI trap.

its biggest advantage is its ability to suppress harmonics of the transmitter's frequency which might otherwise cause TV interference (TVI).

The second coupling method employs a coil and capacitor in what is termed a "tank" circuit, as shown in Fig. 13. A movable link coil is usually required to "load" the antenna to the amplifier tank circuit, but the tuning of the amplifier is accomplished by the tank circuit tuning capacitor. Although efficient in the hands of a skilled operator, the link coil is difficult to adjust—insufficient coupling provides little output power to the antenna, and too much coupling will overload the tube.

With a tank circuit, the tuning must be readjusted for each change in the link loading. And unless you have the correct test equipment to determine when the proper setting has been reached, it is possible that all of the output power may be dissipated either on the plate of the amplifier tube or in the tank circuit, or both. Further, an ordinary link provides no suppression of harmonics whatsoever, so the problem of keeping down interference arises.

Many CB sets, regardless of coupling methods, use low-pass filters in their output circuits to the antennas to reduce the radiation of interfering harmonic signals on TV or FM frequencies.

Modulation. The FCC does not permit over-modulation, and various methods are employed by CB manufacturers to limit modulation to the 100% level. The most common circuit used is that shown in Fig. 14 (A), the economical and well-

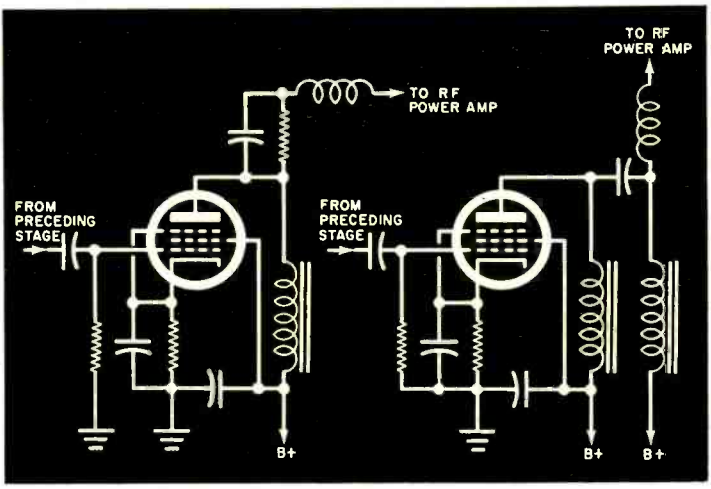


Fig. 14(A). The Heising modulator.

Fig. 14(B). Revised version of Heising modulator.

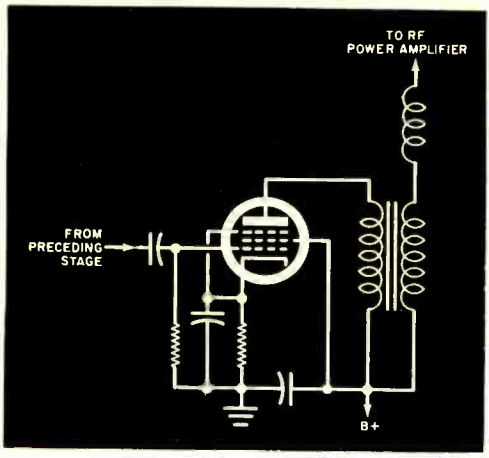
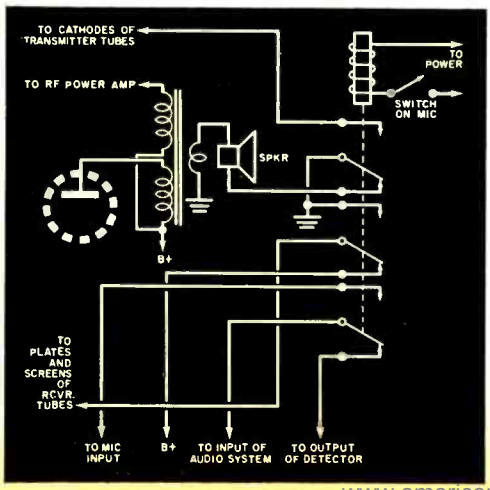


Fig. 15. Improved modulator.

known Heising system which inherently limits modulation to valves below 100%. This particular circuit, while permitting good modulation up to 70% or so, will distort at levels above that, becoming particularly bad above 85%. The revised Heising circuit in Fig. 14 (B) is much to be preferred, since it will work effectively with very little distortion at modulation levels up to 100%.

Perhaps the best method of accomplishing modulation with ease and good response is that shown in Fig. 15. This circuit, however, is easily capable of being over-driven, thereby causing overmodulation, and should not be used unless there is some means to limit the modulation level to 100%. To do so would require a speech limiter or splatter-suppression circuit, but the additional components required would naturally raise the parts cost.

Fig. 16. Transceiver switching.



SWITCHING FUNCTIONS

Switching is required in CB sets to change over from reception to transmission and vice-versa. This is done by disabling the receiver and energizing the transmitter.

Most CB transceivers have a switch in the microphone case to control a relay in the rig which performs the actual switching functions. A few makes use a less expensive multi-contact switch, usually located on the set itself, to provide direct manual switching. Still other makes offer what is termed "electronic switching," which, upon closer examination, may be found to be the same simple manual switching just described but with the switch located on the microphone. This type of switching requires several additional wires in the microphone cable which may introduce hum in the set's audio system. True electronic switching *could* be accomplished by using tubes expressly for that purpose, but the cost would be excessive.

The circuits that disable the receiver vary from model to model. They usually function to remove plate voltage from all —or a portion—of the receiving tubes; sometimes, too, they may disconnect or short-circuit the speaker (see Fig. 16). Another method often used "blocks" the receiver by simply rectifying some of the transmitter's r.f. voltage to create enough bias voltage to disable the receiver. This method is often found in sets using the circuit of Fig. 2 (A).

Energizing the transmitter is commonly accomplished by completing the ground circuits of the oscillator and r.f. amplifier, thereby causing plate current to flow. It is also common practice to switch the microphone into the audio circuit to drive the modulator. Whether a relay or a manually operated switch is used, their contacts may require periodic cleaning to insure trouble-free operation.

All in all, picking a CB transceiver is pretty much like choosing any other piece of electronic equipment. You look them over, size them up, check your bank balance, and make your choice. But you'll be much more certain of your selection if you take time to investigate the circuitry lying behind all those front panels. The above information should be a big help. —30—

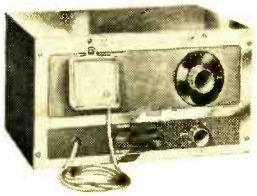
CB Equipment Catalog

POPULAR ELECTRONICS

The following 19 pages represent the first complete catalog and directory of Citizens Band equipment ever published. For convenience, it has been divided into eight sections: Part 19 Transmitters and Transceivers (150 milliwatts to 5 watts input); Antennas; Special Attachments; Microphones; Crystals; Test Equipment; Part 15 Transceivers; and Noise Elimination devices.

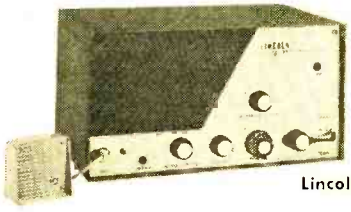
Part 19 Transmitters and Transceivers

There are 59 units described in this section. In each case, we have mentioned the number of channels the transmitter has available; the type of receiver, power supply, noise limiter, squelch, output circuit and output indicator; size (measured in inches—height, width, and depth); weight; and any possible accessories.



Knight-Kit C-11

Knight-Kit C-27



Lincoln L2700

AR-9

ALLIED RADIO CORP.

100 N. Western Ave., Chicago 80, Ill.

Knight-Kit C-11

1-channel transmit; tunable superregenerative receiver; 5 tubes (including rectifier); TVI trap; link-coupled output; ceramic mike; 6⅛ x 11⅜ x 7¼; 9¾ lb. Accessories: 6-12 volt mobile supply ($9.95); mobile mounting bracket ($4.35) and various antennas.

$39.95 (kit only)

Knight-Kit C-27

2-channel transmit and 2-channel crystal-controlled receive plus tunable receiver; 117-volt supply; 14-tube performance double-conversion superhet receiver; series noise limiter; adjustable squelch; TVI trap; link-coupled output; no mike supplied—speaker doubles as mike; 5½ x 12⅞ x 15⅛; 16 lb. Accessories: ceramic mike ($9.50); handset ($19.95); 6-12 volt mobile supply ($12.95); mobile mounting bracket ($5.35) and various antennas.

$79.95 (kit only)

Lincoln L2700

5-channel transmit; tunable receiver; 117-volt power supply; 9-tube performance superhet (1 r.f. and 1 1750-kc. i.f. stage); adjustable series noise limiter; no squelch; ceramic mike; link-coupled output; neon-bulb output indicator; 5½ x 10¼ x 6⅜; 9 lb. Accessories: 6- or 12-volt mobile power supplies ($11.95 each) and base-loaded 45" antenna ($5.97).

$59.95 (net)

APPLIED ELECTRONICS CO. *(Apelco)*

213 East Grand Ave., South San Francisco, Calif.

Model AR-9

5-channel, crystal-controlled transmit and receive; 117-volt supply; 8-tube performance superhet (1 r.f. stage and 1 455-kc. i.f. stage); noise limiter; adjustable squelch (called "Gate"); special carbon mike; pi-network output with series tunable capacitor for minimum standing waves; output indicator; transmitter filaments may be switched off at front panel during extended "standby" periods; 5¼ x 9½ x 11½; 18 lb. Accessories: 12-volt and 32-volt mobile power supplies.

$179.50 (suggested retail)

CATALOG B

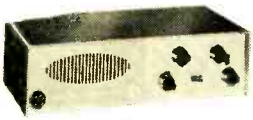
R-2700

S-9

TR-910

T-2700

761A/762A



500

Mobilaire

BROWNING LABORATORIES, INC.

100 Union Ave., Laconia, N.H.

Model R-2700 *(receiver only)*

All-channel bandspread receiver calibrated in frequencies and channel numbers plus 5 crystal-controlled channels; 117 volts only; 15-tube performance double-conversion superhet; adjustable series noise limiter; adjustable squelch; S-meter; delayed a.v.c.; 7 x 15½ x 9½; 25 lb.

$149.00 (mail order only)

Model S-9 *(transmitter only)*

6 channels; 7 tubes; ceramic mike; pi-network output; TVI trap; metered for modulation percentage, plate current and plate voltage of final amplifier tube; "spotting" switch; speech filter and clipper built in; VOX (voice to transmit) operation is optional; may be used with any communications receiver having "transmit" switching facilities; 7 x 9¾ x 9½; 23 lb.

$119.50 (mail order only)

Model T-2700 *(transmitter only)*

6 channels; 4 tubes; ceramic mike; pi-network output; neon output indicator; may be used with any communications receiver having "transmit" switching facilities; 7 x 5½ x 9½; 15 lb.

$65.00 (mail order only)

Mobilaire

4-channel, crystal-controlled transmit and receive; universal transistorized (117-, 12- and 6-volt) power supply; 10-tube performance double-conversion superhet; special noise limiter and "noise immune" adjustable squelch; pi-network output; ceramic mike; output indicator; 5¼ x 9¼ x 8¼; 11 lb. Accessories: various types of mobile antennas.

$159.50 (mail order only)

CADRE INDUSTRIES CORP.

Endicott, N.Y.

Model 500

5-channel, crystal-controlled transmit and receive plus tunable receiver; transistorized 117- and 12-volt power supply (2 watts drain on receive and 8 watts drain on transmit); NO tubes; 17 transistors and 8 diodes; double-conversion superhet; series noise limiter; adjustable squelch; pi-network output; TVI trap; ceramic mike; 3 x 11⅜ x 5⅜; 6 lb.

$199.95 (suggested retail)

DeWALD *(United Scientific Labs., Inc)*

35-15 37th Ave., Long Island City 1, N. Y.

Model TR-910 *("Radio-Phone")*

5-channel transmit; 117-volt supply; 10-tube performance, tunable superhet receiver (1 r.f. stage and 1 1750-kc. i.f. stage); series noise limiter; S-meter; adjustable squelch; ceramic mike; link-coupled output; plate current meter; TVI trap; 4¾ x 10¼ x 6⅜; 9 lb. Accessories: 6- or 12-volt mobile power supply ($19.95 list).

$99.95 (list)

EICO *(Electronic Instrument Co., Inc.)*

33-00 Northern Blvd., Long Island City 1, N.Y.

Model 761A/762A

3-channel transmit; 117- and 6-volt power supply (see below); tunable 9-tube performance superhet (1 r.f. stage and 2 1750-kc. i.f. stages); special series noise limiter; no squelch; ceramic mike; pi-network output; neon output indicator; 6 x 8½ x 9; 10 lb. Model 762A is identical to Model 761A in all respects but has 117- and 12-volt power supply. Accessories: various antennas.

$69.95 (kit) *and $99.95* (wired)

770

CB-100A

SF-1

G-12

MC-4

CB-200

Model 770

4-channel transmit; 1-channel crystal-controlled receive plus tunable receiver; 117-volt power supply (other models with 12- and 6-volt supplies available for $10.00 extra); 11-tube performance superhet (1 r.f. and 2 1750-kc. i.f. stages); series noise limiter; adjustable squelch; pi-network output, neon-bulb output indicator; 6 x 8½ x 9; 12 lb. Accessories: various antennas.

$69.95 (kit) *and $99.95* (wired)

GENERAL RADIOTELEPHONE CO.

2806 W. Burbank Blvd., Burbank, Calif.

Model MC-4

6-channel transmit plus front connection for 7th crystal; 4 crystal-controlled receive channels plus tunable receiver; universal (117-, 12- and 6-volt) semiconductor power supply; 10-tube performance superhet (1 r.f. and 2 451-kc. i.f. stages) including special crystal mixer; series noise limiter; adjustable squelch; ceramic mike; pi-network output, metered output indicator; output jack to remote speaker; sliding variable tone generator for "calling"; "Local-Dist" switch reduces receiver sensitivity; 4¼ x 8¼ x 10½; 15 lb. Accessories: 12- or 6-volt power cables ($4.95); mounting rails ($1.95).

$199.95 (net)

GLOBE ELECTRONICS

400 S. Wyman St., Rockford, Ill.

Model CB-100A *("Citizens Broadcaster")*

3-channel, crystal-controlled transmit and receive; universal (117-, 12- and 6-volt) power supply; 11-tube performance superhet (1 r.f. stage and 2 455-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output; output jack for remote speaker; this model is improved version of CB-100, particularly in selectivity and better modulation; 3 x 13 x 10½; 13 lb. Accessories: 12-volt power cable ($3.49); 6-volt power cable ($2.95); dust cover ($5.95).

$139.95 (net)

Model CB-200 *("Broadcaster Deluxe")*

5-channel transmit with 4-channel crystal-control on receive plus tunable receiver; universal (117-, 12- and 6-volt) power supply; 14-tube performance double-conversion superhet; series noise limiter; adjustable squelch; ceramic mike; pi-network output; output jack for remote speaker; 4 x 12 x 10; 14 lb. Accessories: 12-volt power cable ($3.49); 6-volt power cable ($2.95).

$189.95 (net)

Model SF-1 *"Silent Fone"*

1-channel, crystal-controlled transmit and receive; rechargeable nickel cadmium battery; 11 transistors; noise limiter; 150-milliwatts output; special design built into hard safety hat; usable in areas of high-intensity noise for communications; 32 oz.; receiver features ceramic transducers.

$200.00 (approximate)

GONSET

801 South Main St., Burbank, Calif.

Model G-12

4-channel, crystal-controlled transmit and receive; universal (117- and 12-volt, or 117- and 6-volt) power supply; 12-tube performance superhet (1 r.f. and 2 1650-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output; pilot-bulb output indicator; 4½ x 7 x 10; 11 lb. Accessories: mobile antenna ($13.50).

$149.95 (net)

GROVE ELECTRONIC MFG. CO.

4103 W. Belmont Ave., Chicago 41, Ill.

This company manufactures a variety of transceiver kits, converters, noise suppression kits and antenna. Write for detailed information.

CATALOG B

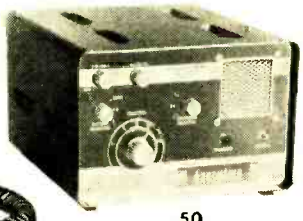
"Citizens Radio Telephone"

GW-10

CB-1

HQ-105 TR

CB-3



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Mercury Mark I

HALLICRAFTERS CO.

4401 West 5th Ave., Chicago 24, Ill.

Model CB-3 *("Littlefone")*

8-channel, crystal-controlled transmit and receive; universal (117- and 12-volt) power supply; 10-tube performance superhet (1 r.f. and 2 1650-kc. i.f. stages); series and shunt noise limiter; adjustable squelch; ceramic mike; link-coupled output; neon output indicator, TVI trap.

$149.50 (net)

HAMMARLUND MFG. CO., INC.

460 West 34th St., New York 1, N. Y.

Model HQ-105 TR

1-channel transmit; tunable broadcast and communications-style short-wave receiver; receiver circuitry identical to that found in HQ-100C—including bandspread, noise limiter, "Q-Multiplier," S-meter; 9 7/16 x 16¼ x 9⅛; 30 lb. Accessories: speaker ($19.95) and clock timer ($10.00).

$219.50 (net)

HEATH CO.

Benton Harbor, Mich.

Model CB-1

1-channel transmit; tunable superregenerative receiver; 117-volt power supply; 4 tubes; ceramic mike; neon output indicator, TVI trap; link-coupled output; 8 x 9¾ x 6; 6½ lb. Accessories: vibrator power supplies for 6- or 12-volt mobile operation ($8.95—kit); various antennas.

$42.95 (kit) *and $60.95* (wired)

Model GW-10

3-channel transmit and 1-channel crystal-control receive plus tunable receiver; 117-volt power supply; 9-tube performance superhet (no r.f., 1 455-kc. i.f. stage); series noise limiter; adjustable squelch; ceramic mike; link-coupled output; neon output indicator; 4½ x 13½ x 5¾; 7¾ lb. Accessories: conversion power supplies for either 6- or 12-volt mobile operation ($14.95) and various antennas.

