BUILD ONE-TUBE POLICE RECEIVER

POPULAR ELECTRONICS

SEPTEMBER 1961

35 CENTS

SPECIAL: Editors Report on the

RADAR SPEED TRAP DETECTOR

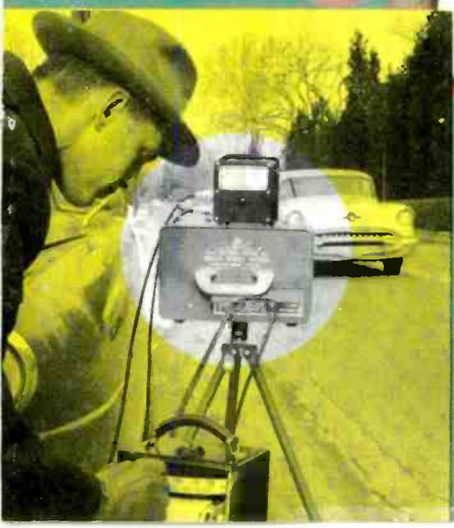
(see p. 49)

Transistorized Voltmeter

Hi-Fi FM Tuner

Photoelectric Control

Cathode Modulator



CB'ers

EASY 100% Modulation CHECKER (p. 53)

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.

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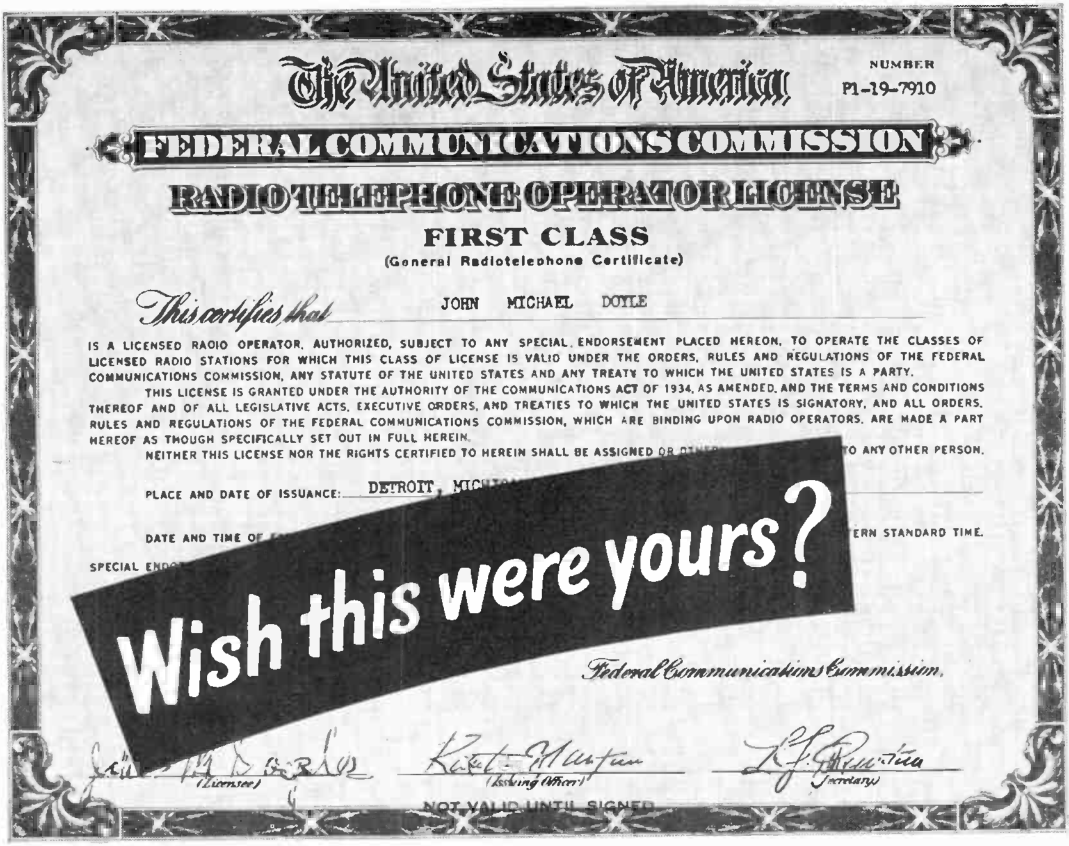
Prices appearing in this advertisement are suggested retail prices



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POPULAR ELECTRONICS

SEPTEMBER 1961

VOLUME 15 NUMBER 3

POPULAR ELECTRONICS is indexed in the Readers' Guide to Periodical Literature

This month's cover photo by Irv Dolin

Special Feature

Electronic Construction Projects

Electronic Features and New Developments

Audio and High Fidelity

Amateur, CB, and SWL

Departments

Tiny though the transistor might be, Transis-Tronics has used it to set a new pace for the entire high fidelity industry. TEC all-transistor amplifiers and tuners have become the "mighty oaks" of high fidelity — no hum, no heat, no microphonics. The transistor, unlike the old-fashioned tube, is a "life-time" device, therefore, both the TEC amplifier and the TEC FM tuner come to you with full two-year unconditional guarantees. Regardless of price, the S-15 and FM-15 are the most efficient amplifiers and tuners on the market today. TEC S-15 STEREO AMPLIFIER is all sound, rated at 20 watts of music power per channel with a 4 ohm load. With 8 and 16 ohm loads, the power is slightly reduced. TEC FM-15 TUNER, the perfect companion to the TEC S-15, will give you years and years of trouble-free listening. The low power consumption characteristic of transistors means that both the TEC amplifier and tuner can be operated with either 117 vac or 18 to 24 vdc as the power source. AND, NATURALLY, EQUIPPED FOR MULTIPLEX. Transistor Engineered Components • Transis Tronics, Inc. • 1601 W. Olympic Blvd., Santa Monica, Calif. TEC™

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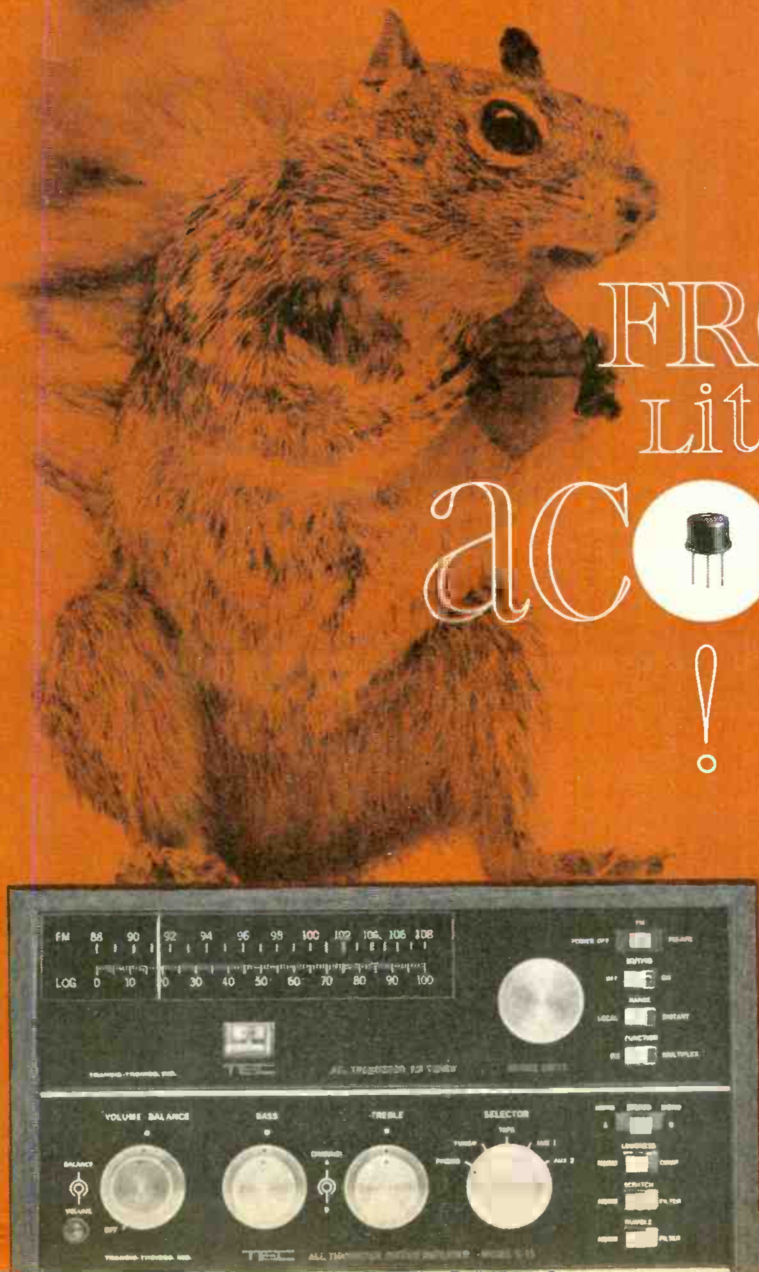

The FM-15 (top) and the S-15 (bottom) are available as separate units or in a handsome walnut or teak combined package. How? No heat means the tuner can be stacked with the amplifier without danger of drift.

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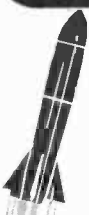

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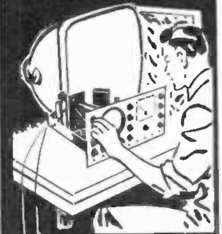

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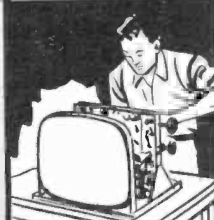

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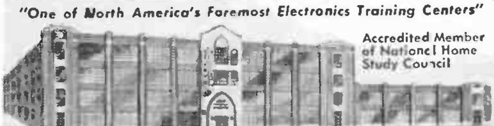

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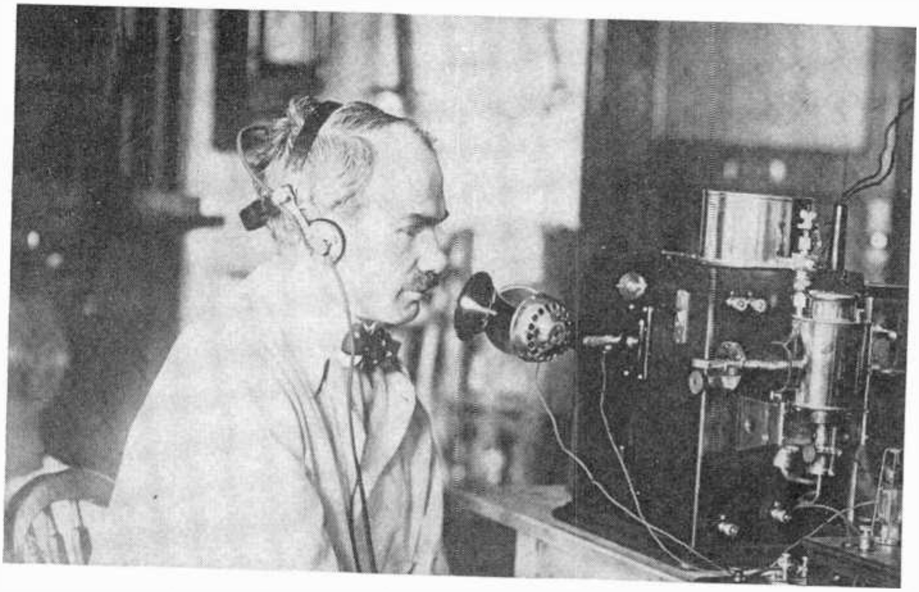
Then there were 3

Dr. Lee DeForest, who became the "father of radio" by adding a third element to the Fleming valve in 1906, is dead



Culver

IT WAS in October of 1906, only 55 years ago, that Dr. Lee DeForest made the discovery that was to revolutionize communications. Decades before—in 1863—the great Edison had stumbled on the "Edison effect" while investigating the curious darkening of one side of his electric light bulb. Later, Fleming put the Edison effect to practical use in the first "electronic" detector of radio signals. But it remained for DeForest to develop a "valve" that could do more than simply rectify.

By inserting a *third* element—the grid—DeForest produced a tube that was as different from Fleming's valve as a superheterodyne from a crystal set. Not only could DeForest's valve (dubbed the "Audion") detect feeble currents; it could also amplify and, as was later discovered, oscillate—properties which were to become basic to the field of electronics.

In 1913, the triode generated the electric waves that were to make radio possible. In 1916, it led to the superheterodyne, long since the basic circuit for virtually every receiver made—AM or FM. In 1920, it placed Pittsburgh's KDKA, the world's first broadcast station, on the air. In 1925, it recorded sound electrically. In 1927 . . . .

But this is history. And history will never forget what Dr. Lee DeForest did for electronics and mankind.

Don and Larry Taylor, with twin backgrounds and skills, have competitively built kit after kit, Paco vs. other makes. In one test Don built the Paco, in the next Larry did. Net results: Paco kits proved faster, easier, and better in performance. **For a typical Twin-Test report turn the page.**

HERE ARE JUST A FEW OF PACO'S NEWEST KITS:

V-70 VACUUM TUBE VOLTMETER KIT: Employs balanced vacuum tube bridge circuit for all voltage and resistance measurements plus 3-way probe for accurate, rapid test. Includes: 7 DC voltmeter ranges, 7 AC voltmeter ranges (RMS) from 0 to 1500 volts, and 7 AC voltmeter ranges (peak to peak) from 0 to 4000 volts. Also 7 decibel ranges, −6 to +66 db and 7 electronic ohmmeter ranges from 0.2 ohms to 1000 megohms.

V-70 Kit with "Twin-Tested" operating assembly manual .... $31.95 net

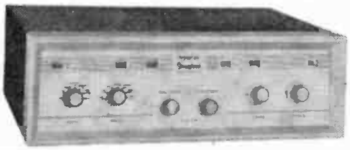
V-70W: Factory-wired .... $49.95 net

C-25 IN-CIRCUIT CAPACITOR TESTER KIT: Reveals dried out, shorted, or open electrolytics—in the circuit—with Paco's exclusive Electrolytic Dial.

Simple Sequential Test: reveals open or shorted capacitors, even electrolytics. **Electrolytic Dial:** Indicates in-circuit capacity from 2 to 400 mfd: condenser is proved non-shorted and not open if capacity reading can be obtained.

Model C-25 Kit: with Paco-detailed operating assembly manual .... $19.95 net

Model C-25W: Factory-wired .. $29.95 net

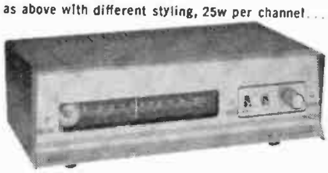


SA-40 STEREO PREAMP-AMPLIFIER: Power: 20W (RMS) per channel, 40W total. Peak, 40W with 80W total. Response: 30 cps to 90 Kc, within 1.0 DB. Distortion: within 0.5% at 20W per channel. Includes: 14 inputs and 14 Panel Controls, black and gold case.

SA-40 Kit with enclosure, "Twin-Tested" operating assembly manual ...... $79.95 net

SA-40W: Factory-wired, ready to operate .... $129.95 net

SA-50: Stereo Kit as above with different styling, 25w per channel .... TBA*



ST-25 FM TUNER: Sensitivity: 1.5 microvolts for 20 DB quieting. Harmonic Distortion: less than 1%. Includes: Dual Limiters, AFC and AFC Defeat, "Eye" type tuning indicator, Multiplex Jack. Black and gold case or walnut enclosure at slight extra cost.

ST-25 Kit with fully-wired prealigned front end. "Twin-Tested" manual .. $42.95 net

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ST-26W Tuner-Amplifier: Factory-wired, ready to operate .... $69.95 net

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G-15 GRID DIP METER: Major Functions: 1-Variable Frequency Oscillator covering 400 Kc up to 250 Mc in 8 bands; 2-Absorption Wavemeter, 400 Kc to 250 Mc; 3-Modulation Indicator. Applications: antenna tuning, standing wave checks, neutralizing. TVI suppression, carrier monitoring, etc: RF signal source for visual alignment marking between 400 Kc and 250 Mc. Weighs only 3 lbs.

G-15 Kit: Complete with 8 plug-in coils, "Twin-Tested" manual ...... $31.95 net

G-15W: Factory-wired ...... $39.95 net

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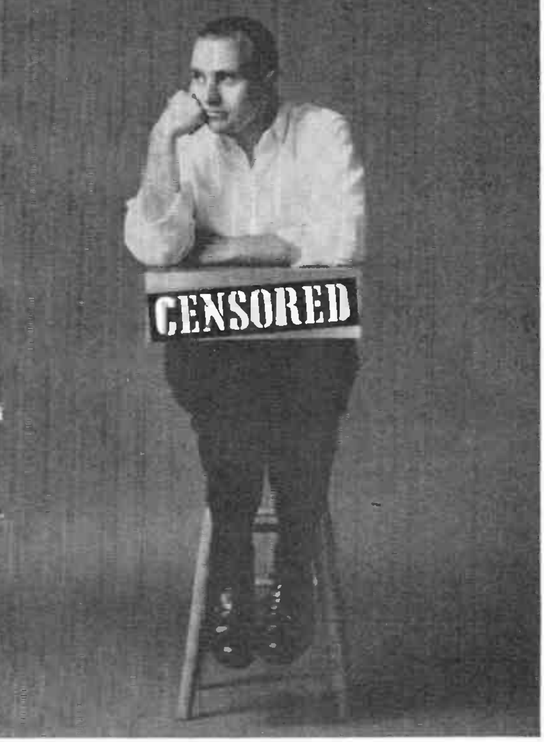
"I built the Paco SA-40 Stereo Preamp Amplifier."

Larry Taylor, 3 Stevens Place, Huntington Station N. Y. "It took me one-third less time to build the Paco kit than it took Don to make the almost identical preamp-amplifier by another kit maker. But it wasn't just the time; it was knowing you're using the right parts and that you understand the instructions completely. Paco parts are all pictured and labelled the resistors are neatly mounted on cards for easy identification. And Paco's instruction book doesn't leave you guessing. The fold-out diagrams and drawings are always right beside the instructions, so you're not reading one part of the book and following a diagram in another part. Photographs in Paco's book show how each assembly should actually look. I enjoyed building Paco kits, because I wasn't wasting time or worrying."

"I built a competing Stereo Preamp Amplifier."

Don Taylor, 39 Cross Street, Smithtown, N. Y. "Neither Larry nor I are speed demons because we're very meticulous about wiring and soldering. So I was even more surprised when it took me 50% more time to finish my kit. My problem began when I tried to separate the parts. The resistors were in boxes, but not in any logical way: identical resistors often wound up in different boxes. The instruction book was clumsy to work from. It caused wasteful mistakes. Once I lost 20 to 25 minutes because I misread a tiny key letter that meant not to solder a certain connection. A lot of the fun of kit building was lost when I had to spend time making up for shortcomings of the packaging and the instruction manual."



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FCC Report

By ROBERT E. TALL
Washington Correspondent

OVER the past months, the FCC has been bombarded with hundreds of "informal" letters from Citizens Band licensees asking for relaxations of one kind or another in CB regulations. Maybe you yourself have some ideas about what should be done to improve the CB service. But keep in mind that you'll only be blowing off steam if you send your personal views to the FCC—*unless* you're willing to go to the trouble of putting your information in a form which the Commission can use.

It is true that any letter sent to the Commission is read and considered by someone. But don't expect action on a proposal unless you make a "formal" petition and follow some very clear guidelines the agency has set up. Fortunately, you can get a full set of instructions by ordering Volume I, *Federal Communications Commission Rules & Regulations,* from the Government Printing Office, Washington 25, D. C. It's $2.50 per copy.

Look at rule sections 1.52, 1.54, and 1.55 particularly. They will tell you, among other things, that "all pleadings and documents" filed with the Commission, except for printed briefs, must be "on paper either 8" x 10½" or 14", or 8½" x 11", 13", or 14", with left-hand margin not less than 1½" wide." With some exceptions for original documents used as exhibits or supporting material, the papers have to be "typewritten or prepared by mechanical processing methods, other than letterpress or printing." Further, "the impression shall be on one side of the paper only and shall be double-spaced, except that long quotations shall be single-spaced and indented."

To get full FCC consideration, with a few exceptions, you have to submit "an original and 14 copies of all pleadings" to the Commission. And if you don't have a lawyer doing the job, the documents have to be "verified," i.e., signed by the petitioners—and notarized. Here's where the strength of the CB organization lies—it can hire a

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LAFAYETTE RADIO ELECTRONICS

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1962 Catalog 620

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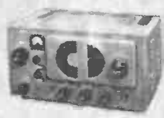

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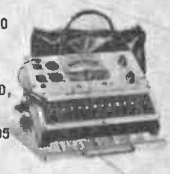

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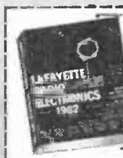

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FCC Report

(*Continued from page* 10)

lawyer who knows the proper procedures to give the Commission what it needs to take action on a request for a rule change. And it has enough active members to split up the work it takes to file such a "formal" petition.

If you follow the recommended procedures, you're in the front door at the Commission with your request for a rule change. But you're right out the back door again if you don't explain to the Commission how your request will serve the "public interest," or if you show the agency that you don't have the slightest idea of the basis for the present CB rules.

The FCC has taken a stand—and a firm one—in setting up the existing CB rules. And you can be sure it's not going to change them unless you prove that something has happened since the present rules were adopted which might make the agency revise its thinking. The Commission is not at all impressed with a "show of hands"—a short "we want" filing, for example, may not meet the above standards, even though it may be signed by hundreds of licensees.

The point is that if you want to tell the FCC something, or ask the agency to do something, you must make your request properly. Don't waste time and effort by getting your buddies to sign a piece of paper that's destined for a quick examination by the FCC staff and then a home in a pile of dust on a back shelf somewhere.

The FCC's FE&MB (Field Engineering & Monitoring Bureau) has gotten its lumps from a good many quarters—largely undeserved, because of a lack of manpower—for its failure to take a more active interest in two-way mobile radio communications, including CB. Lately, however, it has been showing a real spurt of activity in its encouragement of the formation of Citizens Band clubs. The Bureau has been telling people in Washington and elsewhere about the improvement in CB operating procedures directly attributable to the clubs, and it has outlined a step-up in its enforcement program.

Among other things, the Bureau says it is arranging for personal contact between its field engineers and the officers of the CB groups to coordinate enforcement efforts. In addition, it is furnishing all clubs with portfolios containing FCC bulletins, releases, and suggested methods for handling interference problems. The portfolios are available from your nearest FCC field office or from the FCC's FE&MB headquarters, Washington 25, D. C.

—30—

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FM MULTIPLEX STEREO BROADCAST MAKES HISTORY

CHICAGO, Ill.—Station WKFM made the world's first FM stereo multiplex broadcast simultaneous with commercial background musicasting. Equipment used was designed, constructed, and installed by Sherwood Electronic Laboratories. Sherwood achieved another "first" by being the first commercial sponsor of such a program.

Edward S. Miller, Gen. Mgr. of Sherwood cues Frank Kovas, WKFM Pres., to start the pioneer stereocast.

PRESS PARTY

Gathered at the Gaslight Club in Chicago were members of the electronics industry and the press. The Stereo Multiplex broadcast was received via the new Sherwood S-8000 FM/MX Stereo Receiver—the first such unit on the market.

John Radtke, Sherwood's Chief Research Engineer, checks out WKFM's stereo multiplex transmitting equipment.

Sherwood's Bud Fields and Jerry Fields of MusiCraft enjoy the first stereocast over Sherwood's new S-8000 64-watt Stereo FM Receiver.

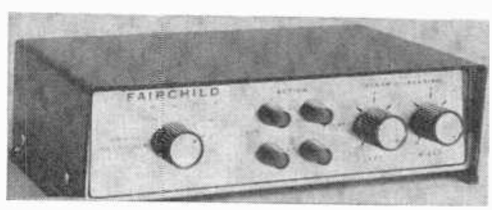
For details on the S-8000 or versatile Stereo MX adapters write Sherwood Electronic Laboratories, Inc., 4300 N. California Avenue, Chicago 18, Illinois. Dept. 9Z

Hi-Fi Showcase

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

A HIGH-EXCURSION 12" speaker now available from *Altec Lansing* is modeled after that company's well-known 15" 803B woofer. The Model 414A boasts excellent linearity and transient response over its frequency range of 30 to 3000 cycles and has a nominal impedance of 16 ohms. Price: $54.00. . . . Another speaker—*Advanced Acoustics*' "Modulaire Bi-Phonic Coupler"—is actually a complete speaker system. Although it measures only 22" x 13½" x 3⅜", the "Modulaire" is capable of reproducing a full range of frequencies from 35 cycles to well above audibility. Further, its size and "bi-phonic" design permit it to be hung on a wall like a picture, used as a room divider, incorporated into a piece of furniture or a bookshelf, or even hidden behind draperies or wall decorations. Nominal impedance is 8 ohms, power-handling capacity 15 watts, and price $99.00 to $120.40, depending on type and finish. . . . The ADC 2 stereo cartridge released by **Audio Dynamics** is a moving-magnet type with high lateral and vertical compliance. Encased in a silvered mu-metal housing, the ADC 2 tracks at pressures as low as 2 grams; frequency response is within 2 db, 10-20,000 cycles.

From ***Fairchild*** comes a volume expander which needs no a.c. power and can be connected to any hi-fi amplifier. The "Com-



pander" restores high-level signals to their original (pre-compression) amplitude, yet has no effect on low- and medium-level passages. The result: both tapes and discs take on greater realism, and stereo material seems to have even greater channel separation. Price, $75.00. . . . Three new transistorized amplifiers from ***Wm. A. Holmin*** are completely portable and incorporate

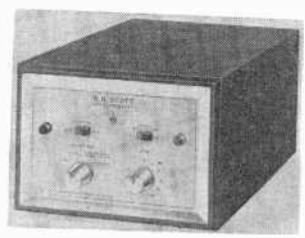
**Write to the manufacturers listed at the end of this column for more data on products mentioned*

Showcase

(*Continued from page* 14)

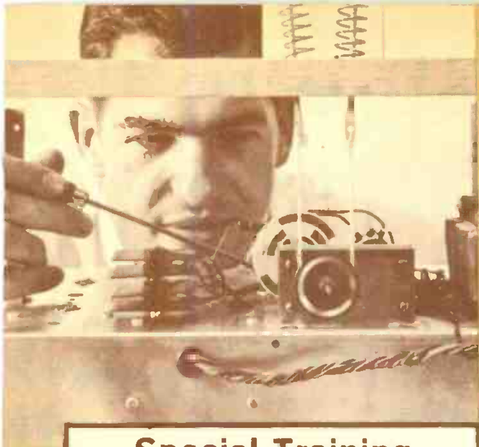
their own built-in battery power supplies. Produced in 5-, 10-, and 20-watt models, they can be used with almost any type of speaker. And while not strictly hi-fi, these amplifiers operate with exceptionally low distortion and are ideal for outings or commercial sound uses. There are separate inputs for microphone and phono, and a special circuit enables both to be used at the same time.

Paco's new FM tuner kit, the ST-25, is a quality unit with a pre-wired and adjusted "front end." Featuring two limiters and a wide-band ratio detector for outstanding fringe-area reception, the ST-25 also boasts a.f.c. (with a front-panel-mounted "defeat" switch) and a magic-eye tuning indicator. Price of the semi-kit, $42.95. . . . The Model 335 multiplex adapter by ***H. H. Scott*** is a self-powered unit that plugs into any Scott "Wide - Band" FM or AM/FM tuner for stereo FM (multiplex) reception. The 335 is supplied with all necessary connecting cables, and it requires only a few minutes to attach. Styled to match other Scott equipment, the adapter is priced at $99.95.



A 3-speed, 4-track stereo playback tape deck from ***Tandberg*** also has facilities for adding record and erase heads. Speeds are 7½, 3¾, and 1⅞ ips from a special hysteresis-synchronous drive motor; frequency response (at 7½ ips) is 30 to 16,000 cycles within 2 db. Equipped with a 4-digit counter, the Model 65 sells for $199.50. —30—

Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.
Advanced Acoustics Corp., 67 Factory Place, Cedar Grove, N. J.
Audio Dynamics Corp., 1677 Cody Ave., Ridgewood, N. Y.
Fairchild Recording Equipment Corp., 10-40 45th Ave., Long Island City 1, N. Y.
Wm. A. Holmin Corp., 1325 Seventh St., Rockford, Ill.
Paco Electronics Co., Inc., 70-31 84th St., Glendale 27, N. Y.
H. H. Scott, Inc., Dept. P, 111 Powdermill Rd., Maynard, Mass.
Tandberg of America, 8 Third Ave., Pelham, N.Y.



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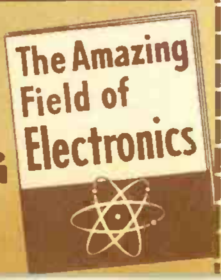

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TURN PAGE

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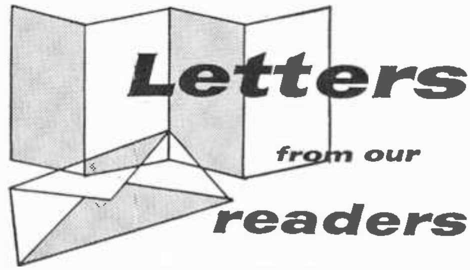


Winning "Min-O-Scope"

■ I recently constructed a model of the "Min-O-Scope" (August 1960 issue) using a 2AP1A cathode-ray tube in place of the 1CP1 which you specified. I got excellent results, and the unit won a first prize at our school science fair.

CHARLES KROGER
Riverside, Calif.

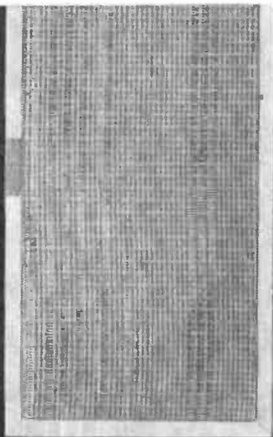
CB Booster Conversion

■ We built the "BC-Band DX Booster" (February 1961 issue) and would like to report that we're pleased with the results. To modify the booster for Citizens Band operation, we changed *L2* to 7 or 8 turns of #22 enameled wire on a ¼" slug-tuned form. Construction time and costs were cut somewhat by using the chassis and power supply from an old TV booster. We now pull in ground-wave signals from outlying towns we've never heard before. Incidentally, the common 6AG5 can be substituted for the recommended 6AK5 with no noticeable change in performance.

FRANCIS L. SKEES, 18A9853
WM. A. HARRIS, Ex-18A5282/9447
W. Lafayette, Ind.

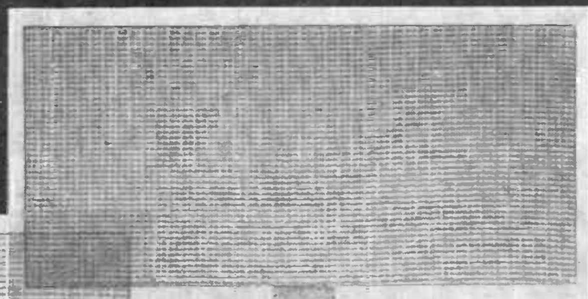
Q-Multiplier

■ I've just finished building the 455-kc. model of the "Citizens Band Q-Multiplier" described in the



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.

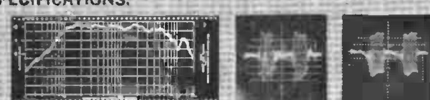
TRY IT — WE GUARANTEE IT
100,000 PEOPLE CANNOT BE WRONG

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

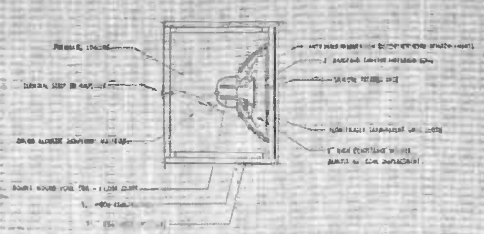
SPECIFICATIONS:



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

Gentlemen please ship________________GIGOLOS.

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.

Name________________

Address________________

City and State________________

Enclosed find check________ money order________

Letters

(*Continued from page* 20)

March 1961 issue, and it works fine with my Hallicrafters S-40 receiver. Keep up the good work.

JOSEPH BIALY
Buffalo, N. Y.

■ I built the Q-Multiplier described by Donald L. Stoner and found that connecting its coax cable directly to the plate of the mixer tube in my Hallicrafters S-120 receiver caused severe signal attenuation. The problem was cleared up by using a 56-$\mu\mu$f., 600-volt ceramic capacitor between the cable and the mixer plate. Now it works beautifully and increases selectivity to a point as sharp as a tack.

J. O. PETTIT
Los Angeles, Calif.

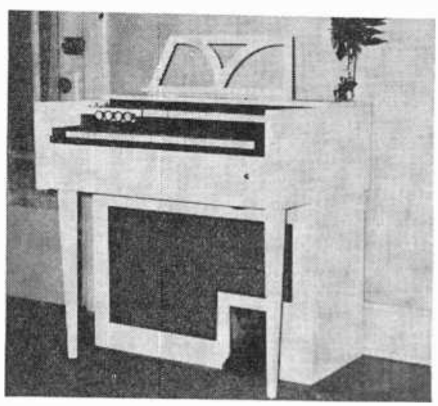
■ Will the Q-Multiplier in the March issue work on the Citizens Band only, or is it suitable for amateur and short-wave bands as well?

FRANK KOVACH
Northfield, Ohio

We're glad to hear that the Q-Multiplier is finding such widespread use. To answer Mr. Kovach's question, the unit will work on any superhet receiver, regardless of its tuning range. The only requirement is that the receiver have an i.f. near 455 kc. or between 1300 and 1800 kc.

Electronic Organ

■ Electronics is my hobby, and I find your magazine very helpful and informative on many projects. Enclosed is a photo of my latest project—an



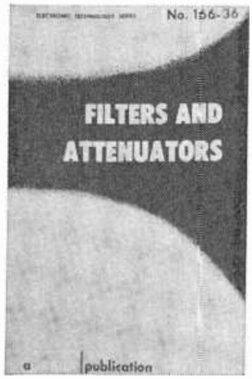
electric organ; the amplifier and oscillators were home-built, and parts from old reed organs were utilized in the construction. I would like to see more articles on electronic musical instruments.

PAUL SNIDER
Colurd'alene, Idaho

Congratulations on your fine job, Paul; we're sure it sounds as good as it looks. You will probably be interested in the article on the transistorized metronome which appeared on page 54 of the June issue. —30—

POP'tronics Bookshelf

FILTERS AND ATTENUATORS *edited by Alexander Schure, Ph.D., Ed. D.*



Volume 36 in the Rider Electronic Technology Series, this book describes the types, functions, circuitry and applications of filters and attenuators. Power supply filters, audio and video filters, wave filters and specialized filter types are analyzed, as well as both fixed and variable attenuators and equalizers. Mathematical as well as narrative presentations are used, and numerical examples and solutions clarify the calculations.

Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York, N. Y. Soft cover. 96 pages. $2.25.

101 KEY TROUBLESHOOTING WAVEFORMS FOR HORIZONTAL-SWEEP CIRCUITS *by Robert G. Middleton*

Intended for servicemen and others who need quick reference material on the causes of horizontal-sweep circuit troubles, this book analyzes the four most popular horizontal-sweep systems (the 90°, 110°, direct-drive, and primary-secondary transformer types). The well-illustrated volume presents 101 abnormal waveforms, together with accompanying circuit symptoms and the appropriate tests to make. By comparing waveforms obtained at various circuit points with those shown in the book, the reader can readily spot a defective component.

Published by Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind. Soft cover. 128 pages. $2.00.

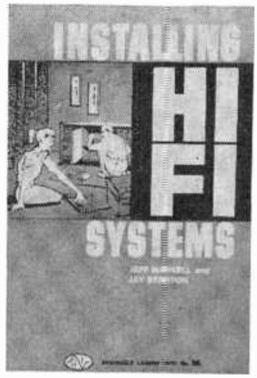
(*Continued on page* 26)

Bookshelf

(*Continued from page 24*)

INSTALLING HI-FI SYSTEMS *by Jeff Markell and Jay Stanton.*

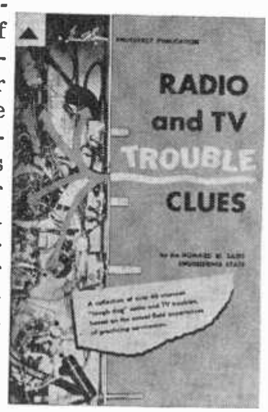
Here is an ideal guide for the hi-fi fan or professional on steps to take *before* a hi-fi installation is begun. Various types of mono and stereo systems are discussed, as well as the elements of a component system, their function and operation. The authors, a hi-fi furniture designer and an audio engineer, have come up with a book that strikes a nice balance between esthetic and technical factors to be considered in hi-fi installations.



Published by Gernsback Library, Inc., 154 West 14th St., New York 11, N. Y. 224 pages. Soft cover. $3.20.

RADIO AND TV TROUBLE CLUES *by the Howard W. Sams Engineering Staff*

This collection of over 60 solutions to "tough dog" radio and TV troubles is based on the actual experiences of practicing servicemen—the reader looks over the serviceman's shoulder as he repairs sets in the field or at the bench. A special section includes solutions for more unusual problems, such as curing noisy operation in portable TV sets, replacing obsolete focus coils, hot-chassis servicing, and servicing TV remote control units.



Published by Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind. 96 pages. Soft cover. $1.50.

(*Continued on page 28*)

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. . while training at home for high-pay career or business of your own!

AMAZING PLAN FOR YOUR SUCCESS IN RADIO-TV-APPLIANCES and ELECTRONICS

Central will show you how to start making money soon . . . servicing AM-FM radios and television sets . . . repairing electrical appliances . . . building and installing electronic equipment in homes, factories, and business offices. Step-by-step, you'll learn how to get started in spare time at minimum cost; how to prepare for a bright future in servicing, audio, communications, broadcasting, or the gigantic electronic industry. Complete FCC license preparation included. High income, prestige, security, prosperity . . . *all can be yours!*

NO EXPERIENCE NEEDED!

You don't need high school diploma or previous knowledge of electronics to get started. Quick, low-cost home training for young and old. New illustrated lessons make learning easy. We supply equipment and *know how* you need to start making money soon. You learn by *doing*. You assemble useful, practical electronic projects—no incomplete "student" radios and testers—our kits meet commercial standards. Also recommended for citizen band and amateur radio operators, hi-fi and stereo enthusiasts, hobbyists, etc. Your personal pleasure and the savings you can make on home installations and repairs alone, make this course a profitable adventure. Keep your present job—set your own pace—add to your income—and find out how much fun Electronics can be!

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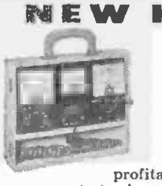
Cash in on growing demand for technicians in hundreds of exciting space-age fields: guided missiles, rocketry, outer space research and development, automation, nuclear power, computers, microwaves, radar, communications, oil field exploration, air traffic control, civil service, armed forces, etc. *Start now.* Get facts — mail coupon today for two FREE books!

NEW KITS!



You will build and keep this handy "transistorized" electronic and appliance tester that you'll use soon to start earning spare-time money. Many other practical and profitable electronic projects to choose from: *4 transistor portable radio—code oscillator—solar cell switch—RF signal generator—CB converter—oscilloscope—others!* Fully described in our FREE 64-page catalog.

Central grad GLEN LEIRER, shown here, earned an attractive income from part-time Radio-TV Servicing. Now he's employed as a Computer Technician for RCA Service Co., Camden, N. J.

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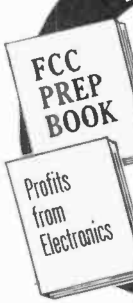
Central grads HOWARD EDMONDS & FLOYD CONKRIGHT are joint owners of EDCO FACTORY TV SERVICE CO., K. C., Mo., and RANCH MART TV & STEREO, Leawood, Kansas, have three service trucks, seven full-time employees.

Grad FRANK LEENKNECHT works in missile field for Convair Astronautics, San Diego, Calif., and as Transmitter Engineer for Station KDEO as a sideline.

FREE



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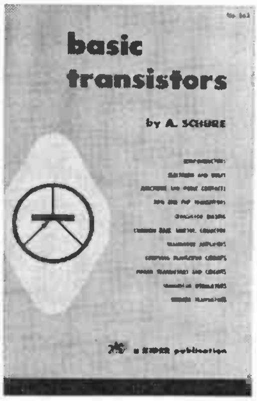
Bookshelf

(*Continued from page* 26)

BASIC TRANSISTORS *by Alexander Schure, Ed.D., Ph.D.*

What is a transistor? What is it made of? How does it differ from a vacuum tube? This profusely illustrated text answers these and many other related questions. Beginning with a discussion of atoms and semiconductors (the materials from which transistors are constructed), the author analyzes the basic *pn* junction diode, then describes basic transistor circuits. Included is material on transistor characteristics, biasing, power transistors, amplifiers and oscillators, and tetrode units. Review questions are presented at the end of each section.



Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York 11, N. Y. 152 pages. Soft cover, $3.95. Hard cover, $5.50.

New Literature

"The Zener Diode" is the title of a four-page CBS "Tech Tips" bulletin covering zener diode theory, characteristics and applications. Both series and parallel uses of zener diodes are discussed; several typical circuits are shown. Bulletin PA-502 can be obtained from CBS Electronics, Engineering Information Services, 100 Endicott St., Danvers Mass.