$62.95 (kit) *and $99.95* (wired)

ITT DISTRIBUTOR PRODUCTS

P.O. Box 99, Lodi, N.J.

"Citizens Radio Telephone"

5-channel, crystal-controlled transmit and receive; transistorized 117- and 12-volt power supplies; NO tubes; 17 transistors, 8 diodes; double-conversion superhet; series noise limiter; adjustable squelch; pi-network output; ceramic mike; 3 x 11 x 5; 5¾ lb. Accessories: to be announced, but will include special selective calling system.

$199.95 (list)

INTERNATIONAL COMMUNICATIONS CORP.

1929 Wilshire Blvd., Santa Monica, Calif.

Mercury Mark I

8-channel, crystal-controlled transmit and receive; universal (117- and 12-volt) power supply; 10-tube performance superhet (1 r.f. and 1 i.f. stage); series noise limiter; adjustable squelch; dynamic mike; direct-reading output meter; link-coupled output; 5 x 14½ x 6⅛; 15 lb.

$150.00 (net)

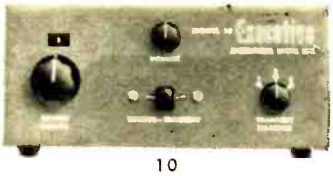
INTERNATIONAL CRYSTAL MFG. CO., INC.

18 N. Lee, Oklahoma City, Okla.

Model 50 *("Executive")*

3-channel transmit and 2-channel crystal-controlled receive plus tunable receiver; universal (117-, 12- and 6-volt) power supply; 12-tube performance double-conversion superhet; series noise limiter; adjustable squelch; ceramic mike; pi-

HE-15A



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Viking "Messenger"

HE-20A

100

TR-327

network output; modulation indicator; 6 x 9 x 10; 12½ lb. Accessories: 12-position crystal switch ($7.50); special mobile mounting bracket ($9.95); 12-volt and 6-volt power cables ($7.50 each); and various antennas.

$169.50 (net)

Model 10

3-channel transmit; tunable superhet receiver; noise limiter; available in various power supply arrangements. Details not available.

$59.50 (suggested net)

Model 100

12-channel transmit; double-conversion superhet receiver; noise limiter; universal power supply; ceromic mike. Details not available.

$199.50 (suggested net)

E. F. JOHNSON CO.

Waseca, Minn.

Viking *("Messenger")*

5-channel, crystal-controlled transmit and receive; available with two basic types of power supply arrangements—Model No. 242-126 is for 117 volts only, Model Nos. 242-127, 242-128, 242-129 and 242-138 are for all possible variations of 230, 117, 24, 12 and 6 volts; 9-tube performance superhet (1 r.f. and 1 455-kc. i.f. stage); series noise limiter; adjustable squelch; ceramic mike; pi-network output; modulation indicator; 5⅜ x 7 x 11⅜; 12 lb. Accessories: electrical noise suppression kit ($13.50); mobile mounting bracket ($2.50); carrying handle ($1.50); and various antennas.

$134.95 (117-volt a.c. model, net)

$144.95 (117- and 12- or 6-volt models, net)

KAAR ENGINEERING CORP.

2995 Middlefield Rd., Palo Alto, Calif.

Model TR-327

4-channel, crystal-controlled transmit and receive; universal (117-, 12- and 6-volt) power supply; 14-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; adjustable squelch; carbon mike; pi-network output; TVI trap; 'Power" tuning control on front panel used to tune transmitter to maximum output; S-meter; special 2-tube a.v.c. circuit varies gain of receiver to minimize effects of noise and interference; 5⅜ x 10¼ x 8½; 16 lb. Accessories: mounting hood ($3.95) and various antennas.

$179.00 (list)

KUHN ELECTRONICS, INC.

20 Glenwood Ave., Cincinnati 17, Ohio

This company manufactures a variety of mobile and fixed station converters, squelch units, noise limiters, etc.

LAFAYETTE RADIO ELECTRONICS CORP.

165-08 Liberty Ave., Jamaica 33, N.Y.

Model HE-20A

4-channel, crystal-controlled transmit and receive plus tunable receiver; universal (117- and 12-volt) power supply; 9-tube performance superhet (1 r.f. and 2 1650-kc. i.f. stages); series noise limiter, adjustable squelch; ceramic mike; link-coupled output; TVI trap; plate current of power output stage is metered; S-meter; 5½ x 12½ x 8; 11½ lb. Accessories: power output meters and field strength meters (various) and fixed and mobile antennas.

$109.50 (net)

Model HE-15A

5-channel transmit; 117-volt supply; 8-tube performance superhet (1 r.f. and 1 1750-kc. i.f. stage); adjustable series noise limiter; no squelch; ceramic mike (no push-to-talk); link-coupled output; neon tube output indicator; TVI trap; cathode current of transmitter metered from front panel jack; 5½ x 10¼ x 6⅜; 9 lb. Accessories: mobile power supplies for either 6 or 12 volts ($10.95) and various antennas.

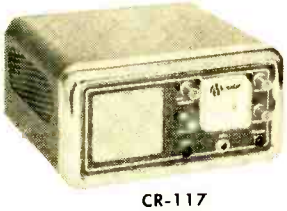
$57.50 (net)

CATALOG CB

27C-2

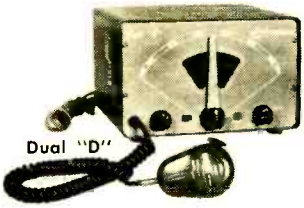
CD-5

5W3



CR-117

D-55



Dual "D"

LAKESHORE INDUSTRIES

Manitowoc, Wis.

Model D-55

5-channel, crystal-controlled transmit and receive; universal 117- and 12-, or 117- and 6-volt) power supply; 11-tube performance superhet (1 r.f. and 2 1640-kc. i.f. stages); series noise limiter; adjustable squelch; dynamic mike; pi-network output; 4⅞ x 9⅜ x 7¾; 11¾ lb. Accessories: various antennas.

$179.50

Model Dual "D"

2-channel transmit; 1-channel, crystal-controlled receive plus tunable receiver; 117-volt power supply, or universal (117- and 12-, or 117- and 6-volt) power supply at increased cost; 11-tube performance superhet (1 r.f. and 2 1640-kc. i.f. stages); series noise limiter; adjustable squelch; dynamic mike; pi-network output; neon-tube output indicator; 5¾ x 9¼ x 8; 11¾ lb. Accessories: various antennas.

$129.95 (117 volts only)

$147.50 (117 and either 12 or 6 volts)

MAXWELL ELECTRONICS CORP.

229 Garvon St., Garland, Texas

Model 27C-2

1-channel, crystal-controlled transmit and receive; 117-volt power supply (other models available for 12 or 6 volts at same price); 12-tube performance superhet (2 high-gain r.f. and 1 455-kc. i.f. stage); noise clipper and series noise limiter; adjustable squelch; dynamic mike; link-coupled output; 3½ x 7⅛ x 11¼; 6 lb. Accessories: battery eliminator converting 12-volt model to 117 volts ($29.95) and various antennas.

$159.50 (net)

MIRATEL, INC.

Richardson St., New Brighton 12, Minn.

Model CR117

5-channel, crystal-controlled transmit and receive; 117-volt power supply; 12-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output with TVI trap; metered to read percentage of modulation and carrier output; S-meter; 5¼ x 10½ x 10; 18 lb.

$229.00 (suggested retail)

MORROW RADIO MFG. CO.

P. O. Box 1627, Salem, Ore.

Model 5W3

3-channel, crystal-controlled transmit and receive; available in either 117-, 12- or 6-volt models only; 10-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; special noise balancing adjustable squelch; carbon mike; link-coupled output; TVI trap; jack for external speaker; high level modulation; 4¾ x 9¼ x 8¾; 11½ lb. Accessories: "Selectro" coders for selective calling ($59.50 and $29.50, one each required); test equipment and various antennas.

$179.50 (single-channel Model 5W1, $169.50)

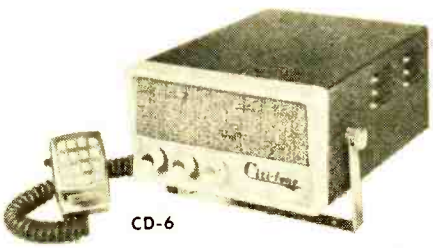
MULTI-PRODUCTS CO.

21470 Coolidge Highway, Oak Park 37, Mich.

Model CD-5 *("Citi-fone")*

5-channel, crystal-controlled transmit and receive; universal (117- and 12-, or 117- and 6-volt) power supply; 10-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output; TVI trap; 4¼ x 8 x 11; 15 lb. Accessories: various antennas.

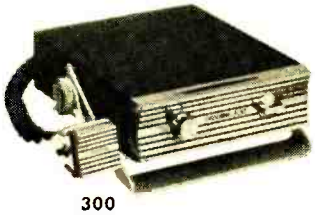
$134.50 (suggested retail)



CD-6

RA-442

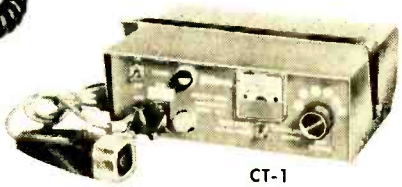
Poly-Comm II-G



300

CBD-5

CC-1



CT-1

Model CD-6 *("Citi-fone")*

5-channel, crystal-controlled transmit and receive; universal (117- and 12-, or 117- and 6-volt) power supply; 10-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; adjustable "noise immune" squelch; ceramic mike; pi-network output; TVI trap; jack for external speaker; 4¼ x 8 x 11; 13 lb. Accessories: various antennas.

$189.50 (suggested retail)

OLSON ELECTRONICS, INC.

260 South Forge St., Akron, Ohio

Model RA-442

5-channel, crystal-controlled transmit with tunable receiver; 117-volt supply; 10-tube performance superhet (1 r.f. and 1 1750-kc. i.f. stage); series noise limiter; adjustable squelch; S-meter; ceramic mike; link-coupled output; plate current meter; TVI trap; 4¾ x 10¼ x 6⅜; 9 lb. Accessories: 6- and 12-volt mobile power supplies ($19.95). This company is also known to have available a lower price 5-watt input transceiver and a hand-held 100-milliwatt transceiver.

$99.95

OSBORNE ELECTRONICS CORP.

13105 S. Crenshaw Blvd., Hawthorne, Calif.

Model 300

4-channel, crystal-controlled transmit and receive; 117-volt power supply (7 watts drain on transmit—5 watts on receive); NO tubes; 9 transistors, 8 diodes; no r.f. stage; 2 455-kc. i.f. stages; noise limiter; adjustable squelch; dynamic mike; pi-network output; 1⅞ x 6 x 7; 4¾ lb. Accessories: power supplies for mobile operation (6, 12, 24 or 32 volts) are available; various antennas.

$149.50 (net)

PEARCE-SIMPSON, INC.

2295 N.W. 14th St., Miami 35, Fla.

Model CBD-5

5-channel, crystal-controlled transmit and receive; universal transistorized (117- and 12-volt) power supply; 11-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; adjustable squelch; carbon mike; link and pi-network output; pilot bulb output indicator; TVI trap; 4½ x 7¼ x 10½; 9 lb. Accessories: various antennas.

$179.50 (single-channel Model CBD-1, $159.50)

PHILMORE MFG. CO., INC.

Richmond Hill 18, N.Y.

Model CT-1 *(transmitter only)*

6 channels; designed for use with manufacturer's power supply ($19.95, kit); 3 tubes; pi-network output; output indicator; plate voltage metered; ceramic mike; 3 x 8½ x 6; 5 lb. Accessories: mobile power supply ($26.75, kit) and antennas.

$39.95 (kit)

Model CC-1 *(converter only)*

Tunes CB band via car receiver; 3-tube performance (1 r.f. stage); may also be used to tune 10-meter amateur band with crystal change; 2 x 6 x 5¼; 1½ lb.

$16.50 (kit)

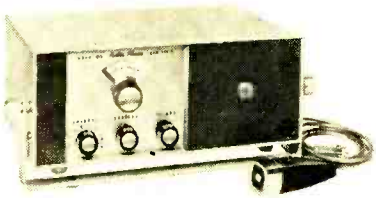
POLYTRONICS LAB, INC.

Clifton, N.J.

Poly-Comm II-G

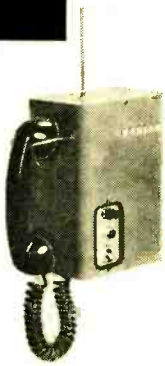
4-channel, crystal-controlled transmit and receive; universal (117-, 12- and 6-volt) power supply; 12-tube performance double-conversion superhet (featuring 3 i.f. stages); series noise limiter; adjustable squelch; carbon mike; pi-network output; pilot-bulb output indicator; TVI trap; hi-Z or lo-Z

CATALOG CB



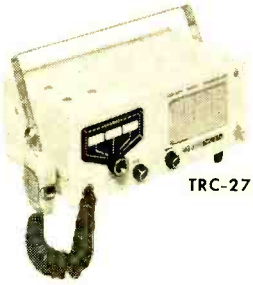
"Mark VII Radio-Phone"

Ray-Tel



RT-70A

Raycom



TRC-27A

RP-115

microphone may be interchanged through connector on front panel; extra-rugged construction; 5 x 11 x 7½; 12¾ lb. Accessories: base station ceramic mike (21.95) and various antennas.

$189.50 (net)

RADIO CORPORATION OF AMERICA

Telecommunication Center, Meadow Lands, Pa.

"Mark VII Radio-Phone"

4-channel, crystal-controlled transmit and receive plus tunable receiver; 117- and 12-volt or 117- and 6-volt power supplies available; 9-tube performance superhet (1 r.f. and 2 1650-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; link-coupled output; TVI trap; 5½ x 12 x 8; 12½ lb. Accessories: various antennas.

$189.95 (list)

RADIO SHACK CORP.

730 Commonwealth Ave., Boston 17, Mass.

Model TRC-27A

3-channel, crystal-controlled transmit and receive; universal (117- and 12-volt) transistorized power supply; 11-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output. Accessories: field strength meter ($6.95) and various antennas.

$89.95 (net)

RADSON ENGINEERING CORP.

Macon, Ill.

Model RP-115

2-channel, crystal-controlled transmit and receive; 117-volt power supply (other models available); 9-tube performance superhet (no r.f., 2 1650-kc. i.f. stages); series noise limiter; no squelch; carbon handset mike; series capacitor output—adjustable for maximum signal; pilot-bulb output indicator; features built-in "Push-to-Call" buzzer system; jack for external speaker; 6 x 9½ x 4½; 9 lb. Accessories: speaker with volume control ($14.95), auxiliary relay for horn or siren ($16.50); handset hanger (65 cents) and various antennas.

$169.50 (mobile units for 12 and 6 volts, $179.50)

Model RT-70A

2-channel, crystal-controlled transmit and receive; this unit is identical to the Model RP-115 (above) except that it does not have a series tuning capacitor in the output circuit or a pilot-bulb output indicator.

$169.50 (mobile units for 12 and 6 volts, $179.50)

RAYTHEON CO.

411 Providence Turnpike, Westwood, Mass.

Ray-Tel

4-channel, crystal-controlled transmit and receive; 117- and 12-volt power supply; 9-tube performance superhet (1 r.f. and 1 455-kc. i.f. stage); series noise limiter; adjustable squelch; special carbon mike; pi-network output; pilot-bulb output indicator; transmitter filaments may be switched off at front panel during "standby" periods; 5 x 9½ x 8¼; 12 lb. Accessories: various antennas.

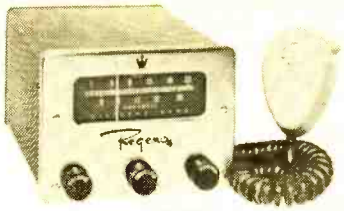
$169.95 (list)

RAYTHEON CO. Marine Products

319 Roebling Rd., So. San Francisco, Calif.

Raycom

5-channel, crystal-controlled transmit and receive; universal (117-, 32- and 12-volt) power supply; 9-tube performance superhet (1 r.f. and 1 455-kc. i.f. stage); switched noise limiter; adjustable squelch (called "Gate"); special carbon mike; pi-network output with series tunable capacitor for minimum standing waves; pilot-bulb output indicator; trans-



CB-27

400

Falcon Radiophone Mk IV

TEC "Radiophone"

"E"

MC-27

mitter filaments may be switched off during "standby" periods; 5⅜ x 10⅜ x 11½; 19 lb. Accessories: various antennas.

$179.50 (list)

REGENCY

7900 Pendleton Pike, Indianapolis 26, Ind.

Model CB-27

2-channel transmit; tunable receiver; 117-volt power supply (other models available); 9-tube performance double-conversion superhet; series noise limiter; adjustable squelch; ceramic mike; pi-network output; neon-bulb output indicator; 4½ x 6½ x 8¾; 8¾ lb. Accessories: various antennas.

$124.95 (12- and 6-volt units available at same price)

RUTHERFORD ELECTRONICS CO.

8944 Lindblade St., Culver City, Calif.

Model 400

6-channel, crystal-controlled transmit and receive; universal (117-, 12- and 6-volt) power supply; 11-tube performance superhet receiver (1 r.f. and 2 1650-kc. i.f. stages); shunt noise limiter; adjustable squelch; ceramic mike; pi-network output; 4⅛ x 10⅛ x 7⅝; 12 lb. Accessories: 12- or 6-volt mobile power cable ($7.50); dummy load ($4.95); mobile mounting bracket ($4.50) and various antennas.

$169.50 (list)

SONAR RADIO CORP.

3050 West 21st St., Brooklyn 24, N. Y.

Model "E"

8-channel, crystal-controlled transmit and receive plus tunable receiver; universal (117-, 12- and 6-volt) power supply; 11-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output; pilot-bulb output indicator; 4¾ x 9½ x 11¼; 9 lb. Accessories: S-meter ($24.95) and various antennas.

$179.50 (net)

TECRAFT SALES CORP.

Box 84, South Hackensack, N. J.