You can build a solid scale model of the U. S. Air Force's supersonic F-105D from free plans available from Republic Aviation Corp., Farmingdale, L. I., N. Y. All releasable performance specifications of the fighter-bomber are listed, and several aerial and ground views show the big jet in various perspectives. —30—

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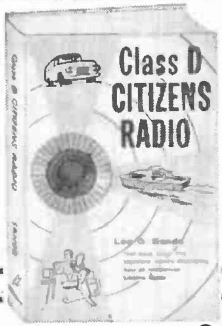
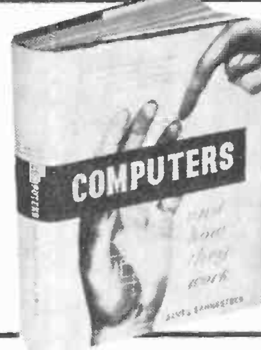


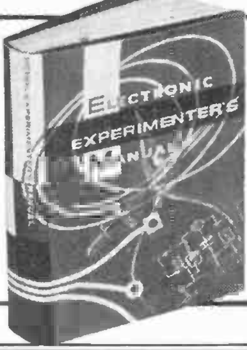
CLASS D CITIZENS RADIO — Leo G. Sands

Here is the first complete book on Citizens Radio Operation. Ever since the initial use of 2-way radiotelephone by police departments, this field has been growing in importance and application. Now, with more than a million vehicles equipped for its use, Citizens Radio is a major phase of the electronics field. This important new volume covers every aspect of the field—its history, rules, and everything about how it works—in seven big chapters with one hundred major sections. You'll learn exactly what Citizens Radio is, its applications, what equipment you need, the full story on receiver circuits and transmitters, antennas, installation, and maintenance, full FCC rulings, how to apply for licenses, etc. Many illustrations. **$4.95**

COMPUTERS AND HOW THEY WORK
by James Fahnestock



Here is a fact-filled exciting guidebook to the wonderworld of electronic computers, with more than 120 illustrations and easy-to-follow tables in 10 big chapters. Step by step, you'll see and understand the workings of every type of computer ever used. This important new book illustrates the basic principles of computers in methods that require no knowledge of electronics. You'll learn all about computer memories, flip-flops and the binary counting system. You'll learn the mathematical language of computers where 1 + 1 = 10. Other chapters show you how computers use tubes and transistors to make complex logical decisions in thousandths of a second. COMPUTERS AND HOW THEY WORK is must reading for career minded students and for electronics pros who want a more complete knowledge of this field. **$4.95**



THE ELECTRONIC EXPERIMENTER'S MANUAL
by David A. Findlay

With a few dollars worth of basic tools, and this book to guide you, you can explore the magic of electronics experimentation more completely than ever before. In a few short hours, you'll start your first project. You'll learn about every component used in experimentation, every tool, its function and why it is used. There are 10 big sections, each covering a specific phase of construction. There's a giant section of projects you can build, test equipment you'll construct and use in your future work. THE ELECTRONIC EXPERIMENTER'S MANUAL will give you the professional know-how you must have no matter what phase of electronics is your specialty. **$4.95**

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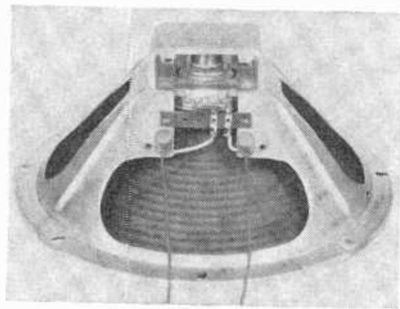
Tips and Techniques

SPEAKER BINDING POSTS

Add a pair of binding posts to your loudspeaker and you'll save lots of time and trouble when making experimental audio hookups. The binding posts (insulated type) can be mounted on the speaker frame close to the voice-coil lugs. When drilling, it's a good idea to lay a piece of cloth under

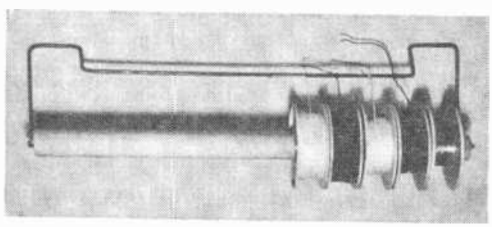


the hole to catch any metal chips—and be careful not to punch the paper cone with the drill. Many speakers already have transformer mounting holes which can simply be reamed out to the proper size. Make sure that all connections are tight and that the binding posts are properly insulated from the frame before trying out the speaker.

—*Art Trauffer*

HANDY DISPENSER RACK

Wire, dial cord, and other materials stored on spools can be conveniently dispensed from an easily made rack like the one illustrated. Bend the frame out of coat-hanger

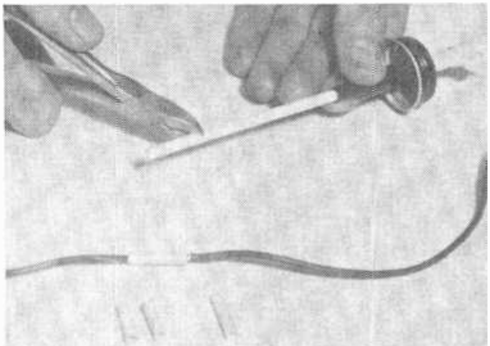


wire and cut the rod from a piece of dowel. The ends of the frame are force-fitted into small holes drilled in the dowel.

—*Bertram S. Kolts*

MAKING "SPAGHETTI" FROM SPRAYER

The tube from the spraying apparatus of an empty window-cleaner bottle is an excellent emergency source of "spaghetti" for covering wire joints. Just use a pair of side-



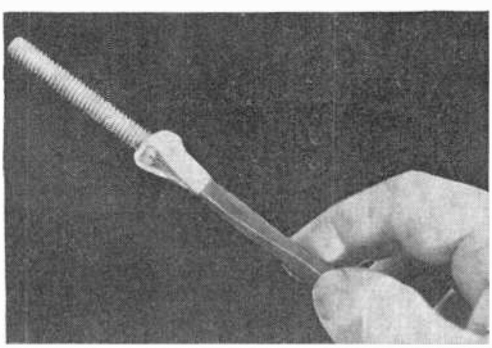
cutters to clip it into the lengths you need. You can also cut away the metal cap of the sprayer and remove the nozzle, leaving a handy plastic grommet for wire or cable feedthroughs. —*John A. Comstock*

DENTAL TAPE LACES CABLE

The next time you run short of lacing cord while making a cable harness, pick up some tape-style dental floss at your local drugstore. The tape, which comes in a dispenser with a convenient cutter, is quite strong and has a waxy surface that holds knots well. —*George D. Curtis*

SCREW STARTER

To start a bolt or screw in a tight corner quickly, fasten it to the blade of a screwdriver as shown in the photo. Poke a hole



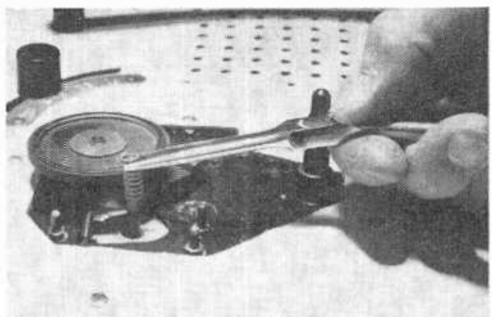
the size of the threaded part of the bolt or screw in a small strip of cellophane or masking tape, and pass the threads through the hole with the sticky side of the tape facing the head. Finally, draw the ends of the tape up and stick them to the blade; a twist of the screwdriver will pull the tape away after the threads have been started. You can use a similar technique for a nut, positioning it over the hole in the tape so that its threads are accessible. —*Glen F. Stillwell*

INDICATOR EYESHADE

Remove the center section from a common rubber towel holder and you have a convenient light shield for an "eye" tube indicator. The flange of the holder extends outward a half inch or more, shading the tube and making it appear much brighter. —*H. Leeper*

INCREASING TURNTABLE SPEED

To bring aging phonograph turntables up to speed when all else has failed, slip a small, tight-fitting spring over the idler drive spindle. Most spindles are already provided with such a spring, but the added diameter of the extra one is often just enough to increase the rpm to the proper value. Experiment with springs of different gauges,



using a strobe disc and fluorescent lamp to check turntable speed, until you've found one that does the job. —*Homer L. Davidson*

CONNECTOR SUBSTITUTION

You can save money by using an Amphenol screw-on microphone plug (single-contact type) in place of a standard male coaxial connector. Just place a *6-32* or *8-32* machine screw in the hole of the coaxial receptacle and screw on the Amphenol plug (the threads are identical). The head of the machine screw will make good electrical contact with the center button of the mike plug. —*Edward Summer*

PROFESSIONAL-LOOKING DECALS

Here's a method for getting professional results when you apply decals to those "troublesome" wrinkle-finished cabinets. First put on the decal according to the

Tips

(*Continued from page* 31)

manufacturer's instructions and wait for it to dry. Next apply a coat of "Solvaset," using just enough to soften the decal. This preparation, which is available at model railroad supply houses, will make the decal "snuggle down" into the wrinkles and resist peeling. When the Solvaset has dried, add a protective coat of Testor's "Flat Finish," a durable flat varnish sold at most hobby stores.

—Kenneth Cameron, WN4AAR

"WIRE-NUTS" EXTEND TEST LEADS

Insulated wire connectors—sometimes called "wire-nuts"—which are generally used for making connections to lighting fixtures, can be quite handy in extending test leads. Just twist together the bare ends of the test lead and the wire to be added, and slip them into the spiral spring of the wire nut. Several clockwise twists of the "nut" make the connection permanent. If you should want to remove the connector later on, try "untwisting" it, or cut if off if necessary—very little of the lead will be wasted, and the cost of the connector is only four or five cents.

—H. Leeper

COMING NEXT MONTH

Record players are the subject of next month's cover story. An easy-to-follow guide on how to go about selecting a record player, this informative article tells you how to choose one you'll like.

(ON SALE SEPTEMBER 28)

- **RUSSIAN ELECTRONICS HOBBYISTS**
  What are Russian hams and SWL's like? How do they compare with their American counterparts? Don't miss this exclusive report on radio in the U.S.S.R.
- **ELECTROLYTIC "RESTORER"**
  Here's an automatic rejuvenator for old electrolytic capacitors that is both easy to build and a cinch to operate.
- **VACUUM-TUBE ELECTROSCOPE**
  A neon bulb has replaced gold leaves in this modern static-electricity device.

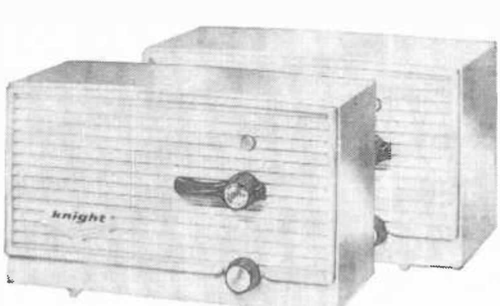
NEW products

TRANSISTORIZED "BULL HORN"

Boating fans, sports enthusiasts, and all other outdoorsmen should find good use for a new, lightweight "bull horn" voice amplifier available from *Lafayette Radio* (165-08 Liberty Ave., Jamaica 33, N. Y.). Completely transistorized, the PA-271 is powered by six standard "C" flashlight batteries (not included) and weighs only 2½ pounds. It's controlled by a trigger switch in the pistol-grip handle and has a range of up to 2000 feet. Price, $10.99.

WIRELESS INTERCOM SYSTEM KIT

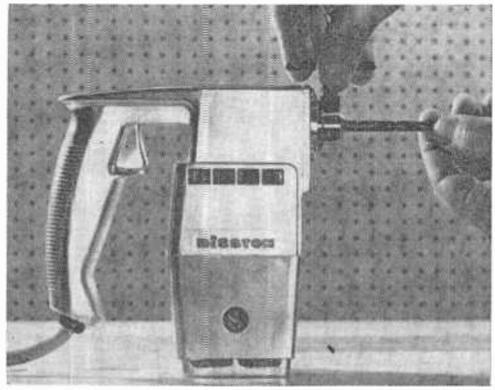
The Knight-Kit wireless intercom system needs no interconnecting wires—each station is simply plugged into the nearest a.c. outlet. Any number of stations may be used, the only requirement being that all locations be served by the same power-company transformer. An adjustable frequency control permits separate systems to operate independently on the same power line, and a special "squelch" circuit silences power-line static. Price of the basic two-station



system (#83 YX 917) is $37.90; additional stations (#83 Y 941) are $18.95 each. (*Allied Radio Corp.*, 100 N. Western Ave., Chicago 80, Ill.)

UNUSUAL ELECTRIC DRILL

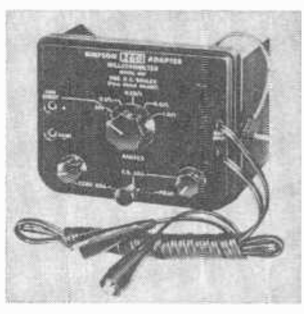
Drilling straight holes in tight quarters is easy with a new quarter-inch electric drill of unusual design. The "Dirk," marketed by Disston, has a space-saving vertical motor positioned at right angles to the drilling axis. The flat base of the 3-ampere,



1800-rpm motor acts as a drill stand and may be firmly anchored to a workbench if desired. Chips and shavings are prevented from obscuring the hole being drilled by means of a controllable chip blower. Price, $30.00. (*Disston Division, H. K. Porter Co., Inc.*, Porter Bldg., Pittsburgh 19, Pa.)

MULTIMETER ADAPTERS

Two new models have been added to the Simpson "260" line of multimeter adapters. The Model 661 d.c. ammeter and the Model 657 milliohmmeter, like the other adapters in the series, are designed for use in conjunction with any Simpson 260 or 270 multimeter. Ranges of 0 - 1, 2.5, 5, 10 and 25 d.c. amperes are provided by the 661. The 657, which has ranges of .1, .25, .5 and 1.0 ohm full-scale (see photo), makes it possible to measure resistance values as low as .001 ohm. Prices: $17.95 for the Model 661; $39.95 for the Model 657. (*Simpson Electric Co.*, 5200 W. Kinzie St., Chicago 44, Ill.)



HEAT-SINK CLIPS

Hunter Tools, Santa Fe Springs, Calif., has announced a series of three heat sinks. Designed to protect delicate semiconductors,

(*Continued on page* 38)

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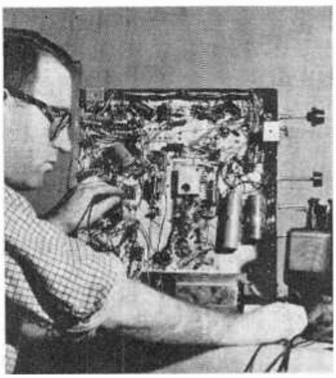

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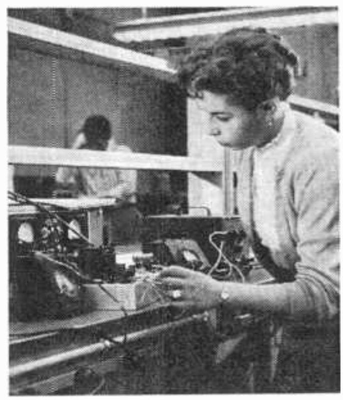
Free Placement Service. RCA Institutes graduates are now employed in important jobs at military installations such as Cape Canaveral, with important companies such as IBM, Bell Telephone Labs, General Electric, RCA, and in radio and TV stations all over the country. Many other graduates have opened their own businesses. A recent New York Resident School class had 92.06% of the graduates who used the Free Placement Service accepted by important electronics companies... *and had their jobs waiting for them on the day they graduated!*



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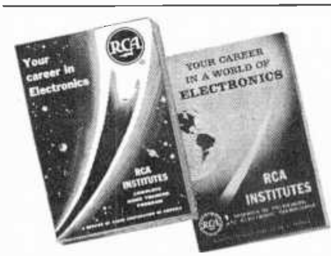

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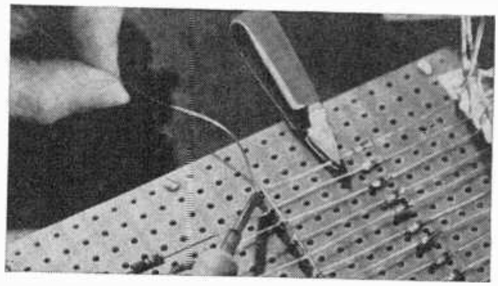
products

(*Continued from page* 33)

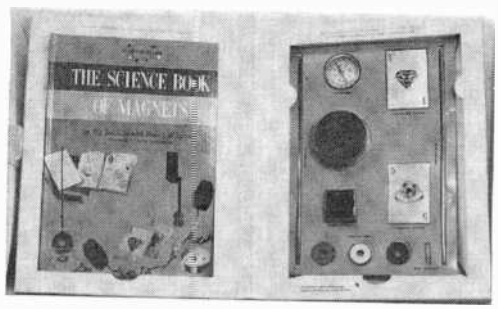
the devices clip onto any small wire and dissipate excess soldering heat. Ranging in size from 1" to 2½" (overall length), they have plastic-coated handles to guard against



burned fingers. Model 51E (illustrated), largest of the three heat sinks, features copper jaws for maximum dissipation; it's priced at 79 cents.

"SCIENCE BOOK-LABS"

A laboratory and library are combined under one cover in each of the "Science Book-Labs" produced for children by the *Science Materials Center* (59 Fourth Ave., New York 3, N. Y.). Every Book-Lab contains a 48-page volume of instructions for making experiments on a single science



subject, together with all of the materials required to carry them out. The four sets available so far deal with magnetism, air, jet engines, and seeds. Price, $3.95 each.

TRANSISTOR REPLACEMENT KIT

A kit of nine transistors, available from *Sylvania Electric Products, Inc.*, 730 Third Ave., New York 17, N. Y., will replace more than 300 popular entertainment-type transistors. The versatile assortment, called the "Big 9," contains *npn* and *pnp* converter-mixer-oscillator, i.f. amplifier, and audio amplifier units. Priced at $20.60, the kit includes a handy transistor replacement chart.

—30—

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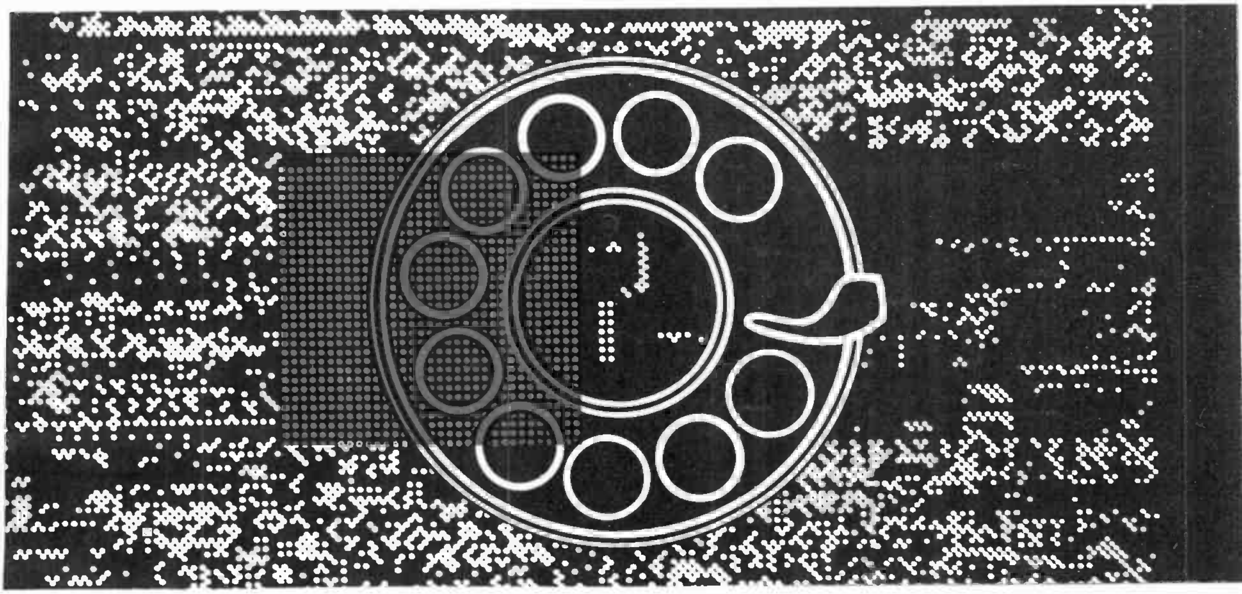
OPERATION TELEPHONE 1965

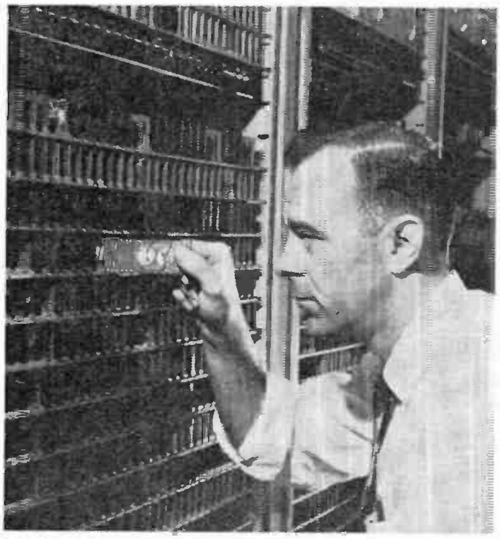


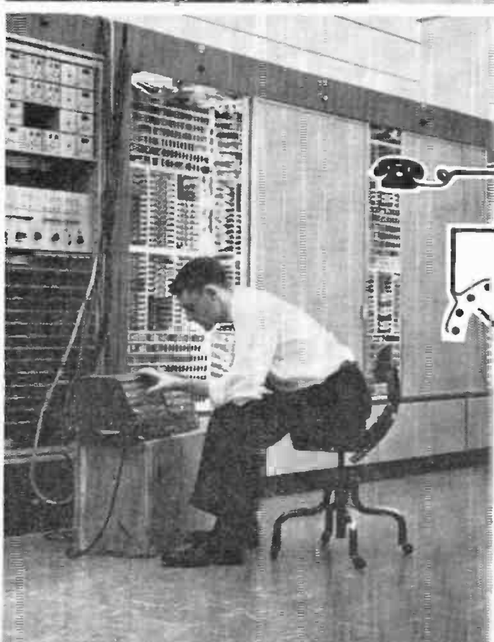
Within the next four years, America's telephones will undergo a major and far-reaching innovation when the new, all-electronic "centrals" take over

By KEN GILMORE

THE TIME: a day in 1965. You're planning to spend the afternoon at a friend's house. But you're also expecting an important telephone call. You pick up your phone, dial first a special code number, then your friend's number. This done, you leave for his house, knowing that all calls to your number will be automatically switched to his. When you return home that evening, you dial another code number and incoming calls are once again routed to your own phone.

This special service—and dozens of others just as advanced—will soon be available to you. Already, a prototype all-electronic telephone central office is in operation in Morris, Illinois. And it's delighting subscribers with services which make present-day systems seem as obsolete



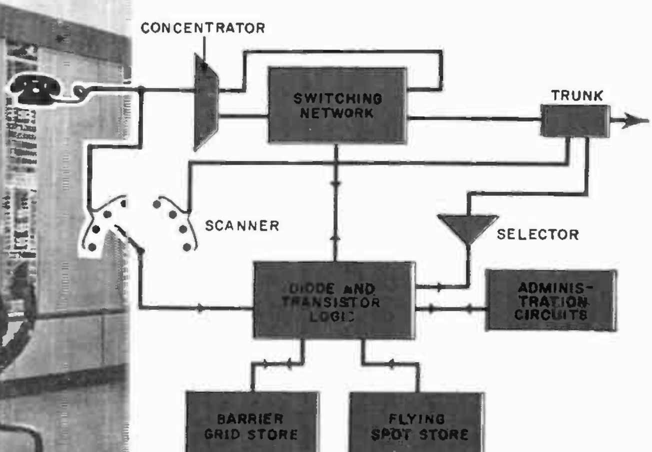


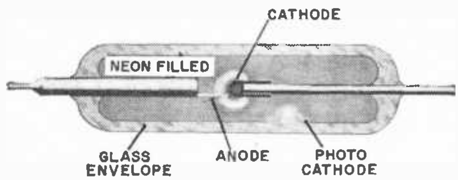
as a hand-crank on an old-fashioned wall telephone.