Falcon Radiophone Mk IV

5-channel transmit with tunable receiver, plus 1 crystal-controlled receive channel; universal (117-, 12- and 6-volt) power supply; 13-tube performance double-conversion superhet; series noise limiter; adjustable squelch; ceramic mike; pi-network output; plate current metered in transmitter; may be purchased with special "TNS" noise-eliminating and squelch circuit built in ($20.00); 5½ x 11¼ x 9⅜; 12 lb.

$169.95 (also available with 5 crystal-controlled receive channels for same price)

TELEPHONE AND ELECTRONICS CORP.

7 East 42nd St., New York 17, N. Y.

TEC *("Radiophone")*

3-channel, crystal-controlled transmit and receive; universal (117-, 12- and 6-volt) power supply; 10-tube performance superhet (1 r.f. and 2 1650-kc. i.f. stages); series noise limiter; adjustable squelch; carbon handset mike; link-coupled output with tunable series capacitor; pilot-bulb output indicator; TVI trap; choice of handset or loudspeaker reception; 7¾ x 5⅞ x 11⅜; 9 lb. Accessories: mobile mounting bracket ($3.95) and various antennas.

$179.00

UTICA COMMUNICATIONS CORP.

1834 Foster Ave., Chicago 40, Ill.

Model MC-27 *("Town & Country")*

6-channel, crystal-controlled transmit and receive; universal (117-, 12- and 6-volt) power supply; 10-tube performance

CATALOG CB

ED-27M

PT-61

"Four-Eleven"

Ray Jefferson
700 "Spokesman"

double-conversion superhet; series noise limiter; adjustable squelch; ceramic mike; link-coupled output; 4 x 11⅞ x 7; 11 lb. Accessories: power cables ($5.95); mounting bracket ($5.95); half-wave vertical antenna for base station ($34.95) and other antennas.

$189.50 (net)

VOCALINE COMPANY OF AMERICA, INC.

Old Saybrook, Conn.

Model ED-27M

4-channel, crystal-controlled transmit and receive; universal (117-, 12- and 6-volt) power supply; 12-tube performance double-conversion superhet; noise pulse suppressor; patented "Vocatron" noise-immune adjustable squelch; ceramic mike; pi-network output; pilot-bulb output indicator; 5¼ x 9¼ x 8¼; 11 lb. Accessories: vibration-proof mobile mount ($19.95) and various antennas.

$189.50 (list)

Model PT-61 *("Commaire")*

4-channel, crystal-controlled transmit and receive—plus tunable CB receiver—plus standard broadcast-band AM reception; rechargeable dry-battery power supply; transistorized double-conversion superhet receiver; 2-tube transmitter with about 1-watt input; noise limiter; squelch switched "in" or "out"; pi-network output; crystal diode rectifier operates special power meter attached to antenna circuit; built-in flashlight; 10 x 4⅛ x 7½; 8½ lb.

$250.00 (list)

WEBSTER MANUFACTURING

371 Roebling Rd., South San Francisco, Calif.

Model "Four-Eleven"

4-channel, crystal-controlled transmit and receive; universal (117- and 12-volt) power supply; 9-tube performance superhet (1 r.f. and 1 455-kc. i.f. stage); series noise limiter; adjustable squelch; carbon mike; pi-network output; pilot-bulb output indicator; 5 x 9½ x 8¼; 12¼ lb. Accessories: various antennas.

$169.95 (list)

WINSTON ELECTRONICS

1128 Madison Ave., Paterson, N. J.

Ray Jefferson 700 *"Spokesman"*

1-channel, crystal-controlled transmit and receive; battery-operated; completely transistorized (8 transistors and 2 diodes) with superhet receiver (455-kc. i.f.) and 1-watt input to final stage of transmitter (about 500-milliwatts output); carbon mike; jack on base of unit for connection to external antenna; 11⅜ x 3⅛ x 5¼; 3¼ lb. (with batteries). Accessories: 117- or 12-volt adapters.

$169.50 (net, plus $1.80 for batteries)

Antennas

In this catalog section, we have purposely not listed steel or Fiberglas 96" and 103" whips; a wide variety are available in the same price range. This section does include shortened—or loaded—whip antennas, fixed station and beam antennas.

THE ANTENNA SPECIALISTS

12435 Euclid Ave., Cleveland 6, Ohio

Model M-37 3-Element Beam

3-element vertically polarized beam antenna; 7-db forward gain compared to ground plane; mounts on 1" IPS pipe; must be rotated; fed with 52-ohm coax.

$75.00 (list)

Model M-27 *and* **MC-27**

Ground plane antenna with 108" radials (4); U-bolt mounting clamps supplied; Model MC-27's aluminum radials have coupling joints and are shipped in 54" lengths; Model M-27 has 1-piece stainless steel radials.

$26.65 (list, Model MC-27); $49.75 (list, Model M-27)

Model M-38

Skirt for mounting 4 radials below either M-27 or MC-27

$18.95 (list)

Model M-36

Sleeve-type coaxial antenna machined of aluminum; mounts on ¾" pipe; accepts 52-ohm cable; Model MA-36 is same as above, but has jointed skirt for parcel post mailing.

$33.25 (list)

Model M-52

Cowl mounting 48" Fiberglas whip; continuously loaded; white plastic covering fits any 15/16" to 1¼" hole; supplied with 5' coax cable and PL-259 connector.

$16.60 (list)

BROWNING LABORATORIES, INC.

100 Union Ave., Laconia, N. H.

6-Element Beam

Consists of two wide-spaced 3-element sections mounted on diagonally braced half-wave horizontal boom; vertically polarized radiation; approximately 11-db forward gain; must be rotated; 50-ohm impedance at feed point; weight—34 lb.

$97.50 (FOB, Laconia, N. H.)

CLEAR BEAM ANTENNA CORP.

21341 Roscoe Blvd., Canoga Park, Calif.

Model GP-1 Ground Plane

Consists of 1"-diameter driven vertical element and three drooping ground plane elements for good match to transmission line; offset support for maximum rigidity.

$9.95 (net)

Model CBY3 3-Element Beam

May be mounted either vertically or horizontally; element spacing—0.10 and 0.15 wavelength between director-radiator-reflector, respectively; matched to coaxial transmission line; must be rotated.

$14.95 (net)

COLUMBIA PRODUCTS CO.

RFD #3, Columbia, S. C.

Shakespeare "Wonderod"

A distributed load mobile antenna 48" long; high-Q air core coil molded into Fiberglas laminate; standard model is in metallic gray—white model available at $4.65 extra.

$11.25 (net)

Model 61 Ground Plane

High-strength white Fiberglas elements (vertical radiator and 3 drooping radials); cadmium-plated steel support bracket mounts to 1¼" pipe thread; may be trimmed for minimum VSWR.

$39.95 (net)

Model 74 Loaded Mobile Whip

For mounting on rain gutter of car—permanently or temporarily; loaded Fiberglas whip 48" long; includes mounting hardware and 9' of RG-58/U cable with Motorola plug.

$14.40 (net)

CONTINENTAL ELECTRONICS & SOUND CO.

6151 Dayton Liberty Rd., Dayton 18, Ohio

"Duo-Pole"

Ground-plane-style antenna with radiator folded to provide better match to 52-ohm coaxial line; one-piece aluminum base; factory-tuned to channel 11.

$29.97 (net)

"Beam Antennas"

3-, 4-, or 5-element beams that may be mounted for horizontal or vertical polarization; 7-to 9-db forward gain; very lightweight; must be rotated; factory-tuned to channel 11; gamma-matching.

$29.95 (net, add $10.00 for each extra element)

CUBEX CO.

3322 Tonia Ave., Altadena, Calif.

Model CBQ Cubical Quad

2-element cubical quad beam antenna; very high front-to-back ratio; about 10-db forward gain; very lightweight; must be fed from 52-ohm RG-58/U cable; rotated; de luxe model ($25.00 extra) uses Fiberglas spreader arms.

$39.50 (net)

GC ELECTRONICS CO.

400 South Wyman St., Rockford, Ill.

Model No. 29-730

Ground-plane antenna with 4 guy wires acting as the radials; made of telescoping aluminum tubing; sold with 50' of coax cable, mast, swivel base, insulators, etc.

$39.75 (list)

Model No. 29-740

Same as above, but with rod radials; requires no guys.

$42.50 (list)

Model No. 29-744

Same as No. 29-730, but without mast, cable and plugs.

$22.50 (list)

Model No. 29-710

Continuously loaded mobile whip; 48" long; Fiberglas construction; may be mounted on cowl, trunk lid or roof top.

$12.00 (list)

HI-PAR PRODUCTS CO.

347 Lunenburg St., Fitchburg, Mass.

Model CO-27

Sleeve-type coaxial antenna; all-aluminum construction; overall height, 17' 6"; coaxial feed from 52-ohm cable; requires 1¼" TV masting or tubing support center pole.

$14.95 (FOB, Fitchburg, Mass.)

HY-GAIN ANTENNA PRODUCTS

1135 No. 22nd St., Lincoln, Nebr.

Model SGP

Ground-plane antenna constructed of aluminum tubing; strong plastic base accepts masts up to 1⅝"; 3 radials; matched to 52-ohm coax line.

$26.95 (list)

Model GP-1

Heavy-duty ground plane; 4 drooping radials; larger diameter tubing employed throughout; matched to 52-ohm line.

$43.75 (list)

Model CLR

Collinear ground plane with ¾-wavelength radiator; provides omni-directional pattern with 3.4-db gain over simple dipole; 3 radials; antenna 20' in height.

$49.95 (list)

Model CXL

Sleeve-type coaxial constructed of heavy wall aluminum tubing; mounted on 1¼" O.D. masting or 1" I.D. plumber's pipe; sleeve length is adjustable for fine tuning.

$33.25 (list)

Model CD

"Rabbit ears" antenna with two telescoping 45" elements; suction cup mounting; matched to 50-ohm line.

$21.95 (list)

Model 113-B

3-element beam antenna; may be used vertically or horizontally; 9-db forward gain; must be rotated; matched to 50-ohm coax line; can be stacked horizontally to add 3 db more forward gain; front-to-back ratio is about 25 db.

$52.50 (list)

INTERNATIONAL COMMUNICATIONS CO.

26330 Sa. Western Ave., Lomita, Calif.

"Stinger" Mobile Whip

32" steel whip inductively coupled at base to short transmission line; designed for cowl or roof-top mounting in standard ⅝" hole; steel rod may be adjusted in length for maximum performance.

$16.95 (net)

HERB KRECKMAN CO.

Cresco, Pa.

Kreco CB Co-Axial

Sleeve-type coaxial antenna machined of tempered aluminum; mounts on ¾" pipe; antenna weighs about 5 lb; requires RG-8/U feedline, but may be used with RG-58/U.

$41.25 (list)

MARINA COMMUNICATIONS

10328 Venice Blvd., Culver City, Calif.

"Gizmotchy" Beam Antenna

3-element beam with each element consisting of three equal-spaced radial elements in vertical plane; antenna may be fed to radiate circular, horizontal or vertical polarization; constructed of aluminum and gamma-matched to feed RG-58/U coaxial line; 8-db forward gain and 28-db front-to-back ratio; available as vertically polarized beam only for $44.95; antenna selector box to shift polarization $7.50 extra.

$55.95 (net, FOB, Culver City, Calif.)

"Buddy" Drooping Ground Plane

Heavy-duty ground plane with 4 umbrella-type radials; solid one-piece center support eliminates need for special fittings.

$19.95 (FOB, Culver City, Calif.)

"Buddy" Mobile Whip

96" Fiberglas-construction whip with special base mounting that attaches to rain gutter of car; if mounted over door on driver's side of car, the whip may be easily lowered by driver when entering garage or gas station; ball-bearing detent holds antenna in vertical position; sold with 52-ohm coaxial lead-in.

$19.95 (FOB, Culver City, Calif.)

MARK MOBILE, INC.

5439-41 Fargo Ave., Skokie, Ill.

Model CSM-11

Folded-dipole antenna for vertical mounting attached to the side of an existing TV, broadcast or communications tower —thus conforming with FCC regulations; includes tower as part of electrical circuit; single unit has 2-db gain in "favored" direction; may be stacked (5-db gain), or staggered (collinear fashion) around tower for non-directional pattern; sold with all mounting hardware; fed from 52-ohm coax line.

$62.30 (list); $151.20 (list, for collinear array with phasing harness)

Model CBB-1 "Beacon"

Bottom-fed half-wave radiator (17') for fixed station installation; employs special quarter-wave matching section at base so antenna may be fed with 52-ohm coax line; non-directional; grain of 1 db over ground-plane antenna.

$33.25 (list)

Model HW "Heliwhip"

Mobile antenna available in lengths of 4' (standard), 5' or 6'; Fiberglas-molded continuously loaded whip; may be mounted on fender, hood, cowl or trunk lid for improved radiation characteristics; matched to 50-ohm coax line.

$16.58 (list)

MINI-PRODUCTS, INC.

1001 West 18th St., Erie, Pa.

Model C6CB

End-loaded fixed station or marine mobile vertical antenna; 12' in height; designed to eliminate ground-plane radials; may also be used on 6-meter ham band.

$29.95 (net)

Model MCB

End-loaded mobile whip; 40" in length; manufacturer claims 5-db gain over similar-length base-loaded mobile antennas; Model M6CB (length, 63") tunes both CB and 6-meter ham bands.

$12.95 (net)

MOSLEY ELECTRONICS, INC.

4610 Lindbergh Blvd., Bridgetan, Mo.

Model VGR-27

2-element, vertically polarized beam with cardioid field pattern; 3-db forward gain over an area of plus or minus 90° from axis of main lobe; front-to-back ratio, 15 db; gamma-matching; ground-plane radials; usually fixed-mounted and not rotated; heavy-duty base mount for unguyed support.

$54.57 (list)

Model A-311

3-element beam; may be mounted for vertical or horizontal polarization; boom length, 12'; forward gain, 9 db; fed from RG-8/U; must be rotated.

$46.88 (list)

Model CA-27

Coaxial-sleeve-type vertical antenna for fixed station use; accepts either RG-8/U or RG-58/U feedlines; maximum VSWR is 1.5:1 at resonant frequency; needs no additional tuning.

$43.69 (list)

Model V-27-GP

Ground-plane antenna with 4 rigid horizontal radials; gamma-matched to coaxial line; ⅞" vertical radiator; heavy-duty base mount for unguyed support.

$43.69 (list)

NEW-TRONICS

Automatic Radio Mfg. Co., Inc., 122 Brookline Ave., Boston 15, Mass.

Model CB-27

Collapsible loaded mobile whip antenna—60" extended and 27" collapsed; features two etched "tuning" scales in top rod section—one for CB channels and one for 10-meter ham band; supplied with 5' length of RG-58/U cable.

Price not announced

TECHNICAL INDUSTRIES, INC.

c/o Electrophone & Parts Corp., 530 Canal St., New York 13, N. Y.

TII Mobile

Consists of special bracket that fits car window and places 40" base-loaded whip antenna in center of car roof; sold with antenna and 10' of RG-58/U cable; bracket may be extended to fit cab of trucks ($2.50).

$19.95 (suggested net)

TELREX LABORATORIES

Asbury Park, N. J.

Model TYHS-11M-518

10-element beam consisting of two 5-element beams horizontally stacked; about 14-db forward gain; must be rotated.

$365.00 (FOB, Asbury Park, N. J.)

Model 11M-518

Single 5-element section of above, but positioned for horizontal polarization; 11-db forward gain; must be rotated.

$160.00 (FOB, Asbury Park, N. J.)

Model 11M-OD4

Omni-directional beam with a gain of 4 db; transmits and receives in all directions; vertically polarized.

$95.00 (FOB, Asbury Park, N. J.)

Model 11M-309

3-element vertically polarized beam; 9-db forward gain; 26-db front-to-back ratio; must be rotated.

$31.50 (FOB, Asbury Park, N. J.)

Model CGP-1011M "Monarch"

All-aluminum-construction ground-plane antenna with 3 drooping radials; fed with 52-ohm coaxial cable.

$29.95 (FOB, Asbury Park, N. J.)

Model 11M-206B

2-element vertically polarized beam; 5-db forward gain; 14-db front-to-back ratio; must be rotated.

$19.95 (FOB, Asbury Park, N. J.)

WEBSTER MANUFACTURING CO.

317 Roebling Rd., South San Francisco, Calif.

"49-er"

Top-loaded mobile whip 49" long; Fiberglas rod with molded-in conductor; coil at top may be slug-tuned for best possible VSWR.

$14.50 (net)

"Marine Citizen"

Half-wave semi-sleeve vertical dipole with coaxial feed; antenna height—18'; Fiberglas-covered.

$56.50 (net)

Special Attachments

Noistop

BUSINESS RADIO CO., INC.

P.O. Box 5652, Minneapolis 17, Minn.

"Noistop"

Special noise-eliminating and squelch circuit mounted in 1½ x 2½ x 4 box; may be attached to any superhet receiver; ideal for mobile use; sold completely wired and with instructions on how to connect to transceiver—specify unit when ordering.

$15.95 (net)

Scrambler

DELCON CORP.

943 Industrial Ave., Palo Alto, Calif.

Model 206 "Scrambler"

Compact transistorized speech scrambler that converts normal speech into unintelligible gibberish; available in two inversion frequencies (2700 and 3900 cycles); available as 117-volt base station or 12-volt mobile.

$298.00

MORROW RADIO MFG. CO.

2794 Market St., N.E., Salem, Ore.

"Selectro"

Selective calling device attached to any CB transceiver; operates by pressing "Call" button for 3 seconds; tone signal activates base receiver; two units necessary per installation; 9 different tone channels available.

$29.50 (transmitter "Coder"), $59.50 (receiver "Decoder")

Selectro

Microphones

AMERICAN MICROPHONE MFG. CO.

412 S. Wyman St., Rockford, Ill.

Model B-213AC

Ceramic element; manufacturer rates output at –58 db; 50-8000 cycle response; 5' coiled neoprene cord; available with or without d.p.s.t. switch; also available with crystal element for $2.50 less; sold with dash bracket; hi-impact polystyrene case.