Special Services. Within a few years—as versatile all-electronic equipment replaces the present relay-switching systems—your phone will perform such tricks as these:

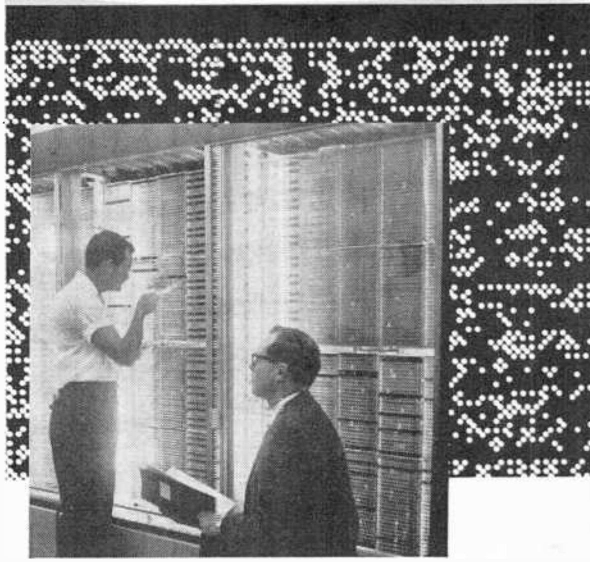
- You're talking to a friend about a new stereo amplifier you're planning to buy. But you need more information. So without either of you hanging up, you simply dial your dealer's number. A few seconds later he is connected into the circuit, and all three of you can discuss the amplifier at will. You can even continue calling additional numbers—as many as you like—and all will be connected so that everybody can talk to everyone else.
- There are several numbers you call regularly. A word to the central office, and each of these "regulars" is assigned a special two-number code. Then, instead of having to dial the usual seven-digit number each time, you simply dial "12" when you want your office, "13" for the corner drugstore, "14" for a friend you call often, and so on.
- You run a small business and don't want to miss any incoming calls. You make the proper arrangements, and if your office line is busy when someone dials it, your home phone rings automatically. If your home phone is busy,

Control center (three photos, left) of world's first all-electronic telephone central office, now serving customers in Morris, Ill., is but a portion of overall network shown in block form below. The system was developed by Bell Telephone Laboratories.





Switching network (right) in the all-electronic telephone system uses tiny gas diodes in place of conventional relays to connect one line to another. When diode (above) fires, the neon glows, setting up a low-resistance path from cathode to anode. Network of wires (below, right) can easily be connected by means of diodes. As long as diodes do not fire, wires are not connected. But if diode 3 fires, for example, input 1 and output 3 are connected; if diode 4 fires, input 2 is connected to output 1.



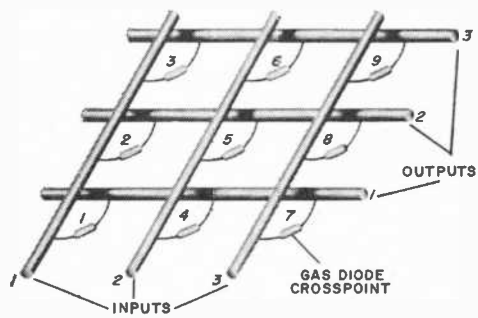
too, a third number—perhaps an answering service—will ring, and so on for as many alternate numbers as you wish.

These are just a few of the scores of special services you'll enjoy when electronics takes over completely. With the new system, switching and routing of calls—now done by relatively slow-moving relays—will be accomplished with no moving parts at all. Hordes of electrons rushing through transistors, diodes, and gas tubes will do the job, and they'll do it within *millionths* of a second. Thus, the all-electronic system will be able to perform thousands of different operations, carrying out extremely complex switching operations impossible with present equipment.

Electronic "Central." To see how the new system works, let's take a look at what will happen to the central office—the heart of any telephone system. At this giant terminal, the wires from your phone, thousands of others in your area, and trunk lines from communities all over the country are brought together. The sole purpose of all the complicated gear at the office is to connect the line from your phone to that of any other phone you want to reach.

In the old days, this was a simple job. An operator simply took a plug connected to your line and pushed it into a jack, connecting you with the number you wanted. Then she pressed down a lever to ring the bell.

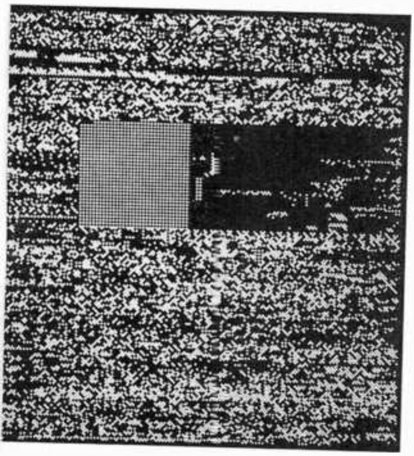
A few years later, the dial system came along and substituted automatic relays for the plugs. Every time your



dial clicks, a number of relays move. When you have finished dialing, the clicking relays have selected a single phone and connected your line to it.

In the new electronic system, a giant computer with a special *scanner* checks over every line coming into the central office to see whether it is in use. It does this job so quickly that it takes just one-tenth of a second to check all of the thousands of lines terminated at the central office. As soon as one check is over, it starts another. Thus, every line is checked to see whether it is idle or busy *ten times every second, twenty-four hours a day.*

Scanner-Computer Circuit. Most of the time any given line will be idle—the phone will be "on the hook." But when you pick up your telephone to make a call, the scanner notices not more than one-tenth of a second later that your phone is no longer idle, and notifies the computer. In the next few millionths of a second, this electronic brain per-



Cathode-ray tube in electronic central's "flying spot store" (below, left) is a photographic "memory" device capable of storing over two million "bits" of information. Tube sweeps spots on film (left)—over 30,000 to each 1½" square—which are either clear or opaque and which pass or withhold the beam of light accordingly.

forms a complex series of operations.

First, it checks its memory to see if a change was made when you picked up your telephone. It finds that there is no record of your phone having been in use a tenth of a second before. It then checks to see if your line is ringing. If it is, your picking up the phone would be in answer to the ring. If there is no ringing, the system concludes that you picked up the phone because you want to make a call.

Having reached this conclusion, the computer switches the dial tone onto your line to notify you that it is ready for you to dial. At the same time, it writes your phone number on what engineers call "an electronic scratch pad"—a temporary memory circuit. It also reserves a space on the "scratch pad" to record the number you dial. Finally, it steps up the number of times your line is being scanned from the regular 10 per second to 100 per second, so that it won't miss any of the pulses your dial sends out as it clicks around.

All this began when you lifted the phone from its cradle, and was completed long before you got it to your ear. In addition, the scanner went on sampling several thousand other lines, and signaling the computer to take whatever action was necessary in each case. In this way, one scanner-computer circuit operates fast enough to handle all the business on all of the lines coming into the central office, moving from one to the other with lightning speed.

As you dial, the scanner is looking at your line 100 times a second. Every time your dial generates a pulse, the scanner notes the event and records it in its temporary memory. When you finish dialing, the computer hooks a ringing connection to the line you dialed. It also sets up the ringing connection on your line, to assure you the line you want is being rung. Simultaneously, of course, the scanner is checking the line you're calling. When someone answers, the "brain" is notified, and it then sets up a talking circuit between the two lines.

After your conversation, you hang up. The scanner notes that your line is now idle, but just to make sure, it waits until your line reads idle for three consecutive checks. Satisfied that you are now through talking, the computer disconnects both phones.

Automatic Switching. Why set up such a complex electronic system when the present-day relays seem to do the job pretty well? There are several reasons, but by far the most important is the fact that the electronic "central" can do things no other setup can even approach.

The present relay system can be connected so that another phone will ring

(*Continued on page* 98)

COMPACTRON

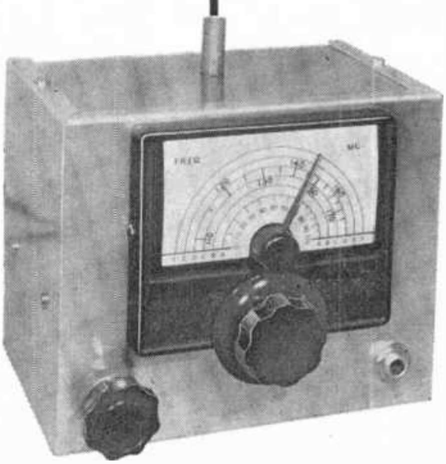
Listen to

- POLICE
- ONE-WAY SIGNALING
- HAMS
- BUSINESS SERVICES
- AIRPLANES
- FIRE

on a triple-purpose single-tube...

V.H.F. RECEIVER

By RALPH M. DORRIS, Receiving Tube Department
General Electric Company



THE BAND OF FREQUENCIES (108 to 174 mc.) lying between the FM band and television Channel 7 offers the experimenter a variety of exciting and informative listening—aircraft communications and navigation signals, messages from ships at sea, and so on. Here, too, are "on the spot" reports from police and fire department emergency crews, and even the two-meter ham band.

Commercially available receivers for these frequencies are generally priced beyond the reach of the experimenter or casual listener. But the v.h.f. receiver shown here tunes the entire range, is easy to construct, and can be assembled for less than $20.00. It uses the General Electric 6D10—one of the new multi-function "Compactron" tubes—as a combination r.f. amplifier, detector, and audio amplifier. And the detector is of the superregenerative type, long noted for its simplicity, extreme sensitivity, and ability to detect either AM or FM signals.

Construction. Although construction of the Compactron v.h.f. receiver is simple and straightforward, keep in mind that v.h.f. circuits are critical as to parts placement and lead lengths. For this reason, it's best to follow the layout shown in the pictorial and photographs very closely.

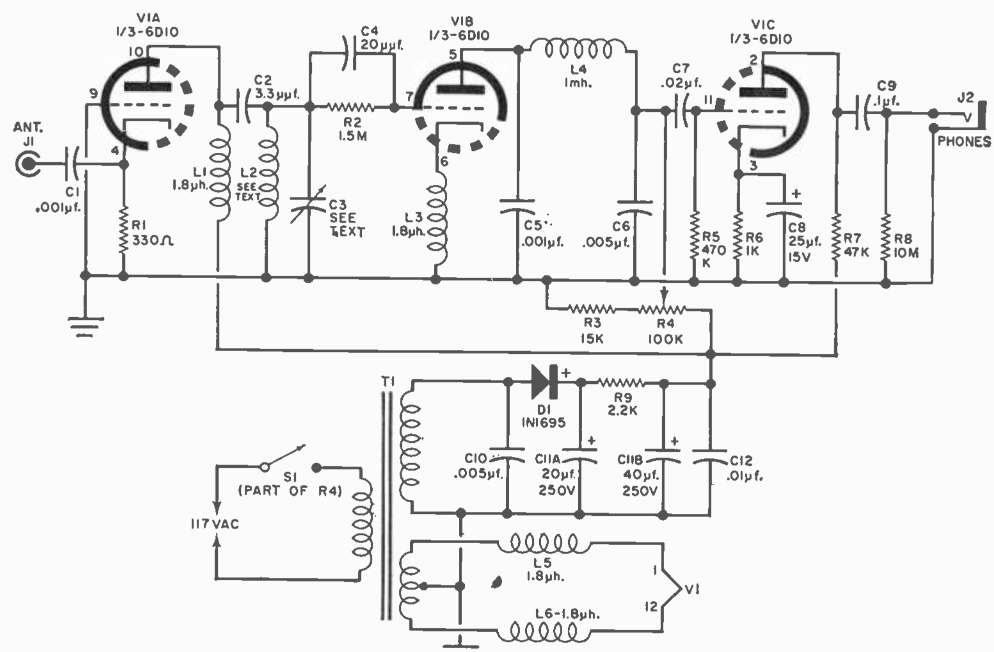
Begin by forming the subchassis. The author used a brass plate and soldered component leads directly to it; however, a printed-circuit board can be substituted if a suitable brass plate is not readily available. In this case, the subchassis would have no lips and could be supported in the cabinet with angle brackets.

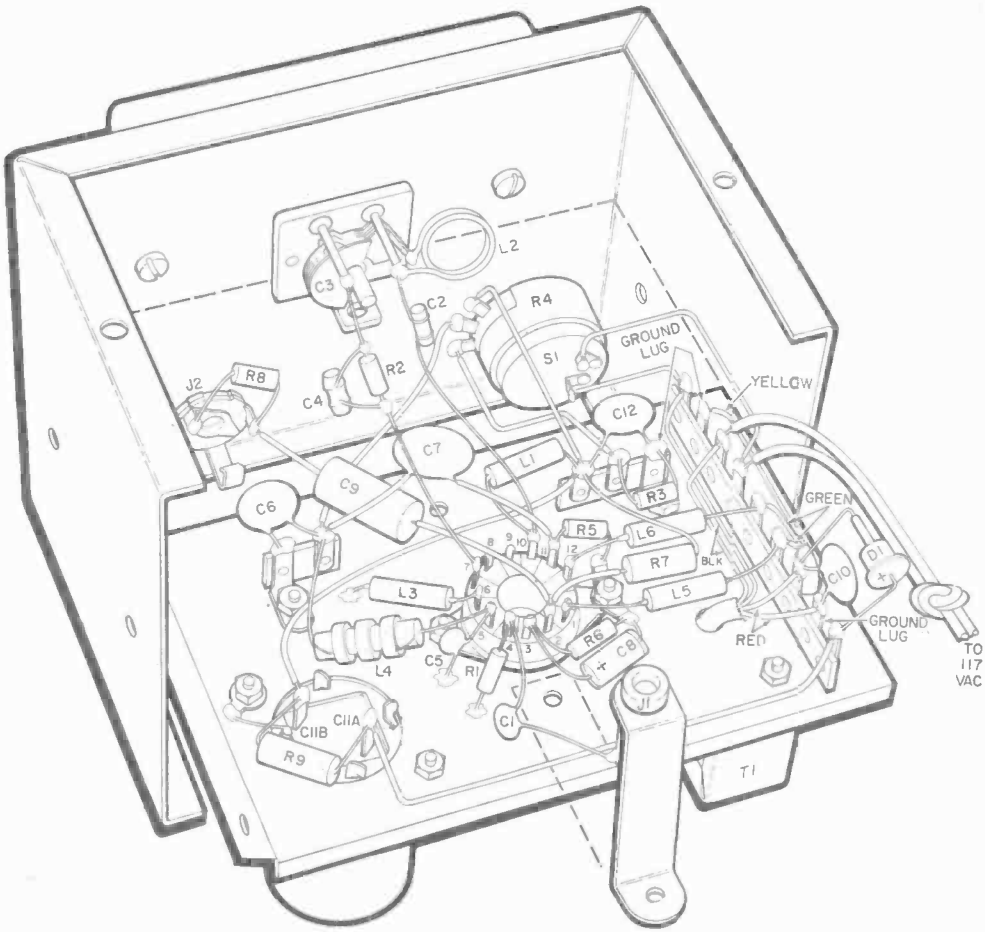
To insure proper fit of the subchassis and correct mating of the tuning capacitor and dial, first drill the required holes in the front of the cabinet as shown in

The v.h.f. receiver uses a hand-wound tuning coil (L2) and a modified tuning capacitor (C3), as explained in the text. If the capacitor specified for C11 proves difficult to obtain, a 20/20/20-µf., 250-w.v.d.c. electrolytic unit may be employed instead, with two of the sections wired in parallel.

PARTS LIST

C1, C5—0.001-µf. disc capacitor
C2—3.3-µµf. ceramic capacitor
C3—Tuning capacitor (Hammarlund HF-50 or HF-35—see text)
C4—20-µµf. ceramic capacitor
C6, C10—0.005-µf. disc capacitor
C7—0.02-µf. disc capacitor
C8—25-µf., 15-w.v.d.c. electrolytic capacitor
C9—0.1-µf., 400-volt paper capacitor
C11a/C11b—20/40 µf., 250-w.v.d.c., can-type electrolytic capacitor (General Electric XC2-22 or equivalent)
C12—0.01-µf. disc capacitor
D1—1N1695 silicon diode
J1—Insulated banana jack
J2—Open-circuit phone jack
L1, L3, L5, L6—1.8-µh. r.f. choke (Ohmite Z-144 or equivalent)
L2—Tuning coil—see text
L4—1-mh. r.f. choke
R1—330 ohms
R2—1.5 megohms
R3—15,000 ohms
All resistors ½ watt unless otherwise noted
R4—100,000-ohm potentiometer, linear taper
R5—470,000 ohms
R6—1000 ohms
R7—47,000 ohms, 1 watt
R8—10 megohms
R9—2200 ohms
S1—S.p.s.t. switch (on R4)
T1—Power transformer; primary, 117 volts a.c.; secondaries, 150 volts @ 25 ma., and 6.3 volts @0.5 amperes (Merit P-3046 or equivalent)
V1—6D10 tube
1—6" x 5" x 4" aluminum chassis box (Bud CU-3007A or equivalent)
1—4" x 7" x 1/32" brass plate (subchassis—see text)
1—Midget panel dial (Millen 10039 or equivalent)
1—Miniature telescoping antenna (Lafayette F-343 or equivalent)
Misc.—Tube socket, wire for L2, hookup wire, line cord and plug, solder, hardware, etc.





Parts layout shown in the pictorial diagram above must be followed very closely for optimum results.

HOW IT WORKS

The v.h.f. receiver employs a single, multi-function tube as an r.f. amplifier, superregenerative detector, and audio amplifier. Its power supply is a conventional transformer-fed, half-wave rectifier.

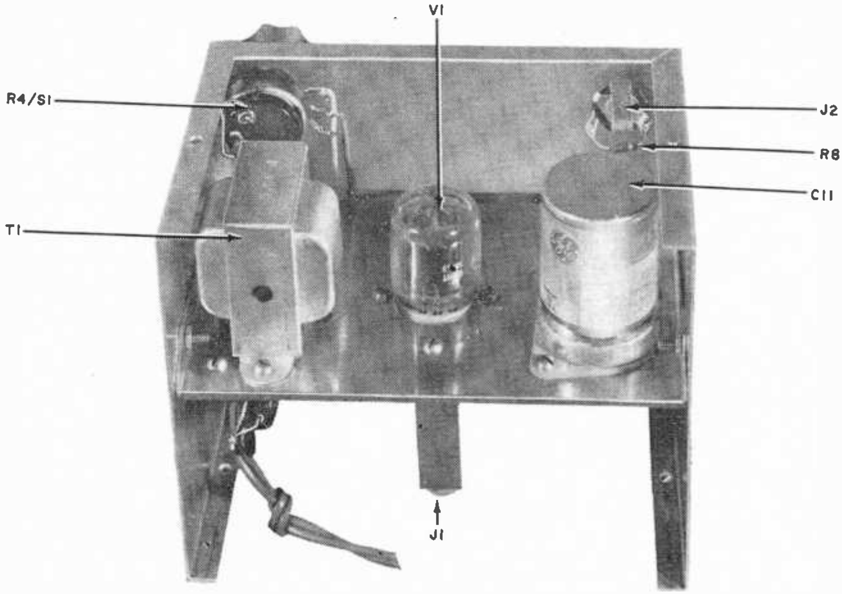
Signals from the antenna are fed through capacitor *C1* to the cathode of *V1a*, connected as an untuned, grounded-grid r.f. amplifier. While this stage provides some gain, its principal function is to isolate the detector from the antenna; the grounded-grid circuit is particularly effective for this purpose, since the grid acts as a shield between input and output.

The output from *V1a* is coupled to the detector (*V1b*) through *C2* and tuned by *L2/C3*. A superregenerative detector of the "hot-cathode" type, *V1b* is brought in and out of oscillation at a supersonic rate determined principally by *R2* and *C4*. This is known as the "quench frequency" and enables the detector to develop tremendous gain without instability.

The last stage (*V1c*) is a conventional resistance-coupled audio amplifier which is fed from the plate of the detector through *C7*. The output, fed to *J2*, is used to drive high-impedance headphones or an external amplifier.

the pictorial and mount the dial assembly. Second, temporarily insert the shaft of the tuning capacitor (*C3*) into the dial plate. Third, slip the subchassis into the cabinet, then mark and drill the tuning capacitor mounting hole, and fasten the capacitor to the subchassis. Finally, square up the subchassis and—in the case of a brass plate—drill the required holes through the sides of the cabinet and the lips of the subchassis in one operation.

With this done, all holes in the subchassis should be drilled or punched and the remaining parts mounted. The wiring can now be completed (except for the connections to regeneration control *R4* and phone jack *J2*) with the subchas-



Inverted view of receiver with cover removed shows placement of major components. All parts are mounted on subchassis except regeneration control R4 and phone jack J2.

sis removed from the cabinet. Pins 8 and 9 of the Compactron socket should be grounded by bending them over sharply and soldering them to the metal rim of the socket; then, after the socket is mounted, solder should be allowed to flow between the socket rim and the subchassis.

The tuning capacitor (*C3*) is a Hammarlund HF-50 or HF-35 with all but three stator and three rotor plates removed by twisting them back and forth with a pair of pliers until they break. Tuning coil *L2* consists of two turns of No. 14 tinned copper wire, ½" in diameter and approximately ¼" long.

When all of the subchassis wiring has been completed, the mounting bracket for the antenna jack (*J1*) should be fashioned from a piece of scrap metal and bolted in place. Finally, the subchassis should be fastened into place in the cabinet and connections made to *R4* and *J2*. Drill holes in the cabinet for the power cord and jack *J1* and the unit is finished.