$16.75 (list)

American

210KK or 600D

ELECTRO-VOICE, INC.

Buchanan, Mich.

Model 205KK

Carbon button element; manufacturer rates output at –50 db; 100-4000 cycle response; 5' coiled cord; d.p.s.t. switch; high noise cancellation—ideal for mobile operation; black finish; supplied with mounting bracket.

$45.00 (list)

Model 210KK

Carbon button element; manufacturer rates output at -50 db; 100-4000 cycle response; 6' coiled cord; d.p.s.t. switch; black finish; supplied with mounting bracket.

$35.00 (list)

Model 600D

Dynamic element; manufacturer rates output at –55 db; 100-7000 cycle response; 6' coiled cord; d.p.s.t. switch; black finish; supplied with mounting bracket; Model 602D is similar but has noise-canceling aperture.

$47.50 (list)

714

Model 714

Ceramic element; manufacturer rates output at –55 db; 80-7000 cycle response; 5' coiled cord; d.p.s.t. switch; gray finish; mounting bracket supplied.

$16.50 (list)

CATALOG CB


70


Elucidator

350-C

729SR


Ten-Four

715SR

Ceramike

Model 715SR

Ceramic element; manufacturer rates output at —55 db; 60-7000 cycle response; 5′ coiled cord (available); d.p.s.t. switch; gray finish; mounting bracket supplied.

$17.50 (list)

Model 729SR

Ceramic element; manufacturer rates output at —60 db; 60-8000 cycle response; 8½′ uncoiled cord; d.p.s.t. switch; gray finish; supplied with desk stand.

$26.50 (list)

RAYTHEON CO.

411 Providence Turnpike, Westwood, Mass.

"Elucidator"

Carbon button, bypassed for r.f.; manufacturer rates output at —48 db; 200-4000 cycle response (peaked at 2000 cycles); 5′ coiled cord; s.p.s.t. switch; sold with mounting stud; banker's gray color; hi-impact plastic case.

$19.95 (list)

SHURE BROTHERS, INC.

222 Hartrey Ave., Evanston, Ill.

"Ten-Four"

"Controlled magnetic" element; manufacturer rates output at —50 db; 200-8000 cycle response; 5½′ coiled cord; various switching combinations are available; sold with mounting bracket; Model 405T includes transistor amplifier as replacement for carbon mikes ($48.50 list); conversion kit Model R5T ($25.00 list) may be purchased to convert standard carbon mike to "controlled magnetic."

$33.00 (list)

SONOTONE CORP.

Elmsford, N. Y.

Model CM-30 "Ceramike"

Ceramic element; manufacturer rates output at —49 db; 100-6000 cycle response; 6′ coiled cord; d.p.s.t. switch; neutral tan-gray color; sold with dash bracket; hi-impact case.

$14.00 (list)

TURNER MICROPHONE CO.

Cedar Rapids, Iowa

Model 350-C

Ceramic element; manufacturer rates output at —54 db; 80-7000 cycle response; 5′ coiled neoprene cord; d.p.s.t. switch; also available with carbon button for $2.20 more, or crystal element at same price; sold with dash mounting bracket; hi-impact plastic case.

$16.80 (list)

UNIVERSITY LOUDSPEAKERS, INC.

White Plains, N. Y.

Model 70

Dynamic element; manufacturer rates output at —50 db; 50-14,000 cycle response; 15′ cord; may be ordered with slide off-on switch ($5.00 extra); sold with slide-on mike stand adapter.

$29.95 (net)

Crystals

All transceiver manufacturers will supply crystals for other channels on special order. However, supplies are sometimes limited and substitutions may not be available for immediate shipment. The manufacturers below supply most of the crystals used by the transceiver manufacturers. In ordering crystals for substitute channels, be sure to specify the manufacturer and model number of your transceiver—many crystals are not interchangeable.

AMERICAN CRYSTAL CO.

821 East 5th St., Kansas City 6, Mo.

INTERNATIONAL CRYSTAL MFG. CO., INC.

18 N. Lee, Oklahoma City, Okla.

JAMES KNIGHTS CO.

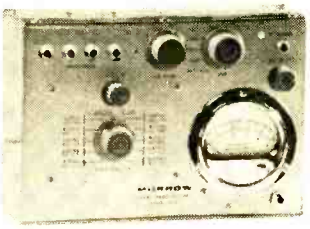
Sandwich, Ill.

PETERSEN RADIO CO., INC.

2800 W. Broadway, Council Bluffs, Iowa

TEXAS CRYSTALS

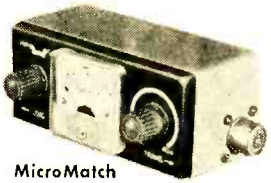
1000 Crystal Drive, Fort Myers, Fla.



TS-2

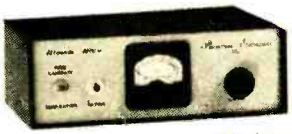
Sweco

Reflectometer



MicroMatch

SWR Bridge



Modulation Monitor

105-B

Test Equipment

The following are but a few of the new test equipment items released in the past few months. For more detailed information, read "Getting Peak CB Performance" (POPULAR ELECTRONICS, May 1961, p. 58).

CONTINENTAL ELECTRONICS & SOUND CO.

6151 Dayton Liberty Rd., Dayton 18, Ohio

Model CM-52 "Reflectometer"

Measures VSWR (direct readings) up to 200 mc.; has comparison power output meter scale; may be left in coax line; needs no balancing or reversing. Write for literature on other items of test equipment.

$29.95 (net)

GENERAL RADIOTELEPHONE CO.

2806 West Burbank Blvd., Burbank, Calif.

Model 615 "SWR Bridge"

Measures VSWR (direct readings) up to 54 mc.; measures true power output to 52-ohm load up to 25 watts; measures relative field strength using telescoping antenna; may be left in coax line; adapter cables for connecting to Motorola plugs available at $1.95 each.

$39.95 (net)

LAFAYETTE RADIO ELECTRONICS CO.

165-08 Liberty Ave., Jamaica 33, N. Y.

Model HE-28 "Wattmeter and Bridge"

Measures power output in two ranges up to 150 watts; measures VSWR in 2-30 mc. range; has built-in dummy load; may be left in coax line.

$37.50 (net)

LAMPKIN LABORATORIES

Bradentan, Fla.

Model 105-B

Very high accuracy frequency meter—accuracy within error of 0.0025%; has built-in calibrator; excellent for shops servicing CB equipment.

$260.00 (net)

M. C. JONES ELECTRONICS CO., INC.

c/o Bendix Corp., Bristol, Conn.

Model 290 "MicroMatch"

Measures VSWR (direct readings); measures true power output to 52-ohm load up to 4 watts; may be left in coax line.

$26.50 (net)

MORROW RADIO MFG. CO.

Salem, Ore.

Model TS-2 "Generator"

Crystal-controlled signal generator with 22-channel coverage; useful in final checkout of receiver sensitivity.

Price not announced

PERFECTION ELECTRONICS INC.

73-03 Grand Ave., Maspeth 78, N. Y.

"Modulation Monitor"

Measures percentage of modulation; provides aural check on signal quality; may be left in coax line.

$24.95 (net)

SOUTH WEST ELECTRONICS CO.

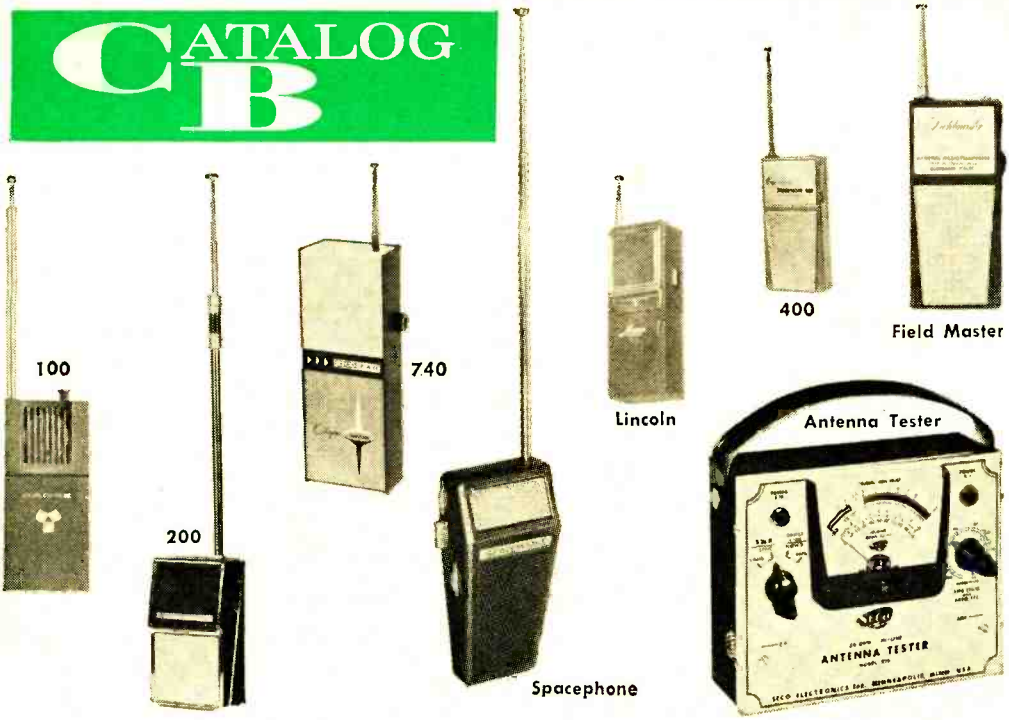
P. O. Box 226, Bakersfield, Calif.

Sweco Wattmeter

Measures true power output to 52-ohm load up to 5 watts; has built-in dummy load.

$18.75 (net)

CATALOG B



SECO ELECTRONICS INC.

5015 Penn Ave. S., Minneapolis 10, Minn.

Model 520 "Antenna Tester"

Measures VSWR (direct readings) up to 150 mc.; measures true power output to 50-ohm load up to 1000 watts—reads on 3 scales (0-10, 0-100, and 0-1000); may be left in coax line; scale especially divided in Good-Poor ranges to assist novice in obtaining peak results with equipment. Write for literature on other items of test equipment.

$42.95 (net)

Part 15 Transceivers

No license is required to operate these transceivers if input does not exceed 100 milliwatts, must be licensed to communicate with Part 19 transceivers.

ALLIED RADIO CORP.

100 N. Western Ave., Chicago 80, Ill.

Lincoln Walkie-Talkie

9 transistors; 1 diode; superhet receiver; 24 oz.; 6⅝ x 2½ x 1½; earphone jack; sold with earphone and carrying case.

$42.95 (net, less batteries—70 cents)

CADRE INDUSTRIES CORP.

Endicott, N. Y.

Model 100

7 transistors, 1 diode; superhet receiver; 20 oz.; 6¼ x 2¾ x 1½; channel selected by purchaser.

$124.95 (suggested retail)

CONCORD ELECTRONICS CORP.

809 North Cahuenga Blvd., Los Angeles 38, Calif.

Model 200

9 transistors, 1 diode; superhet receiver; 10½ oz.; 4⅜ x 3 x 1 5/16.

$99.95

EICO (Electronic Instrument Co., Inc.)

33-00 Northern Blvd., Long Island City 1, N. Y.

Model 740

7 transistors; 1 diode; superhet receiver; 19 oz.; 7⅛ x 2⅝ x 1⅝; channel may be chosen by purchaser; earphone jack. Accessories: carrying case ($3.95).

$54.95 (kit); $79.95 (wired)

ELECTRA INTERNATIONAL CO.

5415 York Blvd., Los Angeles 42, Calif.

Miniphone 400

9 transistors; 1 diode; superhet receiver; 11 oz.; 5⅞ x 2⅝ x 1⅜; channel 15 (other channels substituted on order); earphone jack. Accessories: carrying case; earphone, rechargeable battery and charger, converter for 117 volts.

$89.75

ELECTROSOLIDS CORP.

13745 Saticoy St., Panorama City, Calif.

"Spacephone"

Tunable superregenerative receiver; 6 oz.; 5 x 2½ x 1½.

$24.95 (suggested retail)

GENERAL RADIOTELEPHONE CO.

3804 W. Burbank Blvd., Burbank, Calif.

"Field Master"

8 transistors; superhet receiver; 13 oz.; external speaker jack; may be modified by user to increase power output.

$69.95 (net)

GLOBE ELECTRONICS

22-30 South 34th St., Council Bluffs, Iowa

"Pocketphone"

9 transistors; 1 diode; superhet receiver; 13 oz.; 6¼ x 2⅜ x 1⅝; usually delivered with channel 15 crystals (others on

GW-31

TR-330

GW-30

HE-29

Messenger

Herald Mk I

Pocketphone

WT-101

TC-900

order at $7.50); earphone jack; sold with rechargeable battery and charger. Accessories: earphone ($2.95) and carrying case ($4.95).

$125.00 (net)

HEATH CO.

Benton Harbor, Mich.

Model GW-30

4 transistors; superregenerative receiver; 32 oz.; 6½ x 3¼ x 2⅜; specify crystal desired with order; may be purchased wired for $18.00 extra.

$32.95 (kit)

Model GW-31

4 transistors; superregenerative receiver; 5⅞ x 3⅛ x 1½; receiver may be tuned to any channel.

$24.95 (kit); *$37.75* (wired)

INTERNATIONAL COMMUNICATIONS CORP.

1929 Wilshire Blvd., Santa Monica, Calif.

Herald Mk I

9 transistors; 1 diode; superhet receiver; 18 oz.; 6 x 2⅞ x 1; usually delivered on channel 10 (other channels on order; supplied with leather carrying case, strap and batteries.

$59.50

E. F. JOHNSON CO.

Waseca, Minn.

Personal *("Messenger")*

11 transistors; 4 diodes; superhet receiver; channels 5, 7, 11, 18 or 22 available on request; earphone jack. Accessories: earphone; rechargeable battery ($19.95); carrying case; cigarette lighter adapter for 12-volt operation and external antenna adapter.

$109.50 (net)

KAAR ENGINEERING CORP.

2995 Middlefield Road, Palo Alto, Calif.

Model TR-330 "Han(D)phone"

9 transistors; 3 diodes; superhet receiver; 30 oz.; 10 x 2⅞ x 2½; adjustable squelch control. Accessories: carrying case and hand strap. Four optional battery arrangements.

$129.50

LAFAYETTE RADIO ELECTRONICS CORP.

165-08 Liberty Ave., Jamaica 33, N. Y.

Model HE-29

9 transistors; 1 diode; superhet receiver; 18 oz.; 6⅜ x 3¼ x 1⅝; channel 10; earphone jack; sold with carrying case and earphone.

$49.95 (net)

MAGNAVOX COMPANY

Fort Wayne 4, Ind.

Model WT-101

8 transistors; 1 diode; superhet receiver; 20 oz.; 6⅛ x 3¼ x 1½; channel 11.

$59.95 (available Aug. 1)

MONARCH ELECTRONICS INTERNATIONAL, INC.

7035 Laurel Canyon Blvd., North Hollywood, Calif.

Model TC-900

9 transistors; 1 diode; superhet receiver; 14 oz.; 6⅞ x 2½ x 1⅝; channel 7; earphone jack.

$64.95 (list)

MORROW RADIO MFG. CO.

Salem, Ore.

Model VP-100

11 transistors; 1 diode; superhet receiver; 21 oz.; 6½ x 2¾ x 1¼; channel selected by purchaser; earphone jack; jack for external antenna; receiver has squelch control; carbon lapel mike; uses 9" loaded whip antenna. Accessories: leather carrying case.

$149.50

CATALOG CB


VP-100


Super Rayette


Packet Talkie


4304


300


Realisti-Fone


Duo-Com

OLSON ELECTRONICS, INC.

260 South Forge St., Akron, Ohio

Model RA-446

9 transistors; superhet receiver; 7½ x 2⅞ x 1½; earphone jack; earphone and carrying case supplied.

$44.50

OSBORNE ELECTRONICS SALES CORP.

13105 S. Crenshaw, Hawthorne, Calif.

Duo-Com 100

10 transistors; double-conversion superhet receiver; 20 oz.; 7¾ x 4 x 1⅝; channel 10; jack for connecting external antenna; jack for connecting external speaker-mike.

$99.50 (net)

Duo-Com 100S

11 transistors; 4 diodes; double-conversion superhet receiver; 20 oz.; 7¾ x 4 x 1⅝; receiver features special ceramic resonators in i.f. stages (for increased selectivity) and adjustable squelch; channel selected by purchoser; jack for connecting external antenna; jack for connecting external speaker-mike.

$119.50 (net)

PACOTRONICS, INC.

70-31 84th St., Glendale 27, N. Y.

Model CR-11

9 transistors; 1 diode; superhet receiver, 19½ oz.; 6½ x 3 x 1½; channel 9 (others available); earphone jack; earphone supplied; receiver also serves to cover AM broadcast band by means of switch on front panel; sold with carrying case.

$69.95 (net)

RADIO CORPORATION OF AMERICA

30 Rockefeller Plaza, New York, N. Y.

Personal-Com 300

8 transistors; 1 diode; superhet receiver; 15 oz.; 8 x 2¾ x 1¾; channel may be chosen by purchaser; special cabinet design "ports" sound from speaker to ear when microphone is near mouth. Accessories: rechargeable battery and charger and "power amplifier" to increase output.

$129.95

RADIO MFG. ENGINEERS, INC. (RME)

c/o Electro-Voice, Buchanan, Mich.

Model 4304

7 transistors; 1 diode; superhet receiver; 24½ oz.; 7¾ x 3½ x 2¼; channels 3, 6, 11 or 16 available on request; earphone jack. Accessories: carrying case.

$115.00 (net)

RADIO SHACK CORP.

730 Commonwealth Ave., Boston 17, Mass.

"Realisti-Fone"

9 transistors; 1 diode; superhet receiver; 6⅜ x 3¼ x 1⅝; channel 10; earphone jack; sold with earphone.

$44.95 (net)

RAYTHEON CO.