Adjustments and Operation. After carefully double-checking all wiring, insert the antenna, plug in a pair of headphones, and turn the receiver on. When the set has had time to warm up, advance the regeneration control; you should pick up several stations.

If the tuning range is a bit lower than expected, some stations in the upper end of the FM band may be heard; alternatively, if the range is too high and there is a Channel 7 station in your locality, TV signals may be heard. The tuning range can be altered by adjusting the spacing between the turns of *L2*. Squeezing the turns closer together increases the inductance of the coil and thus lowers the frequency range, while spreading the turns farther apart raises it. Once the range is centered, the dial can be calibrated with the aid of a signal generator or by logging several stations of known frequency and plotting a curve of dial readings vs. frequency.

An outside antenna is not recommended for a number of reasons. For one thing, such an antenna might pick up too much signal and overload the detector. Then, too, even though the r.f. stage provides a good degree of isolation, there is always the possibility that the detector will radiate some signal and thus create interference. Even more important, the receiver is so sensitive that the small telescoping antenna is all that is required. —30—

RADAR SPEED-TRAP DETECTOR

By

OLIVER P. FERRELL, Editor

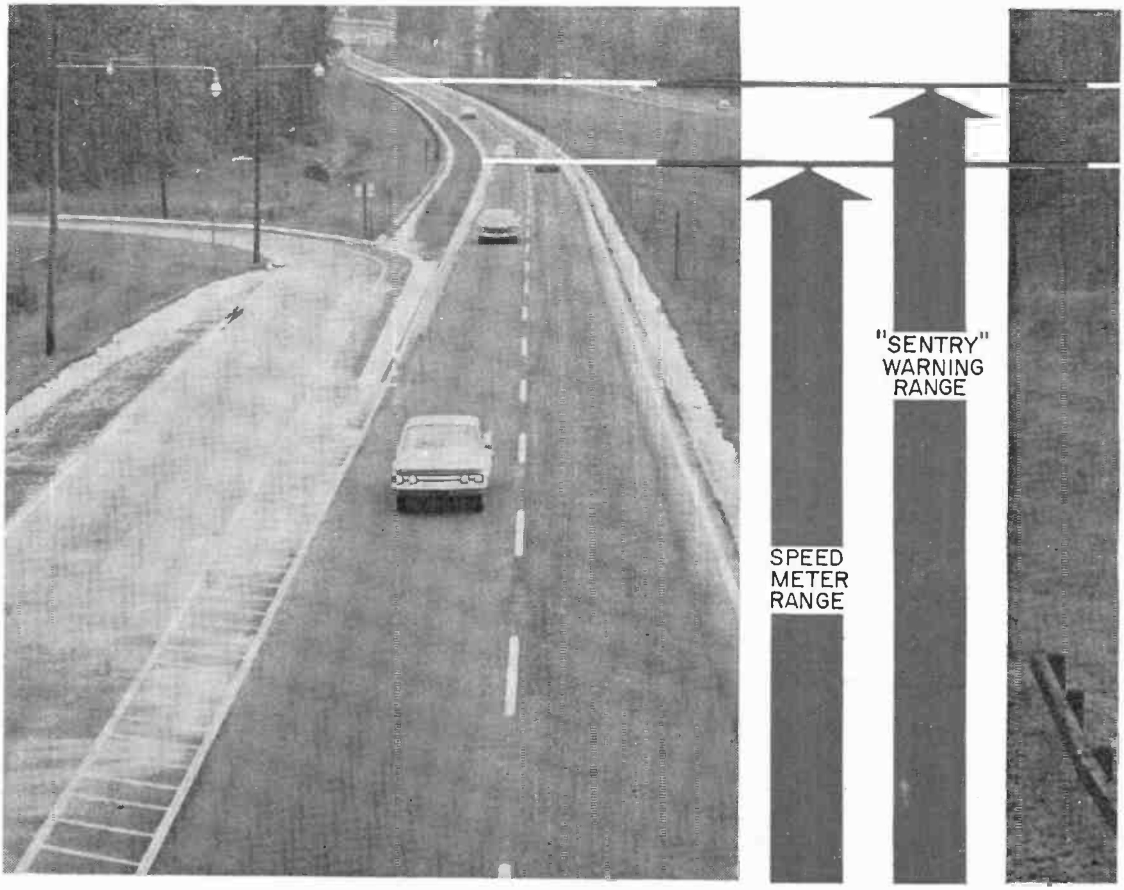
RICHARD A. FLANAGAN, Associate Editor

New transistorized receiver has impressive performance

IF YOU were a reader of POPULAR ELECTRONICS in May, 1956, you may recall a story entitled "Radar on the Highway." It discussed radar speed meters, told how they operate, and explained why—at that time—it was practically impossible to escape detection. The story closed with the prediction that "a microwave detector (radar speed meters operate at microwave frequencies) could be built" to warn motorists as they approach a speed trap.

In the intervening five years, many microwave detectors have come and gone. POPULAR ELECTRONICS has investigated each new speed-trap detector and has rejected some because they violated government regulations; others because of size, weight, or impractical construction; and one or two because they were simply "wishful thinking." Within the past few months, we have spent many days testing a new unit called the "Radar Sentry." Made by Radatron, Inc., 232 Zimmerman St., N. Tonawanda, N. Y., it is available direct from the factory for $39.95.

Four Radar Sentry units have been tested by POPULAR ELECTRONICS, and on the following pages you will find our report on this ingenious device, phrased in an easy-to-follow, question-and-answer format.



The photo and chart above show how the range of the Radar Sentry exceeds that of the radar speed meter. In the POPULAR ELECTRONICS tests, the Sentry usually gave a recognizable tone beep over 2000 feet away.

What is the Radar Sentry?

The Sentry is a miniature (2½" x 4" x 3⅛"), self-contained, transistorized receiver, complete with a special built-in antenna and battery power supply. It will detect signals at about 2455 mc.—the frequency assigned by the Federal Communications Commission for radar speed meters and traffic signal controls.

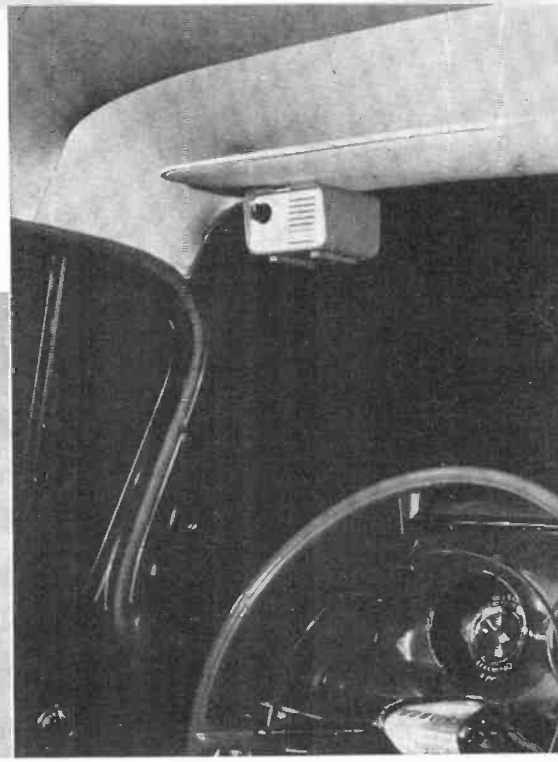
How does the Sentry work—electronically speaking?

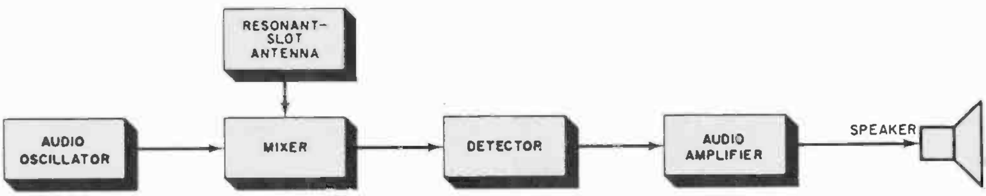
The Sentry is simply a receiver, using eight transistors and two diodes. A resonant-slot antenna (actually the back panel of the case) is fixed-tuned to the "S" band—2455 mc.

Whenever a radar signal is picked up, it is passed through a diode mixer and a diode detector, amplified, and fed to a miniature PM speaker. But since the speed meter signal is unmodulated, nothing would issue from the speaker were it not for an ingenious "flip-flop" audio-oscillator circuit. The diode mixer receives both the incoming signal and the output of the "flip-flop," and effectively "chops" the incoming signal at an audible rate. In actual use, therefore, the Sentry produces only a slight crackling sound until "triggered" by a radar signal, at which time it emits an audible (700-cycle) tone.

Power for the Sentry is supplied by two mercury cells, which, according to the manufacturer, have a life of 800 to 1000 hours; this corresponds to 35,000 miles of driving, assuming an average

Weighing about 14 ounces, the Sentry is ordinarily attached to a car's sun visor and must have an unobstructed "view" of the road ahead to operate properly. The small bars visible on the bottom of the Sentry in the photo at right are magnets to hold it on the dashboard of a truck or other vehicle where the visor cannot be used in the recommended manner.





Block diagram of Sentry's circuitry. Audio oscillator (at left) is actually a square-wave "flip-flop" oscillator, which "chops" incoming signal approximately 700 times a second to produce an audible tone.

speed of 35 mph. Battery life will vary somewhat with the setting of the volume control, but the batteries are readily replaceable and cost only 56 cents apiece.

How does the motorist use the Sentry?

The manufacturer recommends attaching the Sentry to the sun visor (a clip is supplied) on the driver's side of the car. The rear panel of the Sentry must have a clear, unobstructed "view" of the highway in front of the vehicle; in other words, the back plate "looks" out of the windshield and down the highway. Any object that interferes with this "view" —windshield wipers, for example—could scatter microwaves, reducing the Sentry's "sensitivity."

The volume control on the Sentry should be set so that a slight crackling sound is audible. To minimize battery drain, the volume should be kept as low as possible. When the beam of a radar speed meter is intercepted, the Sentry will emit a distinctive 700-cycle signal. The tone will get very loud very rapidly and will be heard only when a microwave signal is being detected by the Sentry.

How much warning does the Radar Sentry give the motorist?

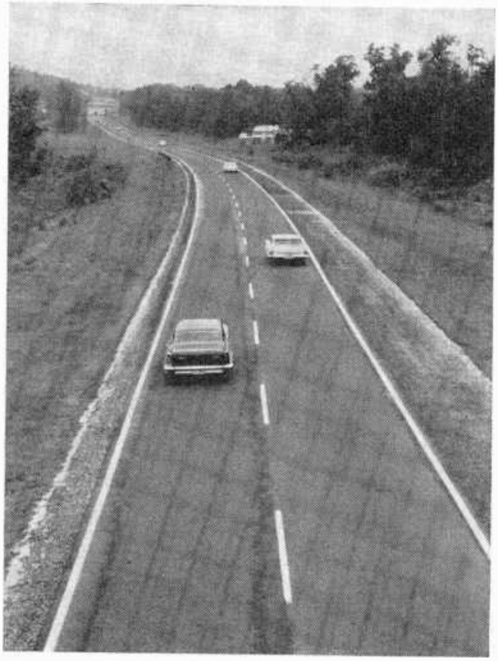
Although there is no all-inclusive answer to this question, a motorist can expect to be warned about 1000 to 2000 feet away from an operating radar speed meter. The range of the warning zone depends upon the topography of the highway, traffic conditions, and, in particular, on just how the speed meter itself has been "aimed" to observe traffic flow.

Aren't all radar speed meters used the same way?

No. Since the majority of present-day radar speed meters are portable, each setup is slightly different. The beam from the speed meter is relatively narrow, and "aiming" it down the highway is a matter of experience on the part of the traffic officers.

If an officer is shooting for maximum range on a "clear" highway, the Radar Sentry will give a warning signal at least 1500 feet away. On turnpikes and freeways where a portable speed meter is mounted on an overpass, the Sentry will give 1800- to 2200-foot warnings. However, if the traffic officer decides to sacrifice range and maximum speed readings by pointing the speed meter into the highway at a 40-45° angle, the Sentry may not give a warning until you are 600 to 750 feet away.

Mounting the radar speed meter on an overpass to observe traffic flow away from the meter is one way to defeat the Sentry. Speed meter will "clock" cars coming toward it or going away from it, but Sentry is useful only when it is approaching a speed trap.



Does the Sentry interfere with the speed meter, and can traffic officers tell that a Sentry is in use?

A double no. The Sentry is simply a receiver and does not radiate any signal of its own.

Can traffic officers find ways to defeat the warning given by the Sentry?

Yes—there are several possibilities. Probably the one most advantageous to the traffic officer would be placing the speed meter so that it records departing vehicles rather than approaching or on-coming cars. It makes no difference to the speed meter which way it is aimed, since it responds only to velocity and not direction or distance.

It might also be possible for a traffic officer with a Sentry in his own car to aim the speed meter in such a way as to minimize warning time but still preserve good speed meter sensitivity.

Lastly, the writers foresee the possibility of radar speed meter manufacturers shifting "wave polarization" in future models. Such meters would feed cross-polarized waves to the Sentry, effectively reducing its sensitivity by 10-12 db.

Why don't traffic officers simply change the frequency of speed meters, leaving the Sentry sitting high and dry?

Unfortunately for the traffic officers, speed meters are licensed to be operated at about 2455 mc. Also, to shift to a new frequency, a speed meter would need to be altered by the manufacturer—an expensive proposition.

Aren't radar speed meters being changed anyhow?

Not necessarily. But there is very limited production of an entirely new speed meter operating in the 10,000-mc. "K" band. It has improved circuitry with considerably more power output and much greater range than the present popular "S"-band models.

(*Continued on page* 107)

THE MONITOR METER

. . . . checks percent modulation and audio quality, also serves as a sensitive field strength meter

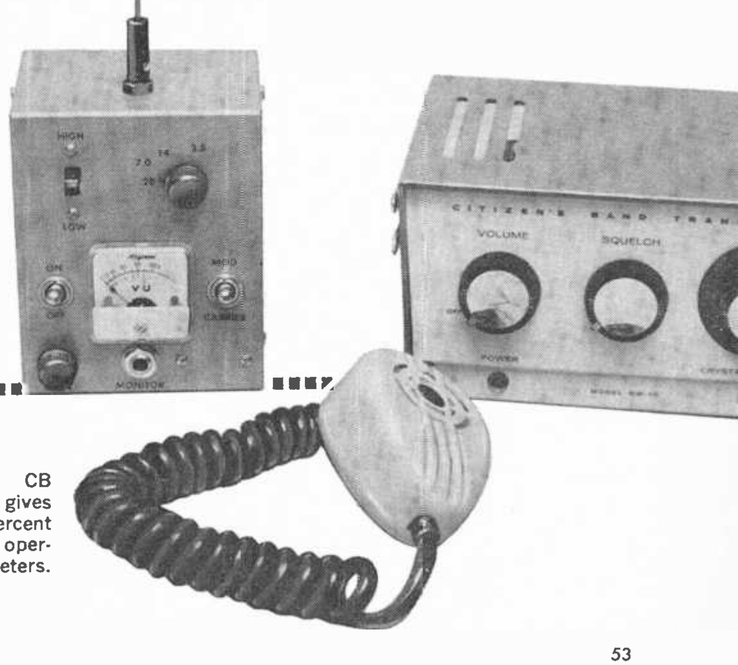
By **HERBERT FRIEDMAN**
W2ZLF

ALTHOUGH "phone men"—amateurs using phone and all Citizens Band'ers—are usually interested in improving their audio, their checking is generally limited to the reports of stations they contact. And, as most hams and CB'ers have learned, the best of signals can sound pretty bad to some individuals. Even worse, the poorest can sound "good" to others.

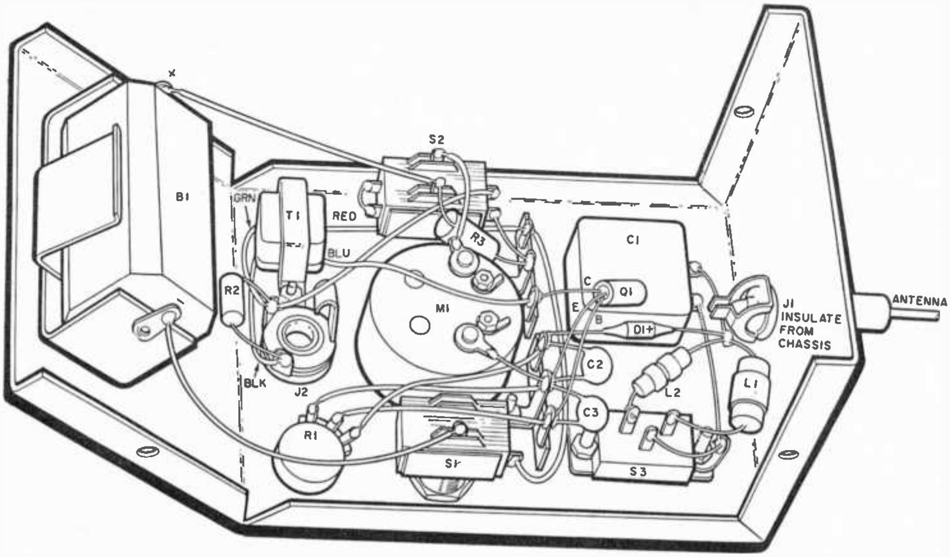
Actually, after all transmitter adjustments have been made and the antenna tuned, it is audio quality alone which can beat interference and static—QRM and QRN. And audio quality goes hand-in-hand with the percentage of modulation. If a modulator having good frequency response and low distortion overmodulates a transmitter, the result is distortion and sideband splatter. And if the audio is crisp and clean but the transmitter is undermodulated, the signal will hardy get through the second layer of QRM—let alone the fifth!

A percent modulation meter with a provision for monitoring will help the "phone man" realize the maximum potential from his transmitter. The "Monitor Meter" described here differs from the usual modulation meter in that it requires no connection to the antenna feedline, thereby eliminating the problem of the meter coupler changing the length of the feedline. Also, no power is removed from the feedline. This may seem unimportant, but at the low output of CB or portable transmitters, even 1 watt is an appreciable loss.

The Monitor Meter is basically an amplified field strength meter. Not only will it function as such, but it will also indicate percent modulation on a VU type-B meter scale, and it has a monitor jack for checking audio quality. Its cir-

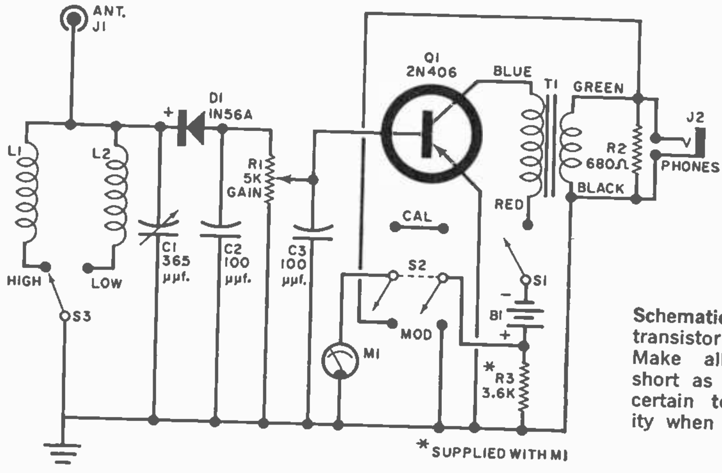


Particularly useful with CB rigs, the Monitor Meter gives continuous indication of percent modulation for transmitters operating between 80 and 10 meters.

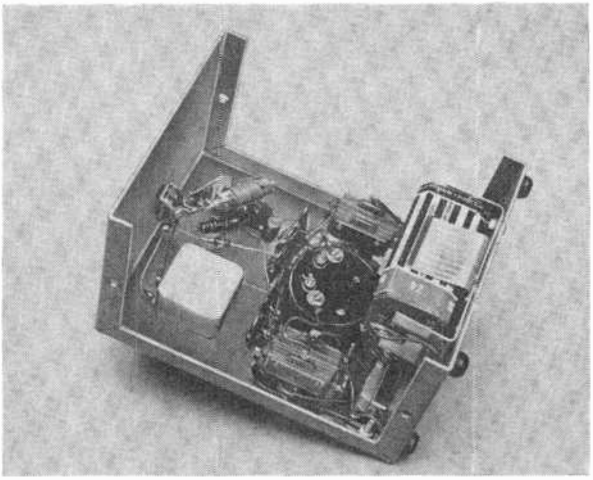


PARTS LIST

B1—6-volt portable radio battery (Burgess Z4 or equivalent)
C1—365-μμf. midget variable capacitor (Lafayette MS-274 or equivalent)
C2, C3—100-μμf. ceramic disc capacitor
D1—1N56A diode
J1—Banana jack
J2—Open-circuit phone jack
L1—0.8-μh. TV filament choke (Miller 6175 or equivalent)
L2—10-μh. r.f. choke (National R-33 or equivalent)
M1—VU meter (Lafayette TM-10 or equivalent)
Q1—2N406 transistor
R1—5000-ohm miniature potentiometer (Lafayette VC-33 or equivalent)
R2—680-ohm, ½-watt resistor
R3—3600-ohm, ½-watt resistor (supplied with meter M1)
S1—S.p.s.t. toggle switch
S2—D.p.d.t. toggle switch
S3—S.p.d.t. slide switch
T1—Miniature driver transformer; primary, 20,000 ohms; secondary, 1000 ohms (Argonne AR-104 or equivalent)
1—5" x 4" x 3" aluminum utility box (Bud CU-3005A or equivalent)
Misc.—Battery holder, wire, solder, hardware



Schematic diagram of one-transistor Monitor Meter. Make all r.f. leads as short as possible, and be certain to observe polarity when wiring diode D1.



Completed unit, with side of box removed. Rubber feet on base lend a professional touch.

The Monitor Meter, which can be used indoors or out, needs no direct connection to transmitter.

cuit is so designed that use of the monitor output does not disable the VU meter, and the unit is tunable from below 80 meters through 10 meters using "stock" coils.

Construction. The meter is built on the main section of a 5″ x 4″ x 3″ aluminum box, with the r.f. components—coils, bandswitch, tuning capacitor, and antenna jack—mounted close together at the top. Before wiring, mount all parts except switches *S1* and *S2*. Complete as much wiring as possible, and then mount *S1* and *S2*. Although all r.f. leads must be extremely short, the audio and power sections can be wired in any convenient manner.

Since most of the components are rather delicate, you'll save yourself some headaches by avoiding the use of a high-wattage soldering iron or gun; a 25- or 50-watt pencil iron should be more than adequate. Use a heat sink when soldering the diode and transistor leads.

Although most components, including transistor *Q1*, are non-critical, the Monitor Meter is designed to operate with the transformer *(T1)* specified. For this reason, no substitution for *T1* should be attempted.

The antenna is made from a section of an unpainted metal coat hanger, 8″ to 12″ in length, with a solderless banana plug for the connector. Since a solderless plug utilizes a setscrew for connection, it makes a very firm contact with the antenna.

With the wiring completed, you're ready to label the front-panel controls. The position of *S3* which places *L1* in the circuit should be labeled *High;* the other position, *Low.* Label the position of *S2* which places the meter across the transformer's secondary *Mod* (modulation); the other position, *Cal* (calibrate). Potentiometer *R1* is the gain control and should be marked *Gain.*

Check-out and Calibration. Place the battery in its holder and set *S2* to the calibrate *(Cal)* position. Turn the unit on; if the wiring is correct, there will be no indication on the meter.

(*Continued on page* 97)

HOW IT WORKS

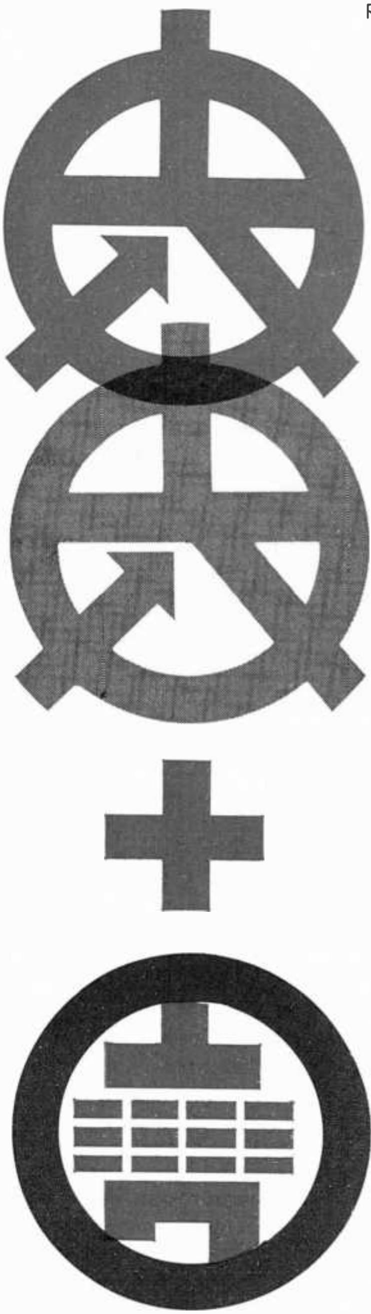
The unmodulated r.f. carrier picked up by the Monitor Meter's antenna is tuned by either *L1/C1* or *L2/C1* (depending on the position of switch *S3*) and rectified by diode *D1*. The resultant d.c. component is applied to the base of transistor *Q1* through gain control *R1*. The applied base current is adjusted so that the collector circuit will develop 1 milliwatt of audio when modulation is applied to the transmitter. In practice, the actual power developed in the collector circuit is slightly greater than 1 milliwatt in order to compensate for losses in transformer *T1*.

The secondary of *T1* is terminated in a 680-ohm resistor (*R2*). Since the VU meter is designed to read 100% when connected across a 1-milliwatt, 600-ohm circuit, the 100% modulation mark represents the collector current which will produce 1 milliwatt in *T1* when modulation is applied.

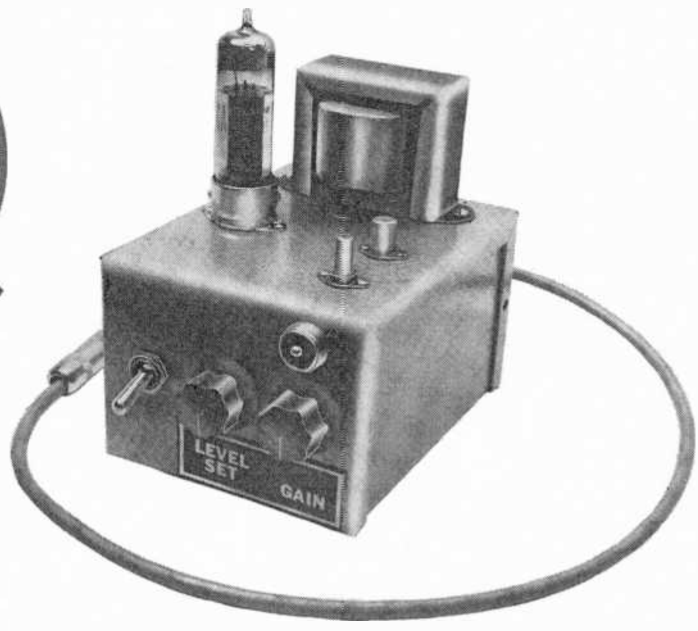
Plugging a pair of earphones into jack *J2* permits monitoring the signal and thus enables you to check the audio quality.

HYBRID CATHODE MODULATOR

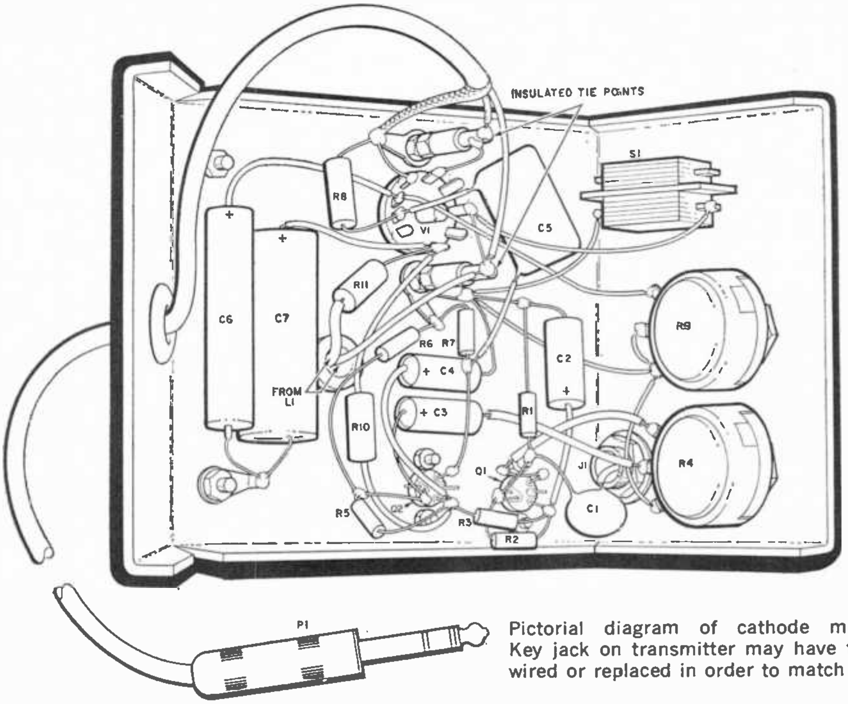
By **MARTIN L. KAISER,** W2VCG
Electron Tube Division
RCA Laboratories



Two transistors and a single tube team up to make a low-cost modulator for low-powered amateur rigs



HERE'S a simple modulator specifically designed for amateur transmitters whose plate current during c.w. operation is 120 ma. or less. Compact in size as well as easy to install and remove, it can be used with almost any small transmitter having a keyed final amplifier. Powering the modulator is no problem, since the entire unit—with the exception of the 6BQ5 heater—receives



Pictorial diagram of cathode modulator. Key jack on transmitter may have to be rewired or replaced in order to match plug P1.

its power from the cathode circuit of the transmitter final.

Because the modulator needs no output transformer or bulky power supply, it is well within financial reach of any amateur—Novice and old pro alike. And it's just the thing to turn a Novice or standby c.w. rig into a fine amplitude-modulated transmitter.

Construction. The modulator is built in a 5" x 4" x 3" chassis, with gain control *R4*, level-set control *R9*, microphone jack *J1*, and modulate/test switch *S1* mounted on the front panel. For connection to the transmitter, a two-conductor shielded cable is run through the rear of the chassis to a three-conductor plug (*P1.*)

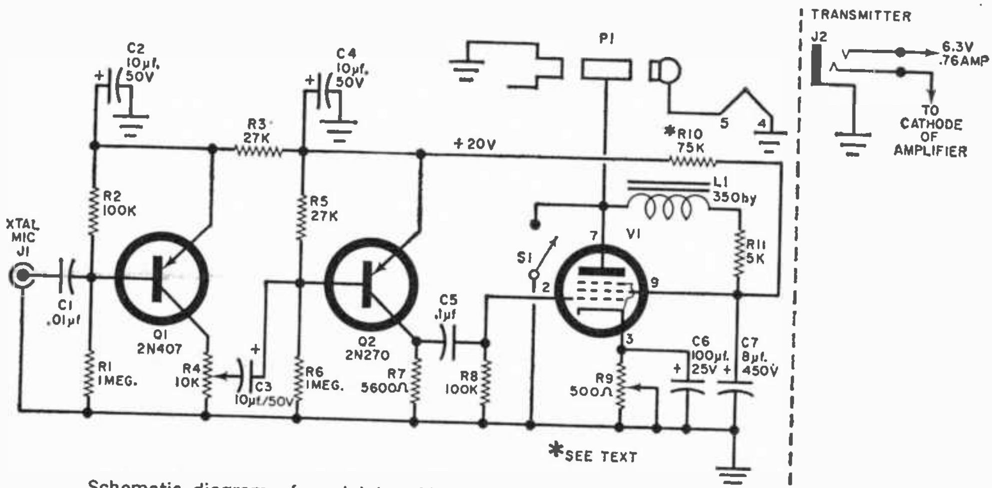
To match this plug, you may have to replace the key jack in your transmitter with a three-contact jack; if you do, a Switchcraft 12B jack should serve nicely. The tip contact should be connected to a 6.3-volt, 0.76-ampere source; the center contact to the cathode of the final; and the other contact should be grounded. Be sure to check connections to the jack and plug with an ohmmeter or other continuity tester to avoid possible damage to the equipment.

Wiring is straightforward and should proceed smoothly; full details appear in the pictorial diagram. Make ample use of spaghetti, and be certain to employ a heat sink when soldering to the transistors.

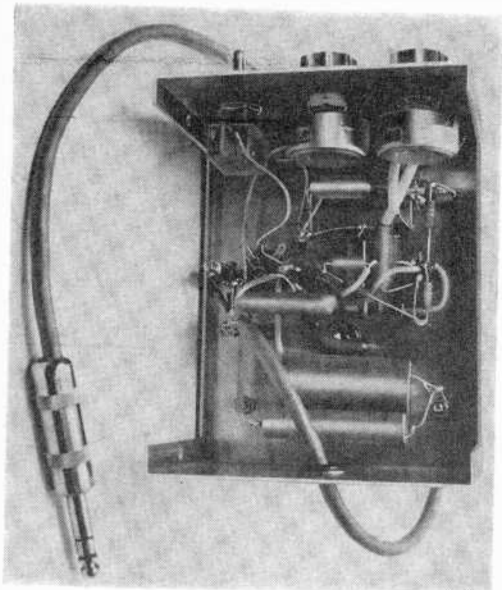
Operation. With the transmitter turned off, plug in the modulator, turn gain control *R4* to zero, set level-set control *R9* at mid-range, and throw switch *S1* to "*Test*" (this will ground the cathode of the transmitter final). Turn on the transmitter and tune it up under c.w. conditions.

Now throw *S1* to "*Modulate*," and adjust level-set control *R9* until the plate current meter on the transmitter final reads one-half its c.w. value. Next, speak into the microphone at a normal level and turn up gain control *R4* until the meter starts to "kick" heavily. This is the point of maximum modulation, and you are now on the air with amplitude-modulated phone.

About the Circuit. Even though the modulator is connected in series with the cathode of the transmitter final, it is basically of the grid-bias type. Since the audio signal controls the cathode voltage of the final, the modulator effec-



Schematic diagram of modulator. Modulate/test switch S1 is shown in "modulate" position; resistor R10 should be selected to produce about 20 volts at the emitter of Q2.



PARTS LIST

C1—0.01-µf., 50-w.v.d.c. ceramic capacitor
C2, C3, C4—10-µf., 50-w.v.d.c miniature electrolytic capacitor
C5—0.1-µf., 75-w.v.d.c. ceramic capacitor
C6—100-µf., 25-w.v.d.c. electrolytic capacitor
C7—8-µf., 450-w.v.d.c. electrolytic capacitor
J1—Microphone jack
J2—3-conductor phone jack (Switchcraft 12B or equivalent)
L1—350-henry, 5-ma. choke (Thordarson 20C50 or equivalent)
P1—3-conductor phone plug (Switchcraft 297 or equivalent)
Q1—2N407 transistor
Q2—2N270 transistor
R1, R6—1 megohm
R2, R8—100,000 ohms
R3, R5—27,000 ohms
All resistors ½ watt unless otherwise noted
R4—10,000-ohm potentiometer, linear taper
R7—5600 ohms
R9—500-ohm potentiometer, linear taper
R10—75,000 ohms, 1 watt (see text)
R11—5000 ohms, 1 watt
S1—S.p.s.t. toggle switch
V1—6BQ5 tube
1—5" x 4" x 3" aluminum box (Bud CU-3005A or equivalent)
Misc.—Sockets, wire, solder, hardware, etc.

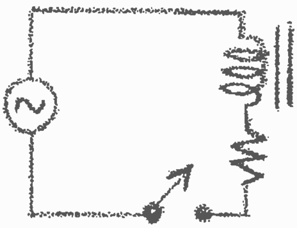
tively governs the final's plate current.

The speech-amplifier section of the modulator, using cascaded 2N407 and 2N270 transistors (*Q1* and *Q2*), provides sufficient gain to drive the 6BQ5 power amplifier (*V1*). Resistor *R10* drops the incoming voltage to about 20 volts for the transistor stages, while capacitors *C2* and *C4* provide adequate regulation and decoupling. Resistor *R10*, by the way, is a 75,000-ohm unit in the model, but its actual value is best determined by test; the voltage at *Q2*'s emitter should be about 20 volts.

In the 6BQ5 modulator stage, audio voltage is developed across choke *L1* and bias is set by a variable cathode-bias resistor (*R9*). During peak carrier conditions, the only bias on the final is a small drop across the modulator tube, plus the drop across *R9*. This is a very small percentage of the full voltage, so it subtracts little from the total power output. —30—

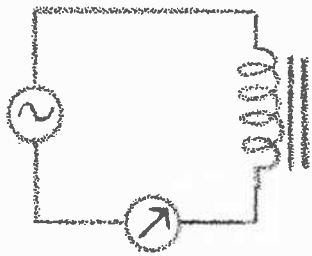
INDUCTANCE QUIZ

Inductance, as you may know, is the electrical property frequently compared to mechanical inertia. To gauge your "inductance" knowledge, solve the problems below, then turn to page 101 to check your answers. **By ROBERT P. BALIN**



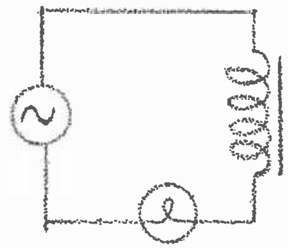
1 The larger the resistance, the greater the voltage developed on opening the switch.

TRUE FALSE



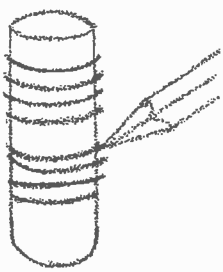
2 Current will continue to flow, even after the supply voltage has dropped to zero.

TRUE FALSE



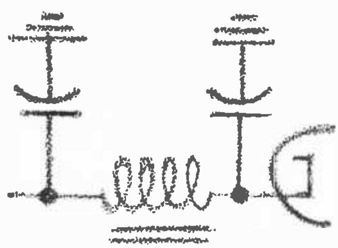
3 Increasing the supply frequency will cause the lamp to glow more brightly.

TRUE FALSE



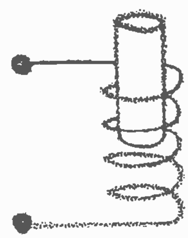
4 Bunching a number of turns together in a coil will increase its inductance.

TRUE FALSE



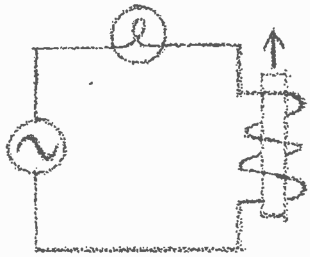
5 The inductance of a "swinging" choke decreases as the current through it increases.

TRUE FALSE



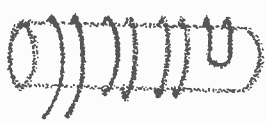
6 Inserting a brass-tipped tuning wand into a coil will increase its inductance.

TRUE FALSE



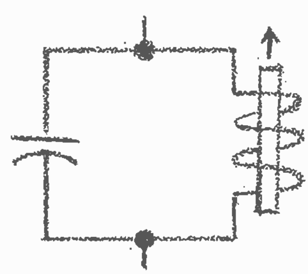
7 The lamp will glow more brightly as the iron core is moved out of the coil.

TRUE FALSE



8 Since a bifilar winding is "doubled back" on itself, it boosts inductance.

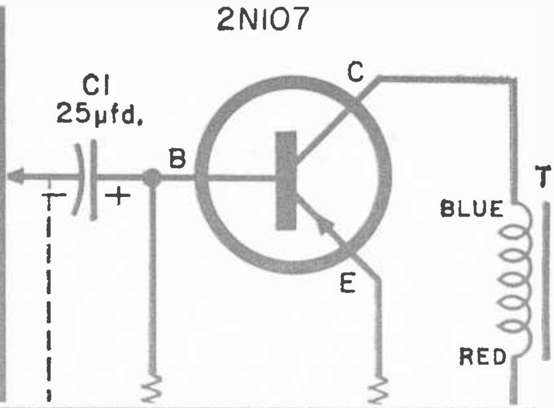
TRUE FALSE



9 The tuning slug on an oscillator coil is most withdrawn at the top end of the band.

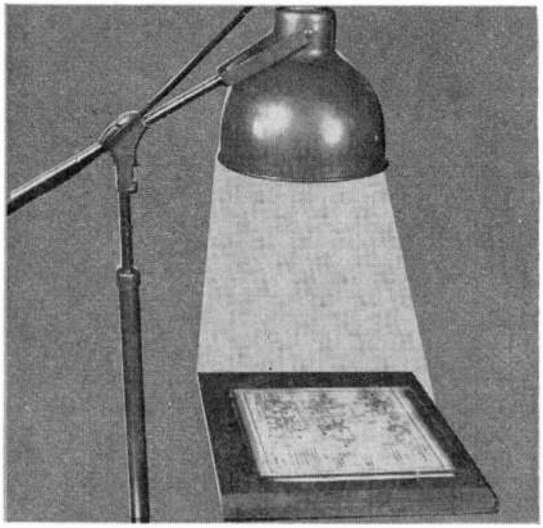
TRUE FALSE

COOKING UP YOUR OWN BLUEPRINTS



By **BOB WRIGHT**

RECIPE:
Take one sheet
of "Ozalid" paper,
top with material
to be copied;
expose first to light,
then to ammonia fumes . . .



Sun lamp provides illumination in this setup. Drawing lies on top of sensitized paper.

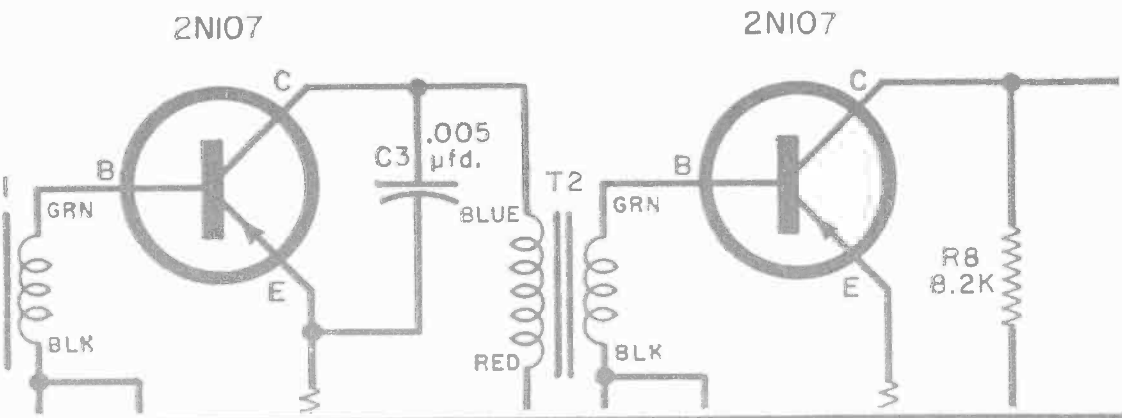
EVER think of making your own "blueprints"? You can—for little more than the cost of the paper. Of course, there are machines that will duplicate your drawings and other line-type material on photosensitive paper very efficiently and with quite uniform results. But if you can do without some of the efficiency, you can still get a fine job—practically free!