411 Providence Turnpike, Westwood, Mass.

"Super Rayette"

Superhet receiver; 14½ oz.; 5¼ x 2¾ x 1 3/16; earphone jack; earphone supplied; rechargeable battery; battery charger included.

$99.95 (suggested retail)

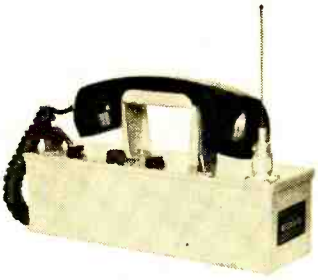
"Regal Rayette"

Superregenerative receiver with squelch; 14½ oz.; 5¼ x 2¾ x 1 3/16; earphone jack; earphone supplied; rechargeable battery; charger included.

$79.95 (suggested retail)

Telepath PM-A

Micro 350



Springfield

CBP

ROSS LABORATORIES, INC.

124 Lakeside Ave., Seattle 22, Wash.

"Pocket Talkie"

5 transistors; superregenerative receiver; 8½ oz.; 5⅛ x 2 5/16 x 1⅛; channel 9.

$69.50 (less batteries)

"Pocket Talkie" Model 300

12 transistors; 2 diodes; superhet receiver; 23 oz.; 6½ x 3⅛ x 1½; channel 9; receiver features noise limiter and adjustable squelch.

$124.50 (complete)

Paging Receiver Model 100

6 transistors; 1 diode; superhet receiver ONLY; 7 oz.; 3⅞ x 2 5/16 x 1¼; self-contained antenna; factory-tuned to specified channel.

$64.50 (complete)

SEISCOR

Box 1590, Tulsa, Okla.

Model PM-A "Telepath"

8 transistors; 1 diode; superhet receiver; 12 oz.; 5¾ x 3 x 1⅜; channel 11; this product available in many adaptations for portable use—write manufacturer for details.

Prices on request to manufacturer

Model SC-A *("Telepath")*

14 transistors; superhet receiver; 20 oz.; 7 x 3 x 4; earphone jack; receiver features noise limiting and adjustable squelch control. Accessories: various power supply arrangements are available from manufacturer, as well as antenna and speaker substitutions.

$199.50 (net)

SONAR RADIO CORP.

3050 West 21st St., Brooklyn 24, N. Y.

Model CBP

8 transistors; 1 diode; superhet receiver; 34 oz.; 8¼ x 3½ x 3; channel selected by purchaser for transmit—receiver may be switched to any one of 22 channels. Accessories: carrying case ($7.95).

$124.95 (complete)

SPRINGFIELD ENTERPRISES

196-23 Jamaica Ave., Hollis 23, N. Y.

This manufacturer has two kits available enabling the construction of 4-channel transceivers. Details not available.

$12.98-19.98 (kits only)

WEBCOR, INC.

5610 W. Bloomingdale Ave., Chicago 39, Ill.

"Micro 350"

9 transistors, 1 diode; superhet receiver; 13 oz.; 5⅜ x 3⅜ x 1⅜; channel 14 (others available).

$99.95 (list)

Noise Elimination

SPRAGUE PRODUCTS CO.

North Adams, Mass.

Type SK-1 "Suppressikit"

Sprague thru-pass capacitors are used in numerous mobile installations to effectively reduce generator and regulator noise. The "Suppressikit" is a new approach to the reduction and suppression of mobile electrical interference. It contains 2 new-style thru-pass capacitors that mount on the generator and armature terminals of the voltage regulator; a third capacitor is mounted under the head of the generator and a fourth at the ignition coil. Contained in the kit is a special wiring harness used to replace the existing connections between the battery, regulator, generator and starter relay.

$18.00 (net)

On the Citizens Band

By **DICK STRIPPEL**, 2W1452

FOR MANY MOONS, Tom Kneitel has been this column's Big CB Chief. But now he has left POPULAR ELECTRONICS for other hunting grounds in the magazine industry. We wish him all the best in his new venture, and at the same time, hope that your new CB editor will fill the post as capably as Tom did.

Remember, this is still your column, and we want to reflect all CB activities. Keep those club bulletins coming, and we'll try to answer correspondence, either in the column, or if necessary, by mail.

Violations. As much as we dislike bringing this up in our first column, we recently read with interest a report that some amateurs had written to the American Radio Relay League asking them to "do something" about the Citizens Band. These amateurs, and there were a large number of them, offered tape recordings to prove violations of rules and requested the ARRL to forward them to the Federal Communications Commission.

The ARRL refused on two points. The first—and this is a point all CB'ers would do well to bear in mind—was that under the Communications Secrecy Act divulging the contents of a two-way conversation is illegal. The second, and the most obvious, was that the ARRL has absolutely no leg to stand on when it comes to CB matters.

We agree that there are times when the 27-mc. band sounds like a can of worms, and this the FCC admits. They are monitoring and sending out violation notices whenever possible. In many cases, license revocations have resulted from FCC monitoring.

The fact of the matter is that we knew what the regulations were when we applied for our licenses. And the FCC seems to have no interest in changing them, which is an honest stand. Let's stop griping about the restrictions so we can keep the band for its intended use —legitimate, short, personal and business communications.

Self-Policing. The idea of taking a page from the amateurs' book and instituting self-policing has come up, and we consider it a good one. The Citizens Radio Association of Burlington (N. J.) has begun a program of sending printed post cards to violators and asking them to stop their unlawful practices for the good of CB radio. This organization is making no effort to turn violators in to the FCC, but just lets them know that others are listening.

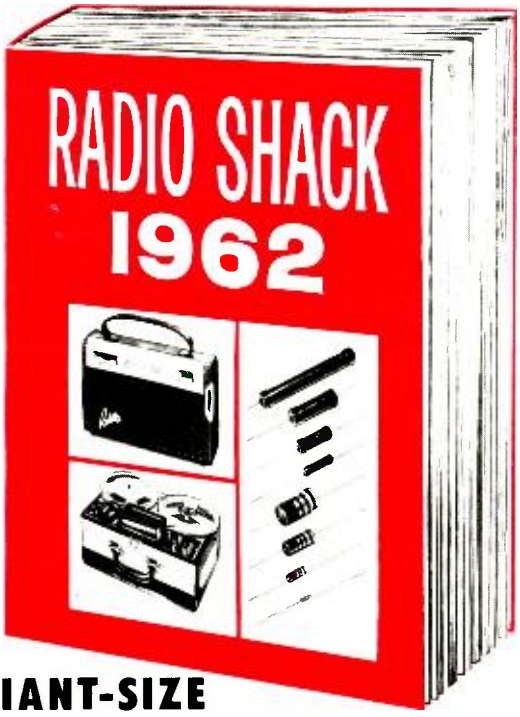
This would be a good project for any club. However, we suggest that before any citation is sent out, a committee should discuss the alleged violation. Remember that there are several circumstances under which some rules do not apply. Also, wording on the citation should be such that it reflects our system of laws which presumes that a person is innocent until proven guilty. A flat-footed accusation could lead to trouble.

Oddly enough, our own travels around the country plus correspondence from other CB operators would seem to indicate that certain areas produce more violations than others, and that these areas are near large cities where the FCC maintains monitoring stations. Also, many of the violations that occur seem to be made by operators who are not the licensees, and who are not controlled properly by the licensees as regulations prescribe.

Club News. We've been receiving lots of mail from CB clubs telling of their activities in the public interest. For example . . . The Wabash Valley Citizens Radio League recently provided coordinating communications for a local Cerebral Palsy fund drive . . . During the spring floods, the North Iowa Citizens Band Club maintained local communications during rescue and disaster work.

(*Continued on page* 119)

IT'S ALL-THE-WAY NEW!
IT'S 2/3 BIGGER THAN LAST YEAR'S
IT'S FROM **RADIO SHACK**
fastest growing electronics company in America



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"Electrostat-2" 2-way Speaker System
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Compare at $99.95!
Realistic 2-speed Tape Recorder
$54.95

Exclusive kit value!

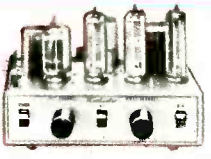
New Realistic Tube Checker Kit
$15.95

Compare it at $49.95!

10-transistor Portable Radio
$29.95

Nat. adv. at $59.95!

Portable 7¼" Power Saw
$29.95



Equals $20 kits!
New Realistic Stereo Amplifier Kit
$10.95

NO MONEY DOWN on any item!

RADIO SHACK CORP.

America's Electronics Headquarters
730 Commonwealth Ave., Boston 17, Mass.

Short-Wave Report

By **HANK BENNETT**
W2PNA/WPE2FT

THE VOICE OF THE ANDES

THE CITY of Quito, Ecuador, located in the Andes Mountains about 10 miles south of the equator and at an altitude of 10,000 feet, is the home of one of the most widely heard short-wave stations in the world: HCJB, *The Voice of the Andes*. A pioneer among missionary broadcasters, HCJB began operations on Christmas Day, 1931. It is now on the air 24 hours a day, seven days a week, on three to five frequencies—depending on the hour.

Eighteen miles east of Quito is the small town of Pifo, where the HCJB transmitters are located. Broadcasts originating in the five different Quito studios are sent via an FM link to Pifo, where they are re-transmitted. Programs are broadcast in Spanish, English, Russian, Swedish, Quechua, Ukrainian, and German.

At Pifo there are five transmitters, two of which are rated in dual service at 60 kw.: one is used on 6050 kc., the other for medium-wave service on 700 kc. The medium-wave station is often reported as being heard evenings in the United States, even at locations well within the range of WLW, Cincinnati, which is also on 700 kc. The other transmitters are used for short-wave service on 17,890, 15,115, 11,915, and 9745 kc. Each transmitter has two r.f. units with common modulator and power supply.

All of the transmitting equipment was designed and built by HCJB engineers and Ecuadorian technicians.

The antenna system consists of nine steel towers which support eight curtain beam arrays as well as two dipole antennas. The tallest tower is 278 feet high and doubles as the long-wave antenna. A single array can be used for both Australia and Europe by merely reversing the directors and reflectors.

Programing at HCJB includes the

Sponsored by the World Radio Missionary Fellowship, HCJB is an international missionary station located at Quito, Ecuador. Its studios (right) are almost on the equator, but Quito's high altitude keeps temperatures low.

"Southern Cross Salute" at 0130-0430 on 15,115, 11,915, 9745, and 6050 kc.; "Morning in the Mountains" at 0900-1130 and "Quito Calling" at 1400-1830, both on 17,890 and 15,115 kc.; and "Ecuadorian Echoes" at 2100-2330 on 15,115, 11,915, and 9745 kc.

During the "Ecuadorian Echoes," you can hear the "DX Party Line," a program devoted to DX'ers and SWL's which is broadcast on the first Monday of each month at 2100 EST. If you wish, you can send in DX items for possible use on this program. Tips, reports, and general correspondence should be addressed to HCJB, International Service Department, P. O. Box 691, Quito, Ecuador.

Short-Wave Monitors may have noticed the new registration certificate which has been in use for the last couple of months. "Colorful" is the best word to describe it—the black type is set on a gold-and-white background with a green border. All new applicants are receiving the new certificate, and old-timers who wish to turn in their old certificates for new ones may do so.

To become a Short-Wave Monitor registered with POPULAR ELECTRONICS or to obtain a new certificate, all you have to do is follow these simple directions:

1 Fill out the form below. (You must be a short-wave listener presently active in the hobby to be eligible for a certificate.)

2 Address an envelope to **yourself**, and put a **four-cent stamp** on it. If you want fast service, use a seven-cent airmail stamp.

3 Dig up 10 cents in coin to cover the cost of the certificate, as well as the handling and registration costs. If you live outside the United States and cannot obtain U.S. coins, either 15 cents in Canadian currency or two International Reply Coupons (IRC's) will do as well.

4 Insert the application form, coins (or IRC's), and stamped, self-addressed envelope in another envelope and mail it to:

Monitor Registration
POPULAR ELECTRONICS
One Park Avenue
New York 16, N.Y.

If you follow steps one through four exactly, your Short-Wave Monitor Certificate will be in the return mail within two weeks. If you already have a certificate that you want to keep, but would like to have a new one as well, be sure to give us your station call sign (WPE.....) when you apply for it.

(*Continued on page* 122)


POPULAR ELECTRONICS

Short-Wave Monitor

Certificate of Registration

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

(Please Print)

Name .....

Address ..... City ..... Zone ..... State .....

Receivers — Make ..... Model .....

Make ..... Model .....

Principal SW Bands Monitored ..... Number of QSL Cards Received .....

Type of Antenna Used .....

Signature ..... Date .....

By
JOHN T. FRYE
W9EGV

Carl and Jerry

Too Lucky

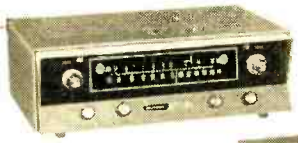
IT WAS A DEAD-CALM humid summer evening, and Carl and Jerry were listlessly tossing a softball back and forth on the latter's front lawn. They stopped playing and watched with interest as a brilliant red convertible rounded the corner on screeching tires, pulled to the curb, and came to an abrupt, teetering halt. A short, wiry, middle-aged man hopped out and strode purposefully toward them across the grass.

"Are you the young fellows who solve problems?" He projected the question ahead of him while he was still a dozen yards away.

"We try—especially if the problem can be solved by electronics," Jerry admitted.

"Well, I don't see how electronics enters into this affair," the little man said as he stopped in front of them; "but people who should know tell me you two are either pretty sharp or mighty fortunate when it comes to unraveling odd-

(*Continued on page* 106)



Introducing a new styling concept in two popular Heathkit Stereo Units

Here's a handsome matching pair for your new Heathkit stereo system! Both have new louvered wrap-arounds of luggage-tan vinyl-clad steel with contrasting charcoal-grey front panels framed with polished aluminum bezels . . . a regal new look to Heath's medium-price stereo line.

HEATHKIT AJ-11 AM/FM TUNER

Successor to the popular AJ-10, this new version features flywheel tuning, two "magic-eye" tuning indicators, adjustable FM automatic frequency control, AM "fidelity" switch for max. selectivity or fidelity, dependable 12 tube circuit, built-in power supply. 21 lbs.

Kit AJ-11 . . . $7 dn., $7 mo. **$69.95**

Assembled AJW-11 . . . $13 dn., $11 mo. **$129.95**

HEATHKIT AA-151 28-WATT STEREO AMPLIFIER

Here's the popular SA-2 model all dressed up in brand-new styling. Delivers 28 hi-fi rated watts (14 per channel) for plenty of power. Has clutched volume controls, ganged tone controls, 4 dual inputs. 28 lbs.

Kit AA-151 . . . $6 dn., $6 mo. **$59.95**

Assembled AAW-151 . . . $12 dn., $11 mo. **$119.95**

can build any Heathkit®!

IGNITION ANALYZER

Switch to primary, secondary, parade or superimposed patterns. See condition of plugs, points, wiring, coil & condenser. Plug-in ID-11 Timing Light available. 15 lbs.

Kit IO-20 . . . $9 dn. **$89.95**

Assembled IOW-20 . . . **$169.95**

NEW TELEPHONE AMPLIFIER!

Hands-free phone chats! Ideal for conferences, dictation, etc. Place handset on cradle, unit turns on, instantly ready! All-transistor: long-lasting battery power. Easy to build. Ivory color.

Kit GD-71 . . . . 4 lbs. . . . **$19.95**

You get guaranteed success with Heathkit!

Never before has a manufacturer of do-it-yourself kits guaranteed your success in completing a project. Heath does so and backs it up with an iron-clad, money-back guarantee! By making this guarantee, we hope to banish any doubt you may have about your ability to build a kit. How is such a guarantee possible? The careful planning that goes into the design of Heathkit equipment revolves around this paramount thought—anyone, regardless of background or experience, must be able to build any Heathkit. This same thought guides the writing of the detailed Heathkit assembly instructions with the world famous "check-by-step" system. These attributes plus the experience of a million customers attests to the fact that anyone can build a Heathkit. Order your favorite Heathkit today. Enjoy top quality equipment with savings of up to 50% and the satisfaction of doing it yourself. Get guaranteed success with Heathkit!

LOW COST DEPTH SOUNDER

Best value in marine electronics. Detects fish, submerged objects, and bottom depth. Big 4¾" dial calibrated from 0-100'. 6-transistor circuit, battery powered. Corrosion & splash-resistant aluminum cab. Transducer included. 9 lbs.

Kit MI-10 $7 dn., $7 mo. **$69.95**

NEW . . . 3-BAND MARINE RDF

Extended coverage and BFO to receive Consolan signals! Covers 188-410 kc Beacon & Consolan, 535-1620 kc Broadcast, 1650-3450 kc Marine band. Loop and "sense" antenna eliminate double null. 10 transistor circuit, battery powered.

Kit MR-11 . . 12 lbs. **$109.95**

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Please send the following items:

Item	Model No.	Price

Order direct by mail or see your Heathkit dealer.

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HEATHKIT

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Carl and Jerry

(*Continued from page* 103)

ball situations, and the situation I'm in is about as odd-ball as they come. The name is Sellers, J. P. Sellers. If we can go somewhere and talk, I'll tell you what's on my mind."

The boys ushered Mr. Sellers into their basement laboratory and sat on the workbench while he perched himself on the edge of the leather-covered couch across from them.

"Did either of you ever hear of a fisherman having too much luck?" he suddenly shot at them.

Jerry and Carl exchanged puzzled glances, then shook their heads with the close unison of windshield wipers.

"I'm not surprised," J. P. sighed. "I didn't think such a thing was possible

myself until a couple of weeks ago, but I know better now. Here's the story:

"I have a cabin cruiser on Lake Segun, about fifty miles north of here. I like to fish, and I've been spending my summer weekends on the boat for the past four or five years. In that time I've become pretty well acquainted with the other 'regulars' at the lake, and a good bit of friendly fishing rivalry has sprung up among us. In fact, we make up a little pool each week for the man who brings in the best string of fish.