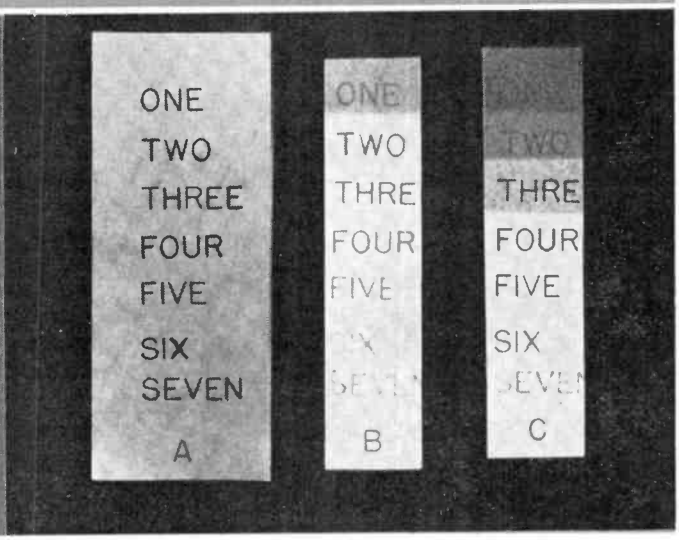
The Paper. The main requirement is sensitized paper, which must be of a type designed for use on an "Ozalid" machine. Such paper is available at office supply houses at a cost of just over one cent a sheet for a package of 250 standard 8½" x 11" sheets. Buy the "Dry Developing" rather than the "Wet Developing" type.

Incidentally, this paper is manufactured in both a "Blue Line" and a "Black Line" variety. As the names suggest, one paper produces drawings with blue lines, while the other makes black-line reproductions. Naturally, the one you choose is simply a matter of your own personal preference.

The Procedure. "For best results, keep in a cool, dry place, away from ammonia and light," reads the warning note on the label of the paper package. Actually, this simple instruction is the key to our duplicating process.

You'll note that the unexposed paper is white on one side, pale yellow on the other. As it happens, the yellow side is sensitive to light, although much less so than photographic paper (it can be exposed to normal room lighting for several





After exposure, "blue print" is developed in glass jar. Fumes from ammonia-soaked cloth do developing.

Correct exposure time can be determined with test strips. Strip A is original; B and C are prints.

minutes at a time without ill effects).

If the paper is subjected to ammonia fumes before it has been exposed to light, it turns a dark color (blue or black). And if it has been exposed to light for a sufficient time, it will be unaffected by the presence of ammonia fumes.

To copy a drawing or other material, take a wide-mouth glass jar with a screw-on lid—a Mason jar or an instant coffee jar, for instance. Then put several drops of household ammonia on a wad of paper or cotton and drop it in the jar.

Place a sheet of the sensitized paper face up on a flat surface, cover with the drawing to be copied (also face up), and place a sheet of glass on top to hold the papers together. Expose to light for a suitable length of time, and develop in the jar.

Exposure Times. You can see the effects of different exposures in the photograph at right, above. Strip "A" is a piece of ordinary tracing paper with the words "one" through "seven" drawn on it in India ink. This was placed over test strip "B," which was lying on a plate of glass. Another plate of glass was placed on top to hold the tracing against the sensitized paper.

Exposure was made 10 inches from a 275-watt, 117-volt Kenmore PS sunlamp. A piece of black cardboard was used to

(*Continued on page* 96)

FM TABLE RADIO TURNS TUNER

By ART TRAUFFER

Improve the sound of your FM receiver by feeding it into your hi-fi system

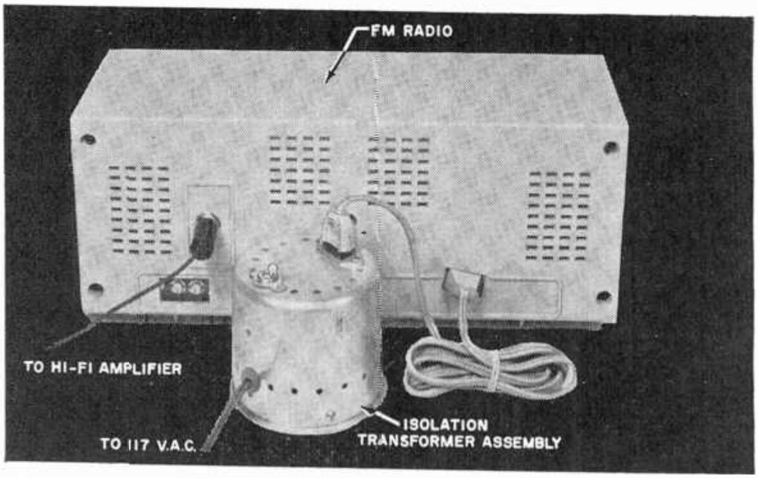
CUSTOM HAS IT that most hi-fi fans start out with an amplifier, a speaker or two, and a changer or a record player—tape decks and tuners seem to come a little later, since the necessary cash is often lacking. As a temporary arrangement, though, the FM section of an FM or an AM/FM table radio can make a fine little tuner for budget hi-fi systems.

Why turn an FM table radio into a tuner? Simply because the performance of such sets is often surprisingly good—prior to the discriminator or detector, at least. But in the audio section, the cost of installing hi-fi circuitry is prohibitive. The result is often a small, replacement-type speaker, inadequately baffled, fed by an inexpensive amplifier that probably produces almost as much hum and distortion as anything else.

The addition of a closed-circuit phone jack can change all this, however, allowing you to turn your table radio into a tuner at will.

Closed-Circuit Jack. All you do is tap into your radio at the output of its FM "detector," and feed the signal into your hi-fi amplifier and speaker system. The jack is wired across the radio's de-

The pretty miss at left is listening to the fine sound of FM over a hi-fi setup. The simple modifications made to the FM receiver are shown at right.



emphasis capacitor, as shown in the schematic diagram. Although the exact mounting details will vary from set to set, the jack can usually be placed at some convenient spot at the rear of the radio.

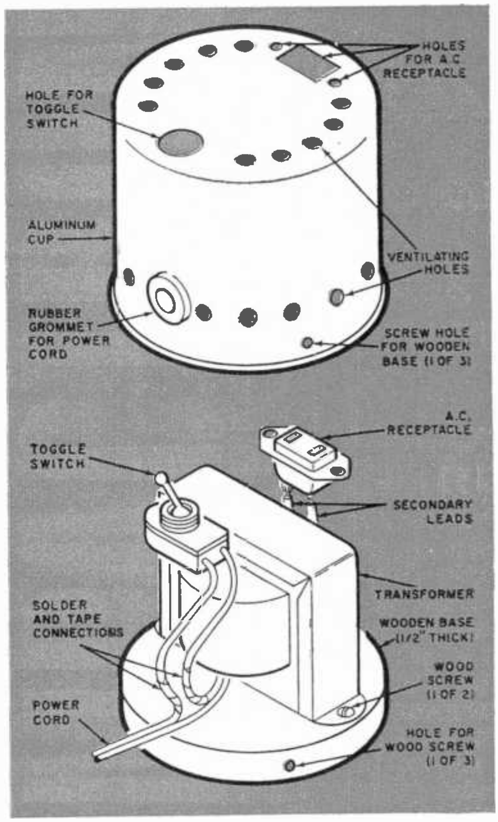
A phono pin plug and a length of phono or mike cable feeds the tuner output into the input of your hi-fi amplifier.

Use low-capacitance cable, and keep it as short as possible to preserve the "highs." If the capacitance of the cable is large and you want to compensate accordingly, the de-emphasis capacitor in your set can be reduced in value in order to produce the required 75-μsec. de-emphasis characteristic.

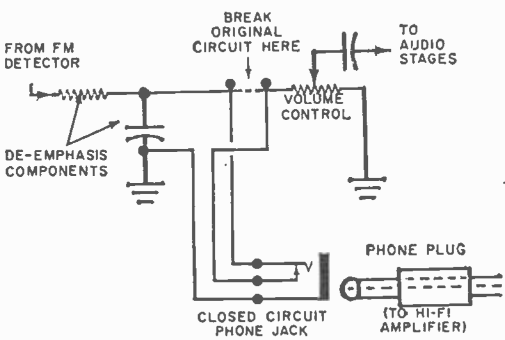
As you can see from the schematic, the table radio's audio section is severed from the "tuner" section whenever the cable from the hi-fi amplifier is plugged into the closed-circuit jack. Since this is the case, volume and tone must be controlled from the hi-fi amplifier or preamplifier whenever you use your receiver as a tuner.

Isolation Transformer. If your FM or AM/FM table radio is of the a.c. type (i.e., containing a power transformer), there is no danger of electrical shock. But if your radio is of the a.c./d.c. type (i.e., without a power transformer), it's almost imperative that you use an isolation transformer between the line and your radio.

Details for constructing a suitable isolaton transformer unit appear at right. The transformer—a Lafayette Type TR-91 or equivalent—is mounted on a round, wooden base, approximately $3\frac{3}{16}$" in diameter and ½" thick. An aluminum drinking cup, 3½" wide and 3" deep, hides the wiring and improves the appearance of the assembly; a power switch and an a.c. receptacle are provided for convenience.



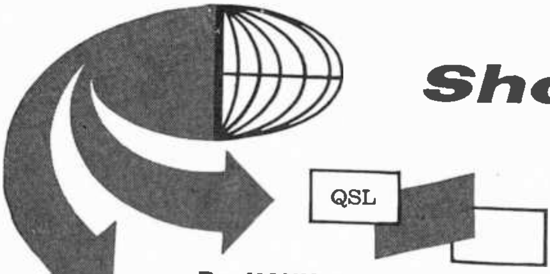
Isolation transformer assembly makes it safe to operate any a.c./d.c. receiver with a hi-fi set.



Schematic diagram shows how a closed-circuit phone jack can be added to your FM radio to permit it to function either as a tuner or as a receiver.

Although the parts shown here are those selected by the author, construction details are largely a matter of individual choice and will depend to a great extent on what you are able to uncover in your spare parts box. Then, too, individual receivers may necessitate some change in design. If your radio requires a larger and heavier-duty isolation transformer than that specified, for example, you will naturally have to use a larger cup than the one shown here.

All holes and cutouts in the cup—including those for the s.p.s.t. toggle switch and the Amphenol Type 2R2 a.c. socket —were made with the small blade of a pocket knife and a few small round and flat files. To pass the transformer's power cord through the rubber grommet in the cup, you'll probably have to clip off the plug and put on another. In any case, be sure to provide plenty of ventilating holes in the cup, since the transformer warms up after a few hours' use. -30-



Short-Wave Report

By **HANK BENNETT**
W2PNA/WPE2FT

NEW DE LUXE RECEIVER FOR SWL'S

FROM TIME TO TIME your Short-Wave Editor has suggested various methods of determining the exact frequencies of stations heard. These methods have been largely based on the use of graph-paper charts, with frequencies of known stations serving as check points along the bandspread line. Now, however, there is a new receiver on the market—the kind SWL's have been dreaming about for years—that will do the job for you. It's the National NC-190.

Second in the new "National Blue" series (the first being the NC-270), the NC-190 receiver incorporates calibrated bandspread coverage for the 13-, 16-, 19-, 25-, 31-, and 49-meter short-wave broadcast bands as well as for the 10-, 15-, 20-, 40-, and 80-meter amateur bands. The short-wave ranges "bandspreaded" are 5900-6300 kc., 8600-10,000 kc., 11,700-12,000 kc., 14,600-15,400 kc., 16,400-18,000 kc., and 21,500-22,100 kc. Overall coverage: 540 to 30,000 kc.

The NC-190 is a double-conversion unit. It eliminates images above 4000 kc., and boasts a variable i.f. selectivity system. Among its other features are: (1) 60 to 1 bandspread tuning ratio; (2) sensitivity better than 1 microvolt for 10-db signal-to-noise ratio; (3) SSB reception with separate product detector and calibrated upper/lower sideband BFO control; (4) automatic volume control operating on SSB and c. w. as well as on AM; (5) voltage-regulated oscillators; and (6) an edge-reading S-meter which operates on all reception modes.

Available from the National Radio Company, Inc., 37 Washington St., Melrose 76, Mass., for $199.50, the new receiver is 8¾″ high, 15¾″ wide, and 9″ deep. Power requirements: 105-125 volts a.c., 50-60 cycles, 75 watts. The NC-190 has 10 tubes, including voltage regulator, and comes equipped with a "flip-foot" to tilt the receiver, sloping the front panel for ease of dial reading. An accessory loudspeaker (Model NTS-3) is housed in a matching cabinet and is priced at $19.95.

(*Continued on page* 112)

Calibrated bandspreads and variable i. f. selectivity are provided in the National NC-190 receiver.

LIGHT CONTROL FOR BATTERY POWERED TOYS

Flashlight-actuated photoelectric relay circuit gives new life to Junior's electric toys

By MARTIN H. PATRICK

HERE'S a good way to add some life to that electric toy which may be beginning to bore Junior. The transistor-amplified photoelectric relay described here will allow him to turn the toy on and off from a distance merely by pointing a flashlight beam at it. Although the model shown is used on a battery-operated truck, the device is adaptable to almost any gadget which runs by electricity.

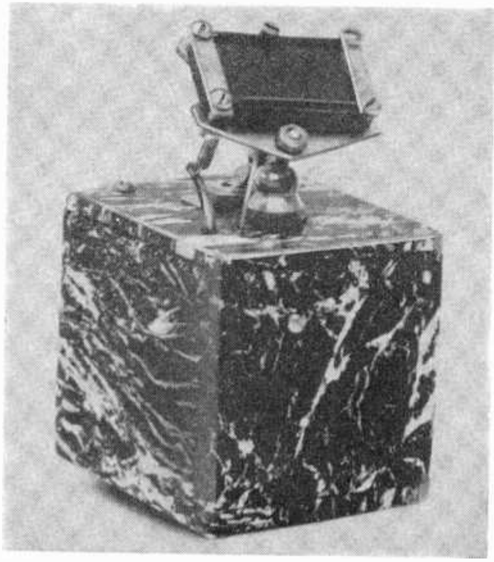
The Circuit. A self-generating photocell (*PC1*) is coupled through a two-stage transistor amplifier to a sensitive, normally open relay (*K1*). The simple direct-coupled amplifier is made up of transistors *Q1* and *Q2*; resistor *R1* serves as a collector load for *Q2*. Potentiometer *R2* and relay *K1* also pass part of the collector current, but only enough to operate the relay; *R2* is set at its maximum value and decreased until satisfactory operation is achieved.

Power for the circuit is supplied by two penlight cells in series (*B1*) through switch *S1*. When the surface of *PC1* is illuminated, an electric current is generated which is amplified and passed through the coil of *K1*, closing its contacts and activating the toy.

Transistors *Q1* and *Q2* may be almost any inexpensive *pnp* and *npn* (respectively) transistors. Experiment with various units if you like, but be sure that the one you choose for *Q2* has a collector current rating of at least 65 milliamperes.

Construction. The components for the model were housed in a 2½" x 3" x 2½" homemade wooden box. The size and material of the housing are not critical,

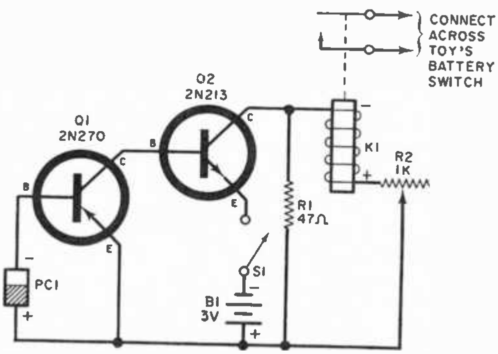
The author's model was designed to "ride" in the back of a small toy truck. Your version could be built right into the toy itself —if enough space is available.



Framed photocell is mounted on optional ball-and-socket joint.

PARTS LIST

B1—Two 1½-volt penlight cells in series (Eveready #912 or equivalent)
K1—High-sensitivity meter relay (Lafayette F-482)
PC1—Self-generating photocell (International Rectifier B-5 or equivalent)
Q1—2N270 transistor—see text
Q2—2N213 transistor—see text
R1—47-ohm, ½-watt resistor
R2—1000-ohm screwdriver-adjusted potentiometer
S1—S.p.s.t. switch



Relay circuit involves few parts, but all polarities are critical.

however. Any container which fits either on or inside the toy can be used. You can even build the circuit right into the toy itself.

Photocell *PC1*, which comes unmounted, is installed in a frame made of some pieces of scrap metal and Bakelite (see photo). The two vertical metal clamps touch the negative contacts located at each end of the front of the photocell. These contacts are shorted together through the mounting screws of the clamps and the metal bottom of the frame. Make the negative connection to the cell via a solder lug secured to one of the mounting screws.

The positive contact of the photocell is located on its rear surface. A metal plate placed between the photocell and the Bakelite back of the frame touches this contact, and a lead soldered to the plate is brought out to the rear of the frame through a hole drilled through the back. This lead is connected to one of a pair of solder lugs bolted together at some convenient spot on the Bakelite. Use the extra lug to make the positive connection to *PC1*.

In the model, the mounted photocell was bolted to a swivel joint salvaged from an old desk pen set and attached to the top of the box. This arrangement makes it possible to tilt the cell away from any strong light which might interfere with the operation of the relay.

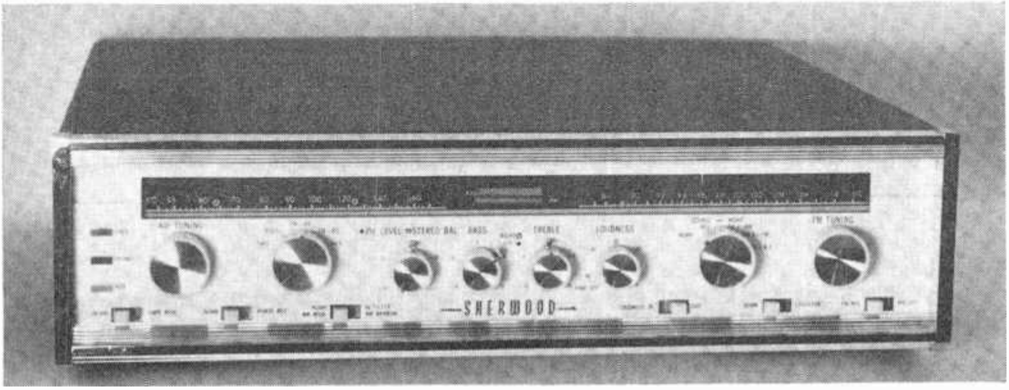
Installation and Operation. Wire the contact points of relay *K1* in parallel with the switch controlling the toy's power, set *R2* for maximum resistance, and turn on *S1*. A flashlight beam is directed at the surface of *PC1*, and the resistance of *R2* is slowly decreased until the relay contacts close, turning on the toy.

The action should stop when the light beam is shut off or moved away from the photocell. Should the room light level be so high that the relay contacts remain closed at all times, install a cardboard shade on the photocell.

To restore normal operation of the toy, just open *S1*; the toy's original power switch will operate as before.

A word of caution. The contacts of relay *K1* are rated at about 500 ma. (half an ampere). This is more than adequate for most small electric toys, but if you're in doubt, measure the toy's current drain before connecting it to the relay. —30—

STEREO ANY WAY YOU WANT IT



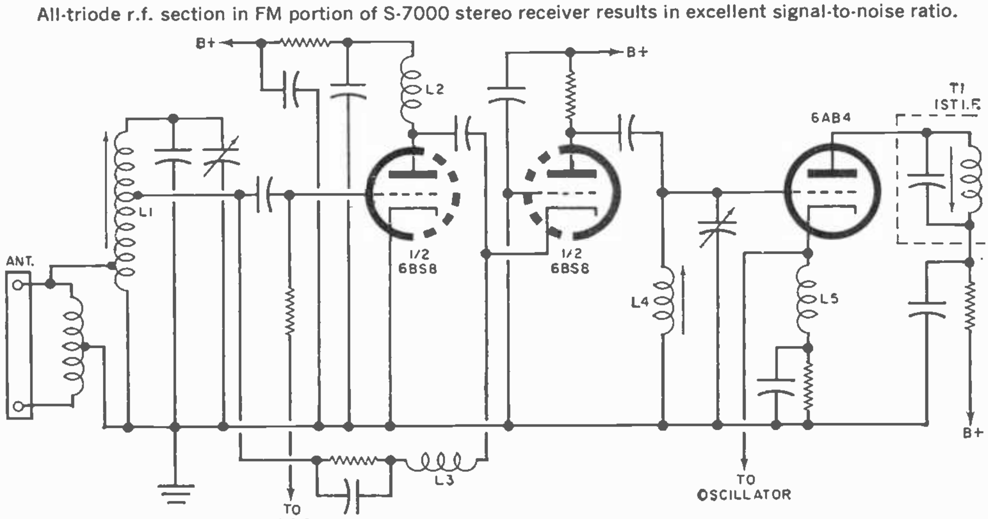
Sherwood's S-7000 delivers quality sound from any stereo source

IF YOU'VE EVER doubted that a pair of preamplifiers, a stereo amplifier, and separate FM and AM tuners could be combined very neatly on one compact chassis, take a long look at the Sherwood S-7000. A "50-watt stereo receiver," the S-7000 provides just about every stereo function you can think of, yet the cabinet for the unit measures only 16¼" x 14" x 4½".

To begin with, it's a quality stereo amplifier, delivering 24 watts per channel, 20 to 20,000 cycles, within ½ db; it can also be connected for 48-watt monophonic operation. And since it is a "receiver," there are AM and FM tuners, each with its own horizontal-bar-type tuning indicator. In addition, the S-7000 is equipped with inputs for stereo or monophonic phono cartridges, tape heads, or "auxiliary" sources, with illuminated signal lights to indicate which source has been selected.

Controls consist of phono level, rumble filter (on/off), scratch filter (on/off), selector (tape, phono, FM-AM, FM-MX, aux), balance, concentric bass, concentric treble, loudness, function (power

All-triode r.f. section in FM portion of S-7000 stereo receiver results in excellent signal-to-noise ratio.



on/off, stereo normal, stereo reverse, mono channel 1, mono channel 2, mono channels 1 and 2), tape monitor, and loudness (on/off).

Supplied with a ferrite rod antenna for AM and two short lengths of wire for FM, the S-7000 is complete and "ready to go" as received. Hook up a pair of speakers, and you can enjoy AM, FM, stereophonic AM/FM, or—with the addition of a multiplex adapter—stereophonic FM reception. Plug in a stereo or monophonic record player, a tape deck, or what have you, and your stereo/hi-fi system is complete.

The S-7000 leans toward the school of thought that values the improved appearance, less cumbersome wiring, and greater ease of handling that stem from a "unified" assembly. Another advantage of this type of unit is the ease with which it can be adapted for custom cabinetry: a full-sized template is enclosed with the S-7000, and installation is simply a matter of cutting the necessary hole and bolting the chassis in place. Alternatively, the unit can be supplied in a specially designed, brown leatherette case.

Produced by Sherwood Electronic Laboratories, Inc., 4300 N. California Ave., Chicago 18, Ill., the S-7000 is priced at $299.50; the optional mounting case sells for $6.50. –30–

ADAPTER FOR VTVM LEADS

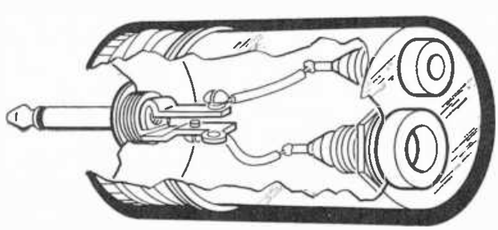
Most vacuum-tube voltmeters have two sets of test leads. One pair of two individual leads is terminated with phone tips, banana plugs, or one of each. The other set (usually the d.c. test leads) runs into a cable which is terminated in a phone plug. You can lessen the resulting tangle and confusion by building a simple adapter to eliminate the second set of leads, including the cable and phone plug. The adapter illustrated (see photo) is housed in a 1"-diameter can about 1¼" long, but you might want to use the can from a 35-mm. film cartridge instead (see pictorial).

First mount a set of jacks on the can bottom to fit the plugs of the individual leads, soldering a short length of wire to each. The jack for the black lead should be of the uninsulated type; the other jack should be insulated. Next, drill a hole in the lid large enough to accept the threads of a phone plug. Run the two wires out this hole and connect them to the plug (the lead from the uninsulated jack goes to the ground terminal). Finally, cement the plug into the hole.

The adapter may now be plugged into the meter's phone jack, thus making the phone-plug-terminated leads unnecessary. The remaining set of leads can be used either in their original jacks or in the adapter jacks.

There's one other point. Before you start to build the adapter, check the probes and plug of the leads to be discarded to see if they contain a series resistor. If you find one, it will be necessary to install it in the adapter. Simply wire it between the uninsulated jack and the phone plug's "inside" terminal.

—*Art Trauffer*



On the Citizens Band

By **DICK STRIPPEL,** 2W1452

THE FCC has recently issued a bulletin covering the possible use of military surplus equipment on the Citizens Band. Such equipment, the notice states, is not suitable for Class C or D stations for the following reasons:

(1) None of this equipment is capable of maintaining a frequency stability of 0.005%.

(2) Almost all such equipment uses frequency modulation, which is not permitted on the Citizens Band.

(3) Much of this military surplus normally operates with a power input of more than five watts.

(4) Most equipment designed for military use is incapable of maintaining emissions within the authorized bandwidth of 8 kc., as required when using amplitude modulation.

The bulletin goes on to say that the expense involved in converting such equipment to meet the required standards is high, not to mention the technical skill and the time needed. Of course, this bulletin refers primarily to transceivers. A number of receivers, especially the BC-603, helped populate the band during its early days, and many operators—your CB Editor included—use one of these sets for monitoring purposes.

The FCC further states that it has no objection to the use of home-designed-and-constructed transmitters, *provided* that they are certified by the holder of a first- or second-class radio operator's license. However, construction of such a transmitter is usually beyond the ability of the average home-builder due to lack of facilities, equipment, and experience.

Want to Form a Club? We've received a lot of mail on the subject of clubs, especially on how to start one. Since there is no better way to promote CB radio and its uses than through organized effort, here are some ideas which may help to get the ball rolling.

First, assemble a "hard core" of four or five "charter members" who are willing to invest quite a bit of their time (and perhaps a little money) to work out the basic details. Each should be given a specific task. For example, one should draw up prospective membership lists, another should look for a regular meeting place, a third should plan activities for several meetings, and another should prepare and mail press releases on the club's formation, goals, and meetings to local newspapers and radio stations.

Prospective membership lists can be drawn up by listening to the band during peak operating hours and jotting down all local calls heard—names and addresses can be obtained from call books. Whenever possible, contact a prospective member in person. It's better to use the telephone than the band to invite someone to a meeting, but nothing beats personal contact.

Establish constructive goals for the club and make certain they are dedicated to improving the band for all users. Community service should be stressed. On the subject of membership qualification, we strongly suggest that voting membership be granted only to licensees, not to members of their families, even though the latter may do the most operating at the station.

As far as a meeting place is concerned, the YMCA, Grange, Scouts, and other organizations in many areas have meeting rooms they will probably let you use. After you have decided on a location, be sure to plan your meeting dates carefully, so they won't conflict with other activities which might draw members away.

The First Meeting. When you get around to your first meeting, we suggest that there be a "charter member" at the door to greet all those who come, and to give

(*Continued on page* 109)

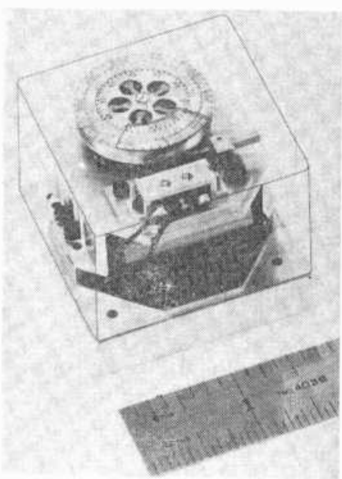
Space Electronics

By **OLIVER P. FERRELL**
Editor

CHALK UP two failures and one successful launching by the National Aeronautics and Space Administration since this column last appeared (July issue, page 82). Included in the failures were the proposed S-45 and S-55 satellites. Successfully launched and now in orbit is TIROS III.

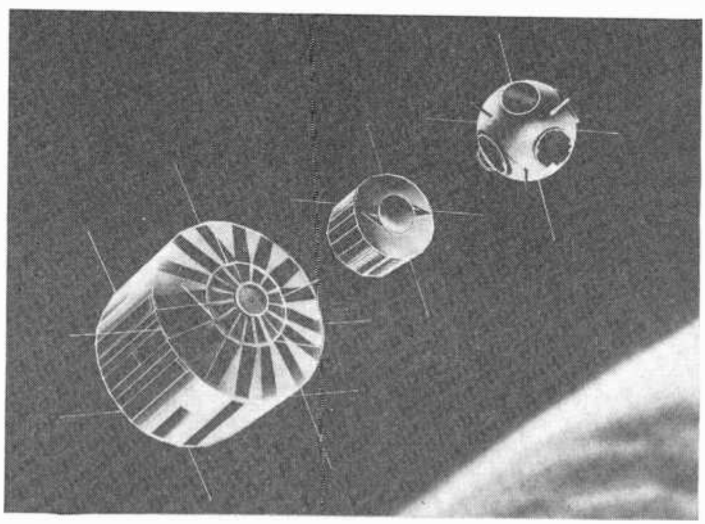
Backup S-45. The first S-45 was described in our April column and the backup S-45 (the reserve satellite package to be used if the first one failed to orbit—which it did) in the July column. We followed the possible orbiting of the two S-45's with great interest, since either one would have been audible to SWL's and experimenters in space sciences—thanks to the possibility of a strong signal on 20.005 mc. The earlier S-45 failed to orbit after booster separation caused a malfunction, the third and fourth stages failing to ignite. Then, on May 24th, much the same thing happened, although the second stage caused the trouble this time. The demise of the S-45 program puts an end to the major use of the 20.0-mc. band by American satellites—at least for 1961.

The S-55. The second NASA failure involved the S-55 satellite—a micrometeoroid detector developed to measure the hazard of micrometeoroids to space flights. Meteoroids are material in space—iron, silicates, and other substances—that generally burn up on entering the earth's atmosphere. They travel at high velocities and may be more dense than heretofore thought probable. Informa-

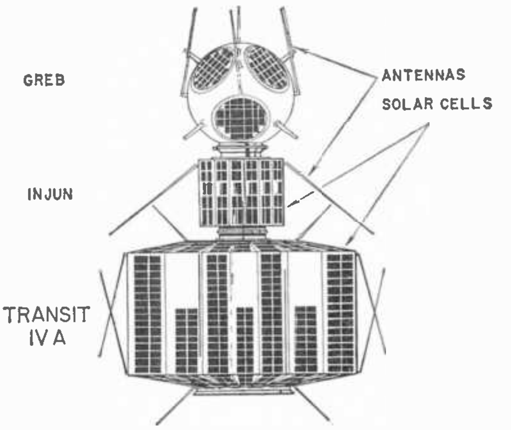


It worked—this time! The electronic timer built into Explorer VII failed to shut off the transmitter on 19.99 mc. in October, 1960. A similar timer installed in Explorer XI worked perfectly and switched the satellite to a new experimental program in late May. Explorer XI operates on 107.97 mc.

On June 29, the U. S. Navy launched three satellites for the price of one. The artist's drawing below depicts them moments after separation from the launching vehicle. From left to right are the navigational satellite Transit IV-A, the INJUN—ready to measure the radiation belts, and the GREB-III, designed to measure solar radiation. Late reports received as we go to press indicate that the INJUN and GREB-III did not separate and are probably orbiting while still attached.



Power to operate four of the six transmitters in the June 29 launching comes from silicon solar batteries. Two transmitters on the Transit IV-A satellite are powered by a nuclear thermoelectric generator.



Offic'al U. S. Navy Photograph

Bell Telephone scientists study satellite shapes and sizes preparatory to developing satellites to relay TV and radiotelephone communications. The smaller model will have about 4000 solar cells; the larger, four feet in diameter, will hold nearly 12,000 solar cells.

tion is urgently needed not only on the size and density of micrometeoroids, but also on their speed and penetrating power—factors that may determine the design of future spacecraft.

The S-55 was to have operated on 136.86 and 136.20 mc. Two separate telemeters—working independently to enhance reliability—were to have been in nearly continuous operation for about one year. The launching vehicle was a solid-fuel Scout rocket whose third stage failed to ignite.

TIROS III. On July 12, NASA successfully launched TIROS III. Designed to take pictures of cloud formations and measure the infrared heat balance of the atmosphere, TIROS III has five transmitters in operation. Each of two TV camera systems has a 2-watt transmitter on 235 mc.; they are triggered into operation by commands from ground stations. Another 2-watt transmitter—also ground-commanded—is on 237.8 mc. relaying infrared information. In addition, tracking beacons are on 108.0 and 108.03 mc. with a power of 30 milliwatts. As this column goes to press, all equipment on TIROS III is reported to be operating satisfactorily.

Navy Launches 3-on-1. Another newsworthy launching was that of the U. S. Navy's Transit IV-A, INJUN, and GREB-III, on June 29. The Navy has pioneered launching multiple satellites with the same rocket, and has been quite successful. This time, the INJUN and GREB-III did not separate and go into individual orbit, but the navigational satellite, Transit IV-A, is doing fine.

The Transit program involves transmitters on 54, 324, 162 and 216 mc. The INJUN's frequency has not been announced, but GREB-III is on 136.20 mc.

At Minus One. The Russians have started publishing numerous semi-scientific articles about the planet Mars, some of which are obviously designed to catch the interest of the Soviet man-on-the-street. The first articles came out in the winter of 1960-61 and others have been appearing in electronics and scientific magazines at an ever-increasing rate. American observers are readying themselves for an announcement that the Russians have a satellite on its way to a Martian orbit. —30—

ac TRANSISTORIZED VOLTMETER

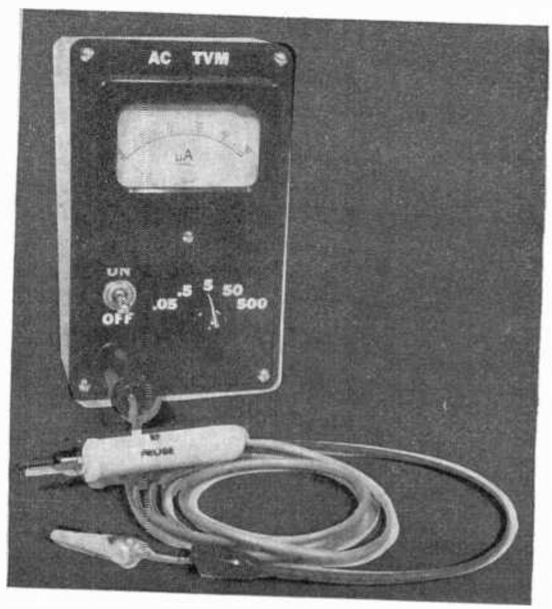
Sensitive pocket-sized instrument, rugged and professional-looking, covers 0.05 - 500 volts in 5 ranges

By FORREST H. FRANTZ, Sr.

THIS versatile a.c. voltmeter is the transistorized counterpart of an a.c. VTVM. Having five input ranges (0 - .05, .5, 5, 50 and 500 volts), the battery-operated unit may be used for making any routine a.c. measurements. In addition, its high input impedance (200,000 to 300,000 ohms on the .05-volt range, 2 - 3 megohms on the higher voltage ranges) makes it suitable for a variety of other applications.

The "AC TVM" (transistorized voltmeter) will check relative output levels of microphones and phono pickups, trace and measure audio signals in sensitive circuits. Signal tracing in the i.f. and r.f. sections of radio receivers can also be carried out if a demodulation probe (such as a VTVM's r.f. probe) is used.

Rugged and professional-looking, the completed unit is compact enough to fit in your coat pocket. The cost is low for an instrument of this calibre, and it can be built in about a day. All in all, the transistorized voltmeter is a worthy addition to anyone's stock of test equipment.



Construction. Begin by mounting switches *S1* and *S2*, jack *J1*, and meter *M1* on the front panel of the Bakelite box. The exact positions of these parts are not important, but the photograph above will serve as a general guide.

Resistors *R1* through *R5* and capacitor *C1* can now be wired to *S1* and *J1*. Connect the shell of *S1* and the metal frame of *S2* (for shielding purposes) to the frame terminal of *J1*. Leave the connections to this terminal unsoldered, since another wire must be added at a later stage of construction.

Though precision resistors are specified for *R2-R5*, you can save some money by using ordinary, 10%-tolerance, ½-watt units if you have access to a Wheatstone bridge. Use the bridge to measure a number of resistors marked with the value you are looking for, selecting the one which hits it "on the nose" in each case. The author found it convenient, in a few cases, to "make" a resistance of the proper value by combining resistors in series or parallel.

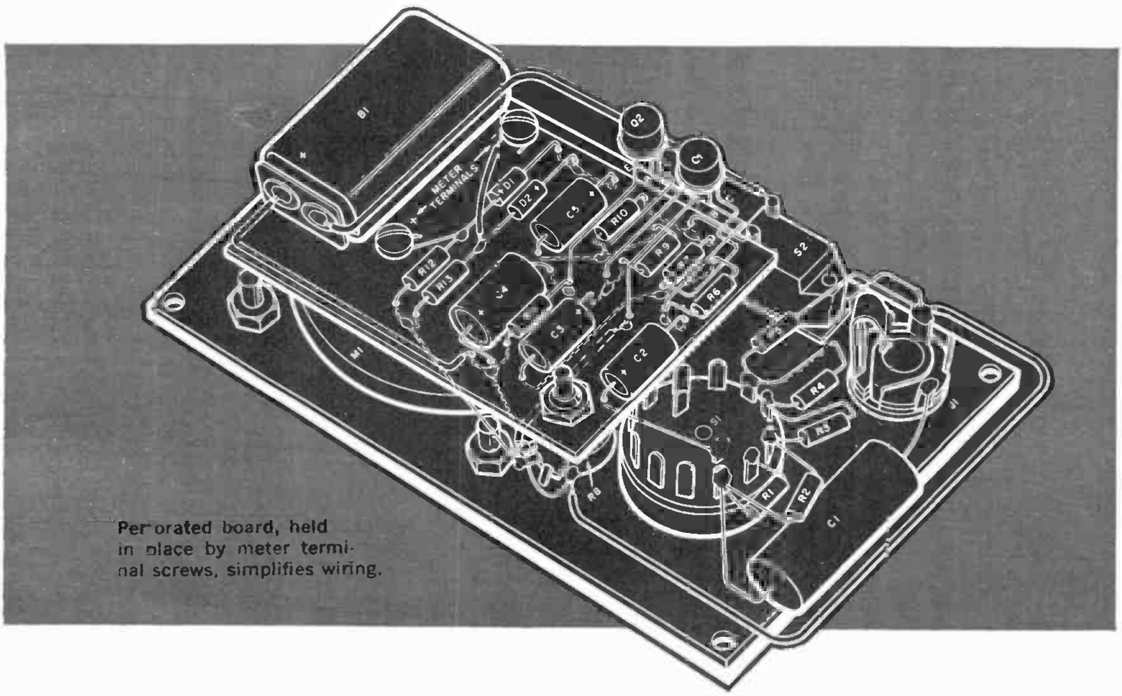
With the front panel wired, you can proceed to the amplifier board. Once again, the exact parts locations are not important—use the component layout shown in the pictorial diagram as a guide. Two ¼" holes should be drilled to accommodate the meter terminal screws (which serve to hold the board in place), and another 1/4" hole for mounting *R8*.

The battery is held in place with two pieces of stripped, solid hookup wire looped over it and passed through the perforations. Pull each wire tight and hold it in place by bending its ends back behind the board. Stick a piece of cellophane tape over the wires and the top of the battery to prevent horizontal movement.

meter leads are looped under the screwheads before tightening.

Finish wiring the voltmeter by making the connections from the amplifier board to switches *S1* and *S2*, and jack *J1*. The terminal of potentiometer *R8* which connects to the frame of *J1* should also be grounded to *R8*'s metal shell, completing the shielding system.

Before moving on to the calibration of your meter, an appropriate input cable must be assembled. Connect one end of



Perforated board, held in place by meter terminal screws, simplifies wiring.

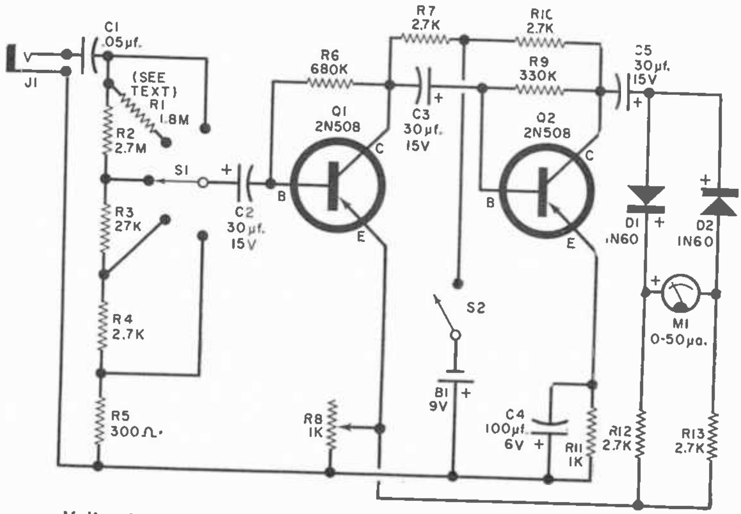
All of the other parts are mounted on the board by passing their leads through the perforations. Leads which are to be connected together are run through a common hole or joined with a length of wire running across the back of the board. Do the soldering from behind, using a small, well-tinned iron and rosin-core solder. Heat should be applied for the shortest possible time to avoid damaging the components (the diodes and transistors are most sensitive).

When the amplifier board is completed, it should be fastened to the front panel assembly. Pass the meter terminal screws through their holes in the board, screwing them into the terminals. The

a length of single-conductor shielded wire to a phone plug (the braid goes to the plug's "shell" connection), attaching a pair of test prods or a test prod and an alligator clip to the other end. The phone plug is inserted into jack *J1* on the voltmeter's front panel.

About the Circuit. The a.c. voltage to be measured passes through *J1* and capacitor *C1* to a voltage-dividing range-selector circuit consisting of *S1* and resistors *R1-R5*. The output of the voltage divider is fed to a high-gain amplifier employing transistors *Q1* and *Q2*.

Feedback for *Q1* and *Q2*, obtained through resistors *R6* and *R9* respectively, improves the linearity and frequency

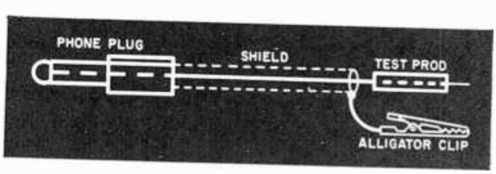


Voltmeter circuit incorporates a sensitive transistorized amplifier.

PARTS LIST

B1—9-volt transistor battery (Burgess 2U6 or equivalent)
C1—0.05-µf., 600-volt Mylar or paper capacitor
C2, C3, C5—30-µf., 15-volt miniature electrolytic capacitor (Sprague TE-1158 or equivalent)
C4—100-µf., 6-volt miniature electrolytic capacitor (Sprague