"Two weeks ago I went out on the lake a couple of miles, anchored in a likely spot, and prepared to make some casts with my spinning outfit; but before I could wet a line the strangest thing happened. A whole bunch of fish appeared just below the surface in a kind of semicircle around the bow of the boat where I was standing, and began swimming slowly toward me. There were large- and small-mouth bass, sil-

vers, walleye, bluegill, and goodness knows how many other kinds; and every one was a whopper! When they came close, one by one they floated to the top and turned on their sides. Then they just lay there as though they were asking me to take them in.

"Well, as soon as I recovered from my astonishment, I obliged them. I grabbed my dip net, and in five minutes I had scooped up the darndest bunch of fish you ever saw outside of a fishing-lure advertisement. Then, suddenly, the fish that were still floating righted themselves and swam down into the lake, and the others were gone, too.

"You can imagine how I laid it on the fellows at the bait-shack that evening when I collected the weekly pool without a contest. You should have heard them hoot when I told them exactly how I got the fish. They called me a liar right to my face and accused me of using everything from dynamite to curare.

"The next morning when I set out from the dock, at least half a dozen boats tagged along and let their anchors slip as soon as I dropped mine. It was the same crazy business all over again. Almost as soon as I cut my engine, the fish began coming to the surface around the front of the boat and turning on their sides. I can't abide a fish-hog; so I didn't net any of them this time, but you could have raked those other fellows' eyes off with a stick. You'd think they would have apologized for calling me a liar, wouldn't you? Oh, no; not them! They kept demanding that I tell them my 'secret,' and they got mad when I said that I had no secret and didn't understand what was happening any more than they did.

"Last weekend when I was up at the lake they wouldn't let me in the weekly pool. They said 'commercial fishermen' weren't allowed. On top of that, the game warden followed me every time I took the cruiser out. The fish came up around the boat just as before, and he dared me to net one. It seems that catching fish in a dip net, unless they're hooked first, is illegal in this state. Since he hadn't actually seen me take the others in a net, he couldn't do anything about that; but he hinted that if he could prove I was doing something to

the fish to make them act as they did, he'd put me where I wouldn't be doing any fishing."

Mr. Sellers jumped to his feet and strode nervously up and down the basement floor. "There it is," he said. "I can't take much more of this. If you boys will go up to the lake with me tomorrow and find out why the fish act that way around me, and prove to the folks it's nothing I'm doing, I'll pay you a hundred dollars plus your expenses. What do you say?"

The boys exchanged a long look; then Jerry spoke for both: "Understand, we can't promise anything, Mr. Sellers; but we'll certainly give it a try."

"Fine!" J. P. said as he headed for the door; "see you here at seven sharp tomorrow morning."

"At worst," Carl remarked a little later as he juggled the softball from one hand to the other, "we'll at least have a day at the lake."

"Yeah," Jerry agreed; "and at best we'll get fifty bucks apiece. That ought to just about buy our books when we start college next month."

ON THE DOT of seven the next morning the yellow convertible screeched its way to the curb again, and soon J. P. Sellers and the boys were riding through

the sunny, dew-fresh morning. Mr. Sellers handled the long, heavy car expertly, but he drove faster than Jerry or Carl liked, and they were glad when they arrived safe and sound at the lake.

They were not too surprised to find that J. P.'s cabin cruiser was the largest and finest boat on the lake. Before they went on board, J. P. unplugged a heavy cable going to the cruiser from a special socket on the dock. As he did so, a gasoline engine started somewhere in the boat.

"That's a gasoline-powered, 220-volt a.c. generator which takes care of the deep-freezer, the refrigerator, et cetera, when I'm away from the dock," was J. P.'s answer to the boys' questioning looks. "It starts automatically when power from the mains is cut off."

Carl and Jerry helped him cast off and then went forward to the bow of the boat while Mr. Sellers handled the craft from a control position atop the cabin. He drove the boat the same way he did a car: too fast for comfort.

Jerry noticed a wooden 2" x 2" about twelve feet long clamped to the low railing and sticking forward and down into the water. Some kind of a heavily taped object was on the end, and a piece of cable ran back along the wooden pole to a black-crackle metal box that was plugged into an outlet on the deck. One side of the box carried a toggle switch and a pointer knob.

"What's that thing?" Jerry called up to J. P.

"It's a gadget my nephew was experimenting with three or four weeks ago," J. P. shouted above the rhythmic slap-slap-slap of the waves against the speeding hull. "He put a big lamp—I think it was 500 watts at 230 volts—in that socket on the end of the pole and controlled the brilliance of it with some sort of a lamp-dimmer he built into that box. He wants to see if a lamp of just the right brightness, immersed in the water, will attract fish. He's coming back to make some more experiments next week; so I left the gear in place. He'll have to get a new bulb, though. I broke the one that was in there while docking a couple of weeks ago. . . . Say, take that hatchet and stand by to knock the clevis pin from

that chain holding the stern anchor when I give the word."

He cut the motor, and the boat settled in the water. When J. P. nodded, Jerry tapped the pin from the clevis, and the released anchor cable ran out quickly. A gentle breeze from the southeast swung them around so that the sun was at their backs as they looked down from the bow. At first nothing happened, but then they saw some shadows floating up from the bottom. In a few seconds they could make out a whole ring of large fish facing directly toward them. Inch by inch, the fish moved forward.

"I never saw anything like that," Carl breathed. "Jerry, I'm going overboard and get a fish's eye-view of this thing. Maybe the fish can see something about this boat that's invisible to us up here." He peeled off his sweat shirt and trousers as he talked, revealing that he was already wearing his swim trunks.

"Can you swim?" Mr. Sellers asked a bit foolishly.

"Like a paramecium," Carl retorted as he slid out over the stern. Soon he was treading water just outside the closing ring of fish.

"See anything?" Jerry called.

"No, but I think I feel something," Carl said in a puzzled voice. "I seem to

be getting a continuous slight shock. I'm going to swim closer to the boat."

A few strokes brought him almost to the place where the end of the wooden pole was sticking into the water. "It's a lot stronger here," he reported as he reached out a hand for the socket on the end of the pole.

Jerry, who had been watching Carl with a thoughtful look on his face, suddenly sprang into action. With a single movement he brought the sharp edge of

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Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Trouble-shooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

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the hatchet he was still holding down on the cable running across the rail. There was a spurt of blue flame and the hissing snap of short-circuited wires.

"Hey, what are you doing up there?" Carl demanded as he took hold of the end of the pole.

"Probably saving your life," Jerry answered as he stared with a white face at the large half-moon melted from the bit of the hatchet. "Come back on board. The fish are gone, and I think the mystery is about solved."

BY THE TIME Carl got back into the boat, Jerry had taken a screwdriver from his pocket and was removing screws from the unplugged black metal box.

"Uh-huh, I thought so," he said with satisfaction. "These little things are silicon-controlled rectifiers. A silicon-controlled rectifier is a *pnpn* semiconductor with three junctions. In the reverse direction, it acts like a standard silicon rectifier; but it will also block current in the forward direction until either a critical break-over voltage is exceeded or a signal is applied to the third or 'gate' lead. When this happens, the rectifier is almost instantly switched to a heavily conducting state. By adjusting the phasing of a pulsed gating voltage, you can make the rectifier conduct over whatever portion of a half-cycle you like. This, in turn, permits you to regulate the amount of pulsating d.c. flowing through a load circuit, such as a lamp."

"And that thing was turned on, feeding 220 pulsating d.c. volts to the exposed filament support leads of the

broken bulb," Carl said, getting a little pale himself.

"Right. Notice that this toggle switch is shot. It's too light to handle the voltage and current necessary for this lamp-dimmer, and the vibration of the boat kept jarring it on and off. That's why the "charm" suddenly stopped working that day after Mr. Sellers netted all the fish. When you said you felt a slight shock, I started wondering where it could be coming from; and I figured it out just as you reached for the lamp socket. I didn't have time to warn you; so I just cut the wires."

"I don't see what all this has to do with the fish," J. P. broke in.

"The U. S. Fish and Wildlife Service uses pulsating d.c. to capture fish alive," Jerry explained. "They employ a 230-volt d.c. generator whose output is fed into a square-wave pulsing unit. It has been found that 50-cycle pulses are most effective. The positive lead is connected to an aluminum grid electrode held under water in front of a metal boat, and the negative lead is connected to the hull.

"When the apparatus is turned on," Jerry continued, "nearby fish are forced to align themselves in the path of the current with their heads pointing toward the electrode. Each pulse produces a muscular spasm in the fish that forces it to swim ahead. The closer it approaches the electrode, the greater the current. Enough current renders the fish unconscious, and he rises to the top. If he swims too close to the electrode before being knocked out, he's electrocuted."

"And you mean I accidentally had the same sort of apparatus?" J. P. sputtered.

"About the only difference was that you had 60-cycle pulses instead of 50-cycle ones," Jerry remarked; "but that didn't keep your fish-charmer from working."

"Boys, you get the hundred dollars!" J. P. exclaimed happily as he reached up and put a hand on both their shoulders. "Now, let's go back to the bait shack. I want you two to explain all this technical stuff to those dough-heads and to the game warden. They won't believe anything I say. Boy, am I going to enjoy seeing those hard-noses eat crow! Is that all right with you two?"

"A-okay!" Carl said with a happy grin. -30-

Compactron FM Tuner/Receiver

(*Continued from page* 48)

na specified in the Parts List to be used with a jack-top binding post, you'll have to attach a standard banana plug to the whip. In the author's case, a force fit was made between the whip and the plug, although the two could be soldered together.

Hooking It Up. With a pair of headphones plugged in and the whip antenna extended, throw switch *S1* to "on" and allow a few minutes for the tuner/receiver to warm up. Next, turn potentiometer *R7* clockwise until a hissing sound is heard, and then turn the dial over its range. When a station is located, adjust both the dial and the potentiometer until you reach settings which deliver maximum volume with minimum distortion.

If you have trouble obtaining good coverage of the FM band, adjust the inductance of *L2* by stretching the coil or squeezing the turns together, depending on whether you want to decrease or

increase the inductance of the coil.

With the whip antenna shown, good signals should be received from all local FM stations. It is possible to use an outside antenna with the tuner/receiver, of course, but this is not recommended. Even though there is an isolating stage between the antenna terminal and the detector, radiation is still possible, and the use of an outside antenna might prove a nuisance to other FM receiver owners.

Almost any dial can be used on the receiver. The one on the model is a National Type K with a scale carrying a rough calibration glued on the front. In the author's case, after the frequency range was determined, the scale was made by preparing a drawing on tracing paper and using this drawing to make a contact print on single-weight photographic paper. The completed scale was cemented to the dial plate and then sprayed with Krylon.

Be sure to make your scale slightly smaller in diameter than the dial plate so that the rim-drive mechanism can work properly. -30-

Transistor Topics

(*Continued from page* 68)

factory performance, try interchanging *Q1* and *Q3* or substituting other transistors. Since direct coupling is used, transistor leakage currents are somewhat critical and selected units may be needed for best results.

New Semiconductor Device. Combining almost all the advantages of a vacuum tube with those of a conventional transistor, the "field-effect" transistor was originally developed several years ago. However, it remained more or less a laboratory curiosity until the recent announcement of full-scale production by Crystalonics, Inc. (249 Fifth St., Cambridge 42, Mass.).

Like a vacuum tube, the field-effect transistor has a high input impedance and is a voltage- rather than a current-operated device. Its electrical characteristics, for example, closely resemble those of a pentode tube. But like other transistors, this device is extremely rugged, is not subject to microphonic effects, has no filament, and is capable of operating on relatively low voltages.

A semi-pictorial representation of the field-effect transistor is shown in Fig. 5, along with its schematic symbol. The unit itself consists of an *n*-type silicon bar with ohmic contacts made at each end to serve as the "cathode" and "anode" electrodes. A pair of *pn* junctions is formed in the middle of the bar and connected in parallel to act as the "grid."

In operation, a negative bias applied to the grid develops a depletion layer (shown by the dashed lines) from each junction into the bar, increasing the effective resistance between the anode and cathode connections. When the anode-cathode voltage is increased, the grid junctions are reverse-biased by the voltage drop due to anode current. This causes a depletion layer to extend from each junction until the two layers meet. At this point, further increases in anode voltage will not result in any appreciable increase in anode current. This potential is called the "pinch-off voltage."

Field-effect transistors can be used as amplifiers, switches, impedance "converters," choppers, or current limiters.

As amplifiers, they have a typical gain-bandwidth product of 5 mc., but they can be used up to 250 mc. in tuned circuits. As switches, they can provide switching speeds of as low as 10 nanoseconds in properly designed circuits.

Product News. Stancor Electronics Corp. (3501 W. Addison St., Chicago 18, Ill.) has announced nine types of transistor audio transformers, including two 150-mw. units, two 300-mw. types, and five output and driver types handling from ½ to 10 watts. All of them are described in Stancor's Bulletin 581.

The highest frequency germanium transistor ever produced to military specifications has been announced by Motorola Semiconductor Products, Inc. (5005 E. McDowell Rd., Phoenix, Ariz.). Type

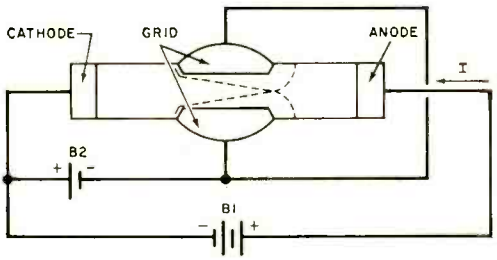
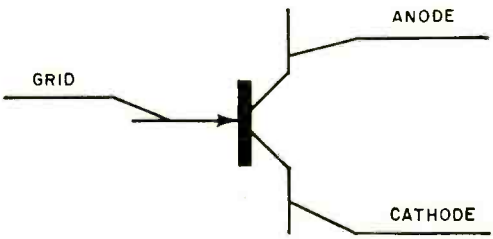


Fig. 5. Pictorial drawing (above) and schematic symbol (below) of new "field-effect" transistor now being produced by Crystalonics of Cambridge.



2N700A will function as an oscillator at frequencies in excess of 1000 mc.

From Raytheon's Semiconductor Division (215 First Ave., Needham, Mass.) comes news of a series of seven new silicon transistors (Types 2N902 through 2N908), claimed to be the first *double-ended* subminiature types available. Two leads extend from one end of each device, a single lead from the other end. Prices range from $8 to $30 per transistor in production quantities.

It's "30" for now, fellows. See you next month . . .

—*Lou*

Capaciquiz Answers

(*Questions on page* 62)

1 True. The voltage to which a capacitor is charged depends upon the density of the electrons on one of its plates. A given number of electrons on a small plate will result in a higher charge density and therefore a higher voltage than the same number of electrons on a larger plate.

2 False. When a tuning capacitor is wide open, there is a minimum of plate area in use and the effective capacitance is therefore at a minimum. The smaller the capacitance in parallel with a given inductance, the higher will be the resonant frequency of the circuit.

3 True. Capacitance varies inversely—but not linearly—with the distance between plates. Putting capacitors with different-sized plates in series not only increases the separation between the outermost plates but also reduces the effective plate area to that of the smallest one.

4 False. The plates of a capacitor are separated by a dielectric material which, being an insulator, prevents the capacitor from passing either a.c. or d.c. current. But the movement of electrons on and off the plates is an effective a.c. current to the lamp, and the lamp lights accordingly.

5 False. A capacitor can be charged to any voltage that does not exceed the breakdown voltage of the dielectric material between its plates. The type of dielectric and its thickness determine the working voltage of a capacitor.

6 True. As the capacitance of a trimmer is small in comparison with that of the main tuning capacitor, during most of the latter's tunable range the trimmer will add little to the total capacitance in use. But at the high end of the band where the main tuning capacitance is at a minimum, the trimmer contributes a larger percentage of the capacity in use.

7 False. Tightening the adjusting screw presses the mica dielectric and metal plates closer together. The thickness of the air dielectric which is also present is thus reduced and the capacitance is thereby increased.

8 True. Even when the voltage present is little more than zero, a large current flows as the capacitor is being charged. At any later time, the voltage built up on the capacitor limits the circuit current to successively smaller values.

9 True. A padder decreases the effective capacitance across the inductance and thus helps in the alignment of an oscillator at the low end of the band. Since it is relatively large, the padder will have increasingly less influence as the capacitance of the main tuning capacitor is decreased.

10 False. As the frequency of the source voltage is increased, there is less time for the electrons to flow on or off the plates. The voltage to which the capacitor can charge therefore decreases.

On the Citizens Band

(*Continued from page* 98)

. . . The Citizens Emergency Network of Baton Rouge, La., holds regular Civil Defense drills and has worked closely with local law-enforcement officials, in addition to helping first-aid workers at L. S. U. football games.

The South Jersey Citizens Radio Club has formulated a complete emergency alert system, setting up radio procedure, channels to be used, and special "12—" signals; other interested clubs may obtain details by writing to them at P. O. Box 99, Stratford, N. J. . . . The Cumberland CB'ers of Fayetteville, N. C., aided Civil Defense authorities during April's nationwide alert—the local CD director is a CB licensee himself. . . . Members of the Apple Valley Citizens Banders Club of Winchester, Va., assisted state police, park rangers and local police during the Harper's Ferry Centennial and the Shenandoah Valley Apple Blossom Festival in late April. Local officials said that their communications net was highly effective.

These and other activities have proven that CB clubs have come of age, and while they can also be a source of friendly recreation, their primary job is to show that the Citizens Band has something to offer the community. Naturally, none of the clubs mentioned above received any remuneration for their work.

Tech Notes. We recently heard several CB'ers discussing how they had modified the "receiver" portion of the Heathkit CB-1 transceiver into a simple one-tube converter feeding a broadcast-band receiver, thus making a double-conversion superhetrodyne. Upon checking standard schematics of pentode mixers and triode oscillators, we found that only a few parts have to be changed or added to achieve this purpose. It might be worth a try for the more advanced electronics experimenters.

After writing the article on achieving maximum performance through the use of field strength meters, dummy loads, etc., (see POPULAR ELECTRONICS, May 1961, p. 58), we had the opportunity to look over a device not mentioned in that story. It's the M. C. Jones "CB Mono-Match." Actually a scaled-down model

of this company's famous "Mono-Match" for high-power transmitters, this unit is designed to be inserted in the line from the transmitter to the antenna. With suitable switching, a meter reads either "forward power" (in watts) or "reflected power" in terms of SWR. The power absorbed from the transmitter is negligible.

If you've worked over your car's ignition system so that it's "quiet" but you're still bothered with other people's noise sneaking through your noise limiter, here's a good trick. Connect a 1N64 diode from the grid of the audio output tube to ground. Before you solder the diode in, however, check for the polarity which produces the best results—it can be different for some sets. The distortion will increase somewhat, but noise peaks will be cut down, and the added distortion seems to make signals more readable. In communications work, we're not striving for "hi-fi"—the idea is to get the message through. -30-

The Trans-Filter

(*Continued from page* 65)

proper polarity when installing capacitor *C1*. The power supply lead is simply a short piece of zip cord running through the grommet on the front panel. Mark the end of the positive wire with red nail polish.

Using the Trans-Filter. To put the unit into service, just connect its input lead to a power supply and hook up the input lead of the device to be powered to jacks *J1* and *J2*—being sure to observe the proper polarity in both cases.

Since the Trans-Filter itself draws negligible current, the power supply ammeter, if present, may be used to read the output current. Because of the filter's internal voltage drop, however, you'll need to connect an external voltmeter across *J1* and *J2* to set the power supply's voltage control for the proper output.

Be careful not to use input voltages of more than 20 volts and not to draw currents of more than 3 amperes continuously. The transistors will deliver a 4-ampere current for about five minutes at a time, but they may be damaged if pushed further. -30-

Across the Ham Bands

(*Continued from page* 61)

News and Views

Jim Casanova, KN9EGI, 200 S. Washington St., Watertown, Wis., has worked only a few states with his 15-watt transmitter and Heathkit AR-3 receiver on 80 and 40 meters, but he's having a lot of fun. Jim is now adding 15-meter coverage to his transmitter. . . . **Larry Wommack, KN5ERQ,** Rt. 1, Rhome, Texas, has been a busy boy in his seven-month Novice career. In addition to obtaining his WAS and a Rag-Chewers Club certificate, he has worked 12 foreign countries. Larry uses a Hallicrafters HT-40 and a Heathkit DX-20 for transmitting and also has two receivers, a Hammarlund HQ-110 and a Heathkit AR-3. His antenna farm sprouts 80- and 40-meter dipoles and a 130' "long wire." . . . **Ashley Spencer, WN4AGT,** 17 Trumbo St., Charleston, S. C., does most of his operating between five and seven in the morning and has made 85 contacts in 16 states, all on 40 meters. His Heathkit DX-40 feeds a 40-meter dipole, and he receives on a Hammarlund HQ-110C. Ashley would like to be nominated to the RCC (Rag-Chewers Club).

Ronnie Conley, KN7LTV, 811 Palmer, Miles City, Montana, with two months to go on his Novice ticket, only had one state—New Mexico—still to work for his WAS when he wrote to us. He keeps 80, 40, and 15 meters hot with his Johnson Ranger transmitter and National NC-303 receiver. Ronnie uses an NC-109 receiver as a monitor! Although constantly "rotating the crops" on his antenna farm, at the moment he has an 80-meter dipole, two 40-meter dipoles, a 15-meter dipole, a 1-element 15-meter beam, and a "long wire." Sked Ronnie for the RCC or a Montana contact. He will be glad to help local prospective hams earn their tickets. . . . **Chuck Salmon, WN4AAA,** 4 Richards Ave., Winchester, Va., has a call that most old-timers would envy. In three months, he has worked 33 states and Canada, mostly on 40 meters. He transmits on an EICO 720 feeding a 40-meter folded dipole antenna, and receives on a surplus BC-342 receiver. Chuck has built several of our construction projects, is a member of the RCC, and QSL's 100%. . . . **Daniel S. Nardo, W3QEK,** 912 Dorothea St., Baden, Pa., proves again the saying that "once a ham, always a ham." Previously active from 1937 to 1941, he is now back on the air with his 1937 R.M.E.-69 receiver and a Heathkit DX-100B transmitter feeding an 80-meter antenna. Dan has lots of fun on 80- and 40-meter c.w. And, after the band goes dead at night, he

SPACE ELECTRONICS

The "Space Electronics" column has been dropped from this issue to make room for the CB Equipment Catalog. The next installment will appear in the September issue.

likes working "ground-wave" up to 50 miles on 15-meter phone.

Bob Alsaker, WV6NTQ, 7977 Vista Del Roas, Downey, Calif., needs Maine and South Dakota for his WAS. In eight months as a Novice, he has also worked 15 foreign countries, and his record includes 17 contacts with Hawaii. A Johnson Adventurer running 50 watts and a home-built 4-watter do Bob's transmitting via a 40-meter folded dipole and a 1-element, 15-meter beam. He receives on a Hallicrafters SX-71, plus a Gonset converter. . . . **Gary Brown, WV2ROV,** 529 Morgan Parkway, Hamburg, N. Y., works c. w. by day and phone by night. His phone rig is a converted BC-522 feeding a vertical antenna on 2 meters, and a souped-up Heathkit AT-1 handles his c.w. work on 40 meters. A Hallicrafters S-85 takes care of the receiving, helped along by a home-built converter on 2 meters.

Dan Ditto, WØCMI, 3 Gocke Place, Overland 14, Mo., who has been a Technician for two months, operates on 6 meters with a Heathkit "Sixer" feeding a 5-element Hi-Gain antenna. When not operating, Dan likes to modify his equipment; so you other "Sixer" users may want to exchange modification notes with him. . . . **Paul L. Talley, K5COH/6,** 1942 San Diego Ave., San Diego 1, Calif., spent his seven-month Novice career in Orange, Texas, where his Knight T-50 transmitter and Hallicrafters S-38E receiver—feeding either a 20′ vertical or a 40-meter dipole—accounted for 34 states. Paul operates on all bands from 40 through 2 meters. He is now waiting for his sixth call area call letters to come through.

Remember that all Novices are eligible to try for the free subscription to POPULAR ELECTRONICS we award each month for the best Novice station picture published. Also, I am always looking for your News and Views, suggestions, and other interesting pictures of you and your station. Address all *Across the Ham Bands* letters and contributions to: Herb S. Brier, W9EGQ, P. O. Box 678, Gary, Ind. 73.

Herb, W9EGQ

Short-Wave Report

(*Continued from page* 102)

CURRENT STATION REPORTS

Here is a résumé of the current station reports. All times shown are Eastern Standard and the 24-hour system is used. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. Please send all reports to P. O. Box 254, Haddonfield, N. J., in time to reach your Short-Wave Editor by the eighth of each month.

Angola—*Emissora Oficial de Angola,* Luanda, has moved from 17,795 to 17,705 kc. for

its Portuguese xmsn at 1600-1730. A newscast is given at 1715. *(WPE6BPN, WPE6UK)*

Australia—VLQ9, Brisbane, 9660 kc., operates in the Home and Regional Service and is heard well at 0200-0430 in Eng. with children's programs, music, and talks. A three-note gong signal is given before the ID. *(WPEØAE, VE5PE2D)*

Bolivia—CP30, *R. Libertad*, Santa Cruz de la Sierra, has moved from 6235 to 6308 kc. but is announcing as 6345 kc. It was noted around 1920 with L.A. music and commercials. Don't confuse this station with *R. Santiago*, 6312 kc., or *R. Miraflores*, 6316 kc. A new station, *R. Pio XII*, Siglo XX, (Dep. de Potosi), on 5958 kc., has been tuned from 2035 with sports results, music, and religious talks, all-Spanish. *(PY2PE1C)*

Cambodia—*R. Cambodia*, Phnom-Penh, has Eng. news scheduled on 6090 and 7183 kc. at 0115-0130; news in Thai follows. *(VE7PE2M)*

Canada—The Eng. service on schedule #35 from Montreal reads: to Australian areas daily at 0325-0405 on 9630 kc.; to Europe at 0700-0730 (Monday through Saturday; Sundays only to 0715) and at 1030-1045 daily on 17,820 and 15,320 kc., and news to ships and armed forces at 1200-1215 daily on the same channels (more Eng. is aired at 1230-1415 to Africa, and at 1545-1630 in the second European xmsn, also on 17,820 and 15,320 kc.); to the Caribbean and Latin American areas at 1800-1830 on 15,190 and 11,760 kc.; to East and Central Northern Canada at 1700-1745, and to Central and Western portions at 2000-0210 on 11,720 and 9585 kc. *(WPE2BYZ, WPE2EQI, WPE4CIR, WPE9CHH, WPEØBDW, WPEØBOQ, VE3PE6D, AW, CBC)*

SHORT-WAVE ABBREVIATIONS

B/C—Broadcasting	mc.—Megacycles
Eng.—English	N.A.—North America
FM—Frequency modulation	R.—Radio
ID—Identification	s/off—Sign-off
kc.—Kilocycles	VOA—Voice of America
kw.—Kilowatts	xmsn—Transmission
L.A.—Latin America	xmtr—Transmitter

Chatham Islands—ZLC, Chatham Islands B/C Service, Waitangi, broadcasts daily on 2196 kc., with local news and ship arrivals from New Zealand in Eng. at 0445. This one is an extremely good catch. *(VE7PE2M)*

Chile—CE970, *R. Vitalicia*, Santiago, 9700 kc., is tuned at 1900-1945, and CE1174, *R. Nuevo Mundo*, Santiago, 11,740 kc., is heard at 1915-2015; both with all-Spanish programs of L.A. music and many commercials. *(WPEØAE)*

Colombia—HJEF, Cali, 4765 kc., is strong to past 0000 with a new slogan, "R.C.O. La Radio Melodia de Cali." The commercials are distorted and the general format indicates that this station may possibly be using new automatic equipment. *(WPE5JH)*

Cook Islands—Rarotonga is operating on a new frequency of 9695 kc. at 1400-1430. *(WPEØEW)*

Costa Rica—TIGPH, *R. Monumental*, San Jose, has moved from 6150 kc. to 6230 kc., where it is heard from 1830 to 0100 s/off with

all-Spanish music and commercials. At times it carries baseball from *Union Radio*, Managua, Nicaragua. Reports are said to be acknowledged between 1830 and 1900. *(WPE5JH, WPE6BPN, KP4PE1G, VE7PE1R, CB)*

Cuba—*Aqui La Onda Corta Experimental Cubana* has been noted on 21,630 kc. at 1208-1223 and 1257-1317 (Sundays) in Eng. and at 1530 in Spanish with talks. This is apparently a new outlet, dual to the 11,765-kc. outlet. Reports go to P. O. Box 7026, Havana. *(WPE1CR, WPE4BC)*

Dominican Republic—*R. Caribe* operates on 3322, 6210, 9485, and 15,055 kc., and on 96 and 105 mc. FM. It is heard well evenings on 9485 kc. The 15,055-kc. outlet now closes at 2245 instead of the listed 1945. Programs are in Spanish, with ID in Spanish, French, and English. *(WPE2ABX, WPE3BIK, WPE6BPO, WPE9CQN, WPEØATE, VE3PE1DK)*

Ecuador—HCCR1, *R. La Casa de la Cultura*, Quito, 4930 kc., was tuned and verified at 2004-2025. They will be increasing the power to 10 kw. in the near future. *(PY2PE1C)*

England—Here is the latest schedule from London: to N.A. at 0900-1200 on 15,310 kc. (also from 1100 on 17,860 kc.); to the Caribbean at 1715-1845 on 21,550, 17,870, and 15,140 kc.; in Portuguese to Brazil at 1800-1915 on 15,260 kc. (north of the Amazon) and on 17,890, 15,260, and 11,930 kc. (south of the Amazon); in Spanish to South America (south of the Amazon, except Peru) at 1800-1930 on 15,435, 17,790, and 11,780 kc.; to other areas of South America, Central America, and to Caribbean areas at 2000-2130 on 15,435 and 11,750 kc.; to Mexico at 2000-2130 on 11,780 kc. The General Overseas Service broadcasts to Canada, U.S., and Mexico at 1615-1745 on 17,790 kc. (and to 1930 on 15,375 kc.), and at 1745-2200 on 11,860 kc. (also from 1800 on 12,095 kc. and from 1930 on 9510 kc.); to the West Indies, Central America, South America (north of the Amazon, except Peru) at 1500-1715 on 21,550 kc. (also from 1615 on 17,870 kc. and from 1700 on 15,140 kc.), at 1745-1845 on 17,870 kc. (and to 2200 on 15,070 kc.), and at 1845-2200 on 12,040 and 11,820 kc.; to other areas of South America at 1500-1930 on 17,740 kc., at 1615-2200 on 15,110 kc., and at 1800-2200 on 12,040 kc.; to southern Georgia at 1715-1745 on 11,750 kc. and at 1715-1930 on 7230 kc.; to S. E. Asia, India, Pakistan, and Ceylon at 1800-1815, 1900-1930, and 2045-2115 on 11,800 and 9765 kc. *(WPE1CEA, WPE3NB, WPE4CON, WPEØBDW)*

France—Paris has a new Eng. program at 1500-1600 on 6145 kc. *(WPE2AXS)*

Ghana—Accra has been heard giving test xmsns at 1800 with news on 11,797 kc. *(WPE6BPN)*

Greece—A new xmtr may be built by VOA having 150-kw. power. Probable languages to be used are Eng., Swahili, Hungarian, Bulgarian, Russian, and Polish. *(WPE9ABH)*

Guatemala—*R. Nuevo Mundo* has apparently opened a new outlet on 7664 kc., dual to 5990 kc. It has been noted from 2221 with a football game, and as late as 0030 with L.A. music, commercials, and countless ID's. *(PY2PE1C)*

Honduras—HRLC, *R. Continental*, is now

on 4770 kc. and is strong until 2330 s/off. It is located at San Pedro Sula. *(WPE4BMR, WPE5JH)*

HRQN, *La Voz del Atlantico*, 4905 kc., lists its schedule as 0755-1500 and 1655-2300 with an outlet on 4880 kc., although it is believed that this latter channel is no longer in use. *(WPE4BMR)*

Italy—Rome has resumed use of 11,905 kc. (replacing 6010 kc. and dual to 9575 kc.) at 1930-1950 and 2205-2225 in Eng. to N.A. with news and music. They are asking for letters with musical requests to be sent to P.O. Box 320, Rome. A late report indicates that the 9575-kc. channel has been replaced by 15,400 kc. *(WPE1AZL, WPE4AVW, WPE4BNW, WPE5AVL, WPE5BCR, WPE8CCS, WPE8COJ, WPE9AGB, CB2, RD, JG, HM)*

Ivory Coast—Abidjan has been noted on 11,820 kc. at 1345-1415 in Eng., with news at 1400; at 1500-1600, from 1715 to 1832 s/off, and from 0130 to 0300 s/off in French with news at 1730, 0200, and 0230. The "William Tell Overture" is played frequently. The ID is given as *Ici Radio-diffusion Cote Ivoire (ee-vwahr). (WPE8AIJ, WPE8FV, WPEØAE, VE2PE1H, BL)*

Jordan—Amman is operating regularly to Europe and N.A. at 2015-2045 in Eng. and to 2215 in Arabic on 7155 kc. The Arabic ID, *Huna Amman*, is easy to catch. Reports go to P. O. Box 909, Amman, Jordan. *(WPE1AYB, WPE1BDE, WPE1KO, WPE2ABX, WPE2CVH, WPE2DTO, WPE3BAR, WPE3BFC, WPE3BIK, WPE5SW, WPE6BPO, WPE8AIJ, BB)*

Kuwait—Kuwait B/C Service has daily Arabic programs at 1830-2300 and 0100-1315 on 4967.5 kc. The power has been increased to 10 kw. and a further rise to 50 kw. is expected during 1961. *(VE7PE2M)*

Lebanon—Beyrouth, on 8036 kc., carries Arabic at 2130-0000, 0230-0625, and 0700-1400. A new 100-kw. xmtr may be on the air by now. *(VE7PE2M)*

Liberia—The VOA is constructing new xmtrs near Monrovia which are expected to be on the air in 1962. Languages to be used will include Eng., Swahili, Portuguese, French, and numerous native dialects. *(WPE4CJQ, WPE9ABH)*

Malaya—*R. Singapore* has Eng. news at 1930 on 4820 kc. The full schedule reads: 1730-1130. *(WPEØEW)*

Mali Republic—*R. Mali*, Bamako, has moved from 7075 to 7138 kc. where it has been noted from 0145 to 0303 s/off in French. News bulletins in French are given at 0255. *(WPEØAE)*

Monaco—*Norea Radio* xmsns (the Swedish xmsns from *Trans-World Radio*, Monte Carlo) are aired at 1300 on 9690 kc. Reports should be sent to Tegnergatan 34, Stockholm, Sweden. *(WPE2AXS)*

Netherlands—Hilversum has replaced 17,775 kc. with 17,810 kc., dual to 15,425 kc., at 1430-1520 to Africa and Europe. The N.A. xmsn reads: 1630-1720 on 15,220 and 11,730 kc., and 2030-2120 on 11,730 and 6025 kc. The "Happy Station" program is beamed to the United States on Sundays at 2100-2230 on 9590 and 6025 kc. *(WPE1CHS, WPE2BRH, WPE2CKI, WPE2EMN, WPE2FAH,*

SHORT-WAVE CONTRIBUTORS

Walter Lenk *(WPE1AYB)*, Wellesley Hills, Mass.
Stephen Ray *(WPE1AZL)*, Stoneham, Mass.
Roger Demers *(WPE1BDE)*, Springfield, Vt.
Laimutis Tamosaitis *(WPE1BWZ)*, S. Boston, Mass.
Fred Wasti *(WPE1CEA)*, Brockton, Mass.
Thomas Cardullo III *(WPE1CHS)*, Somerville, Mass.
Jim O'Mara *(WPE1CR)*, S. Boston, Mass.
Edward Bowker *(WPE1KO)*, Keene, N. H.
Joe Brown *(WPE2ABX)*, Endicott, N. Y.
Robert Newhart *(WPE2AXS)*, Merchantville, N. J.
Albert Mencher *(WPE2BRH)*, Bayside, N. Y.
Irwin Belofsky *(WPE2B1Z)*, Brooklyn, N. Y.
Thomas Campanile *(WPE2CKI)*, Brooklyn, N. Y.
Philip Wittlin *(WPE2CVH)*, Flushing, N. Y.
Ronnie Breiger *(WPE2DTO)*, Englewood, N. J.
Philip Sterdt *(WPE2DWN)*, Bronx, N. Y.
John Kiernan *(WPE2EMN)*, New York, N. Y.
Michael Bender *(WPE2EQI)*, New Paltz, N. Y.
Henry Klinck *(WPE2FAH)*, Buffalo, N. Y.
Andy Schneit *(WPE2FAS)*, East Rockaway, N. Y.
Joseph Clawson, Jr. *(WPE3BAR)*, Tarentum, Pa.
Samuel Marsh *(WPE3BCM)*, Baltimore, Md.
Don Ruokonen *(WPE3BFC)*, Baltimore, Md.
Charles Craft *(WPE3BIK)*, Lansdale, Pa.
William Clark *(WPE3CEA)*, Punxsutawney, Pa.
John Wilson *(WPE3NB)*, Wilmington, Del.
Robert Colegrove *(WPE4AVW)*, Silver Spring, Md.
Grady Ferguson *(WPE4BC)*, Charlotte, N. C.
Johnny Futch *(WPE4BMR)*, Nashville, Ga.
James Poore *(WPE4BNW)*, Byrdstown, Tenn.
William Pate, Jr. *(WPE4CIR)*, Lawrenceville, Ga.
Lewis Cheek *(WPE4CJQ)*, Beaufort, S. C.
Geoffrey Ashford *(WPE4CON)*, Raleigh, N. C.
R. E. Todd *(WPE4CXH)*, Falls Church, Va.
Paul Moratto *(WPE5AVL)*, League City, Texas
Robert Himburg *(WPE5BCR)*, Seabrook, Texas
John Callarman *(WPE5IH)*, Canyon, Texas
Charles Bennett *(WPE5SW)*, Sumrall, Miss.
Dennis Nunez *(WPE6AXD)*, Del Paso Heights, Calif.
Shaler Hanisch *(WPE6BPN)*, Pasadena, Calif.
Bob Chamberlain *(WPE6BPO)*, Los Angeles, Calif.
Matt Collins *(WPE6BZM)*, Los Angeles, Calif.
Carlon Tanner *(WPE6UK)*, Monterey, Calif.
David Hillenbrand *(WPE8AIJ)*, Columbus, Ohio
Lee Arp *(WPE8BMR)*, Conneaut, Ohio
Larry Bassett *(WPE8CAU)*, Royal Oak, Mich.
Fred Wolff *(WPE8CAV)*, Sandusky, Ohio
James McGraw *(WPE8CCS)*, Steubenville, Ohio
Jess Dyer *(WPE8COJ)*, Dearborn, Mich.
Mike Eisenstot *(WPE8CPB)*, Youngstown, Ohio
John Fridenstine *(WPE8CPH)*, Oberlin, Ohio
Trevor Hilfer *(WPE8CUK)*, Maple Heights, Ohio
Richard England *(WPE8FV)*, Columbus, Ohio
Dan Wilt *(WPE8HF)*, Ingleside, Calif.
David Gants *(WPE9ABH)*, Decatur, Ill.
Earl Kinmonth *(WPE9AGB)*, Joliet, Ill.
John Paschkewitz *(WPE9CHH)*, Stoughton, Wis.
Jerome Long *(WPE9CNR)*, Milwaukee, Wis.
Heimo Kraemer *(WPE9CQN)*, Mundelein, Ill.
Robert Frey *(WPE9IP)*, Niles, Ill.
John Beaver, Sr. *(WPEØAE)*, Pueblo, Colo.
Bill Holscher *(WPEØATE)*, Webster Groves, Mo.
Richard Adamson *(WPEØBDIW)*, Trimont, Minn.
Greg Palfe *(WPEØBOQ)*, St. Paul, Minn.
James Howard *(WPEØEW)*, Kansas City, Mo.
Hector Davila *(KP4PE1G)*, Bayamon, P. R.
Giacomo Perolo *(PY2PE1C)*, Bauru, Brazil
Gregg Calkin *(VE1PE3L)*, Saint John, N. B.
Roy Geldart *(VE1PE3Q)*, Sussex, N. B.
Donald Druick *(VE2PE1H)*, Montreal, Que.
Greg Douglas *(VE3PE1DK)*, Woodville, Ont.
Mike Ligeza *(VE3PE1EX)*, Scarboro, Ont.
Donald Golding *(VE3PE6D)*, Oshawa, Ont.
Jim Tomkins *(VE5PE2D)*, Regina, Sask.
David Bennett *(VE7PE1R)*, Richmond, B. C.
Richard Laviolette *(VE7PE2M)*, Richmond, B. C.
Benjamin Braude *(BB)*, Providence, R. I.
Charles Boehnke *(CB)*, Reno, Nevada
Charles Beauchesne *(CB2)*, N. Andover, Mass.
Joseph Brown *(JB)*, Chicago Heights, Ill.
Richard Derrickson *(RD)*, Alexandria, Va.
James Ekblom *(JE)*, Williamsport, Pa.
James Greiner *(JG)*, La Jolla, Calif.
Jean Howard *(JH)*, APO, New York, N. Y.
Bill Lund *(BL)*, Manhattan Beach, Calif.
Charlie Mink *(CM)*, Bricktown, N. J.
Henry Marbach *(HM)*, White Plains, N. Y.
William Meyers *(WM)*, Duluth, Minn.
Edward Schmall *(ES)*, Whitestone, N. Y.
Arthur White *(AIW)*, Pittsburgh, Pa.
Canadian Broadcasting Corp. *(CBC)*, Montreal, Que.
Swiss Broadcasting Corp. *(SBC)*, Berne, Switzerland
R. Sweden, Stockholm, Sweden

WPE2FAS, WPE3CEX, WPE4CON, WPE8BMR, WPE8CAU, WPE8HF, WPE9AGB, WPEØAE, JB, WM, ES)

Norway—*R. Norway*, Olso, operates to N.A., the North Atlantic and Caribbean areas with "For Norwegians Abroad" in Norwegian at 2000-2120, and with "Norway This Week" in Eng. on Sundays only at 2100-2125 on 15,175, 11,850, 9610, and 6130 kc. *(WPE2DTO, WPE2DWN, WPE3BCM, WPE8CPH, VE1PE3Q, JH, BL)*

Panama—HP5H, *R. La Voz del Pueblo*, Panama City, is again active on 6121 kc. and was tuned from 2115 to 2210 s/off with political talks, Italian songs, and commercials. *(PY2PE1C)*

Paraguay—*R. Teleco*, Asuncion, 11,850 kc., has been noted at 1904-2011 Sundays in Spanish. Their schedule reads: 0400-2220. *(WPE1CR)*

Peru—*R. Junin*, Huancayo, has moved from 3300 to 4695 kc., where it is heard fair to poor at 2130-2334. *(WPE2AXS)*

OAX4W, *R. America*, Lima, 9455 kc., has Eng. at 1800-1830 on Saturdays only. *(CB)*

Sweden—English is aired from Stockholm as follows: at 0730-0800 to the Far East on 17,845 and 15,420 kc.; at 0945-1015 to South Asia on 17,845 and 15,240 kc.; at 1115-1145 to the Middle East on 15,240 and 11,705 kc.; at 1245-1315 to Africa on 15,240 kc.; at 1445-1515 to Africa on 11,705 kc.; and to Europe at 1530-1600 on 7210 kc. The American programs are broadcast at 2215 to West N.A. and at 0900 and 2045 to East N.A. on 11.805 and 17,840 kc. *(WPE2DTO, WPE3CEX, WPE4AVW, WPE4CXH, WPE6BZM, WPE9IP, R. Sweden)*

Switzerland—English from Berne is broadcast as follows: at 0215-0400 to E. Australia and New Zealand and at 0400-0445 to W. Australia and the Far East on 11,865, 15,315. and 21,605 kc.; at 0745-0930 to S. E. Asia and Japan on 17,720, 15.315, and 11,865 kc.; at 0945-1130 to India and Pakistan on 17,795, 15,315, and 11,865 kc.; at 1145-1330 to the Middle East on 15.315, 11,865, and 9665 kc.; at 1345-1530 to the United Kingdom and Ireland on 7210 and 9545 kc.; at 2030-2215 and 2315-0000 to N.A. on 11,865, 9535, and 6165 kc.; and at 0500-0545 to Africa on 15,315, 17,720, and 21,520 kc. (also 0945-1130 on 17,720 kc.). *(WPE1BWZ, WPE2BRH, WPE3CEX, WPE4BNW, WPE5AVL, WPE6AXD, WPE8CAV, WPE8CPB, WPE8CUK, WPE9CQN, VE1PE3L, VE5PE2D, CM, SBC)*

Turkey—Changes in Ankara's schedule: broadcasts in Turkish at 0600-0700 and 1100-1115, Arabic at 0000-0045, 1030-1100, and 1230-1300, and Persian at 0830-0845 and 1000-1030 are now all scheduled on 17,820 kc. rather than 9515 kc. English is still beamed to Asia at 0845-0915 on 17,820 kc., to Europe at 1645-1730 on 7285 kc., and to N.A. at 1815-1900 on 9515 kc. *(WPE2DTO, WPE9CNR, VE3PE1EX, VE7PE2M, JE, JH, HM)*

Uruguay—CXA19, *R. Sport*, Montevideo, 11,835 kc. has an Eng. language program at 1400-1415 on Sundays only. *(CB)*

Venezuela—*R. Continente* is the ID used by *La Voz del Tigre* on 3255 kc. It was heard at 2130 with news. *(WPE4BMR)* —30—

POPULAR ELECTRONICS

August 1961

Advertisers' Index

Transistorized P.A. System

(*Continued from page* 58)

All screws and bolts are countersunk in the plywood to insure a smooth undersurface. And finally, small wooden blocks are cemented inside the case to "lock" the base in position when the case is closed.

OPERATION

With the assembly work completed, the system should be given an overall check. First, connect the speakers, power source, and microphone. Place the speaker/baffle assemblies about 10′ to 12′ to each side of the microphone, turn the unit on, and adjust the gain level while speaking into the microphone. Use a speaking voice slightly louder than normal and hold the mike reasonably close to your lips, but not so close as to muffle the sound.

If the system works properly, fine! Squealing may occur at full gain, but this is to be expected due to acoustic feedback. However, if squealing occurs with the gain turned down—or if the system is "dead"—you have either a defective component or an error in wiring. Double-check your amplifier and all interconnecting wiring.

The amplifier is designed so that either one or both speakers can be used. In a typical installation, the speaker/baffles should be placed on each side and slightly ahead of the microphone and should face the audience; normal speaker separation will be from 15′ to 40′, depending on the size of the room (or area) in which the system is used. To minimize acoustic feedback and squealing (oscillation), the announcer should speak reasonably close to the microphone in a slightly louder than normal voice, with the gain control advanced *only as far as* necessary. Don't use excessive gain or try to pick up whispers.

Since the amplifier is transistorized, no "warm-up" time is needed; the system is ready for use as soon as the power switch is thrown "on." For this reason, there is no need to keep the system "on" when it is not actually in use—you can conserve your batteries by switching it "off" whenever there is a break in the program. -30-

ELECTRONICS MARKET PLACE

RATE: 60¢ per word. Minimum 10 words prepaid. October issue closes August 10th. Send order and remittance to Martin Lincoln, POPULAR ELECTRONICS, 1 Park Ave., New York 16, N. Y.

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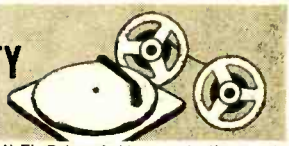

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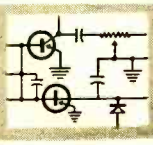

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	1J3	.79		6BD6	.51		12AT6	.43
	1K3	.79		6BE6	.55		12AT7	.76
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	3BA6	.51		6BQ7	1.00		12BE6	.53
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	3BN6	.76		6BY6	.54		12BL6	.56
	3BU8	.78		6BZ6	.55		12BQ6	1.06
	3BY6	.55		6BZ7	1.01		12BY7	.77
	3BZ6	.55		6C4	.43		12BZ7	.75
	3CB6	.54		6CB6	.55		12C5	.56
	3CF6	.60		6CD6	1.42		12CN5	.56
	3CS6	.52		6CF6	.64		12CR6	.54
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	5V6	.56		6W4	.60		17W6	.70
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	5Y3	.46		6X4	.39		19BG6	1.39
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	6AL5	.47		8AW8	.93		25DN6	1.42
	6AM8	.78		8BQ5	.60		25EH5	.55
	6AQ5	.53		8CG7	.62		25L6	.57
	6AR5	.55		8CM7	.68		25W4	.68
	6AS5	.60		8CN7	.97		25Z6	.66
	6AT6	.43		8CX8	.93		35C5	.51
	6AT8	.79		8EB8	.94		35L6	.57
	6AU4	.82		11CY7	.75		35W4	.42
	6AU6	.52		12A4	.60		35Z5GT	.60
	6AU7	.61		12AB5	.55		50B5	.60
	6AU8	.87		12AC6	.49		50C5	.53
	6AV6	.41		12AD6	.57		50DC4	.37
	6AW8	.90		12AE6	.43		50EH5	.55
	6AX4	.66		12AF3	.73		50L6	.61
							117Z3	.61

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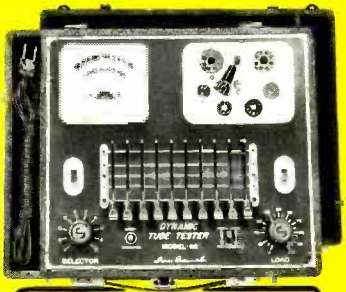
Superior's New Model 85—*a DYNAMIC type* **TRANS-CONDUCTANCE**

TUBE TESTER



Model 85—Trans-Conductance Tube Tester. Total Price—$52.50.
Terms: $12.50 after 10 day trial, then $8.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

● Employs latest improved TRANS-CONDUCTANCE circuit. Tests tubes under "dynamic" (simulated) operating conditions. An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured as a function of tube quality. This provides the most suitable method of simulating the manner in which tubes actually operate in radio, TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.

● **SYMBOL REFERENCES:** For the first time ever in a trans-conductance tube tester, Model 85 employs time-saving symbols (★, +, ●, ▲, ■, ◗) in place of difficult-to-remember letters previously used. Repeated time studies proved to us that use of these scientifically selected symbols speeded up the element switching step. As the tube manufacturers increase the release of new tube types, this time-saving feature becomes more necessary and advantageous.

● **THE "FREE-POINT" LEVER TYPE ELEMENT SWITCH ASSEMBLY** marked according to RETMA basing, permits application of test voltages to any of the elements of a tube. The addition of an extra switch position permits the application of the necessary grid voltage needed for dynamic testing and insures against possible obsolescence due to changes in basing design.

● **NEW IMPROVED TYPE METER** with *sealed air-damping chamber* provides accurate, *vibrationless* readings.

● **FREE FIVE (5) YEAR CHART DATA SERVICE.** The chart provided with Model 85 includes easy-to-read listings for *over 1,000 modern tube types*. Revised up-to-date subsequent charts will be mailed to all Model 85 purchasers *at no charge* for a period of five years after date of purchase.

● **SPRING RETURN SAFETY SWITCH** guards Model 85 against burn-out if tube under test is "shorted."

● **7 AND 9 PIN TUBE STRAIGHTENERS** have been included on the front panel to eliminate possibility of damaging tubes with bent or out-of-line pins.

● **AN ULTRA-SENSITIVE CIRCUIT** is used to test for shorts and leakages up to 5 megohms between *all* tube elements.

Model 85 comes complete, housed in a handsome portable cabinet with slip-on cover. Only..... **$52.50**

Superior's New Model 77

VACUUM TUBE VOLTMETER

WITH NEW 6" FULL-VIEW METER

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

Model 77—VACUUM TUBE VOLTMETER... Total Price.....$42.50
Terms: $12.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise, return, no explanation necessary.

• Extra large meter scale enables us to print all calibrations in large easy-to-read type.

• Employs a 12AU7 as D. C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability. • Meter is virtually burn-out proof. The sensitive 400 micro-ampere meter is isolated from the measuring circuit by a balanced push-pull amplifier. • Uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

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

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

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

SPECIFICATIONS

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

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

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

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

SEE OTHER SIDE

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MOSS ELECTRONIC, INC.
Dept. D-892 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after a 10 day trial positively cancelling all further obligation.

☐ **Model 77 Total Price $42.50** $12.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ **Model 85 .....Total Price $52.50** $12.50 within 10 days. Balance $8.00 monthly for 5 months.

☐ **Model TV-50A ..Total Price $47.50** $11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ **Model 70...Total Price $15.85** $3.85 within 10 days. Balance $4.00 monthly for 3 months.

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All prices net, F.O.B., N. Y. C.

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Superior's New Model 70 UTILITY TESTER®

FOR REPAIRING ALL ELECTRICAL APPLIANCES and AUTOMOBILE CIRCUITS

Model 70—UTILITY TESTER
Total Price...$15.85—
Terms: $3.85 after 10 day trial, then $4.00 monthly for 3 months, if satisfactory. Otherwise return, no explanation necessary.

As an electrical trouble shooter the Model 70:

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

As an Automotive Tester the Model 70 will test:

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

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

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

Model 70 comes complete with 64 page book and test leads

Only $15.85

Superior's New Model TV-50A **GENOMETER**

7 Signal Generators in One!

Model TV50-A—Genometer
Total Price $47.50
Terms: $11.50 after 10 day trial, then $6.00 monthly for 6 months if satisfactory. Otherwise return, no explanation necessary.

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

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

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

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

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

MARKER GENERATOR: The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency)

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

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

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

Complete with shielded leads

$47.50 Net

TRY FOR 10 DAYS

BEFORE you buy! ***THEN*** if satisfactory pay in easy, interest free, monthly payments. See coupon inside.

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

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

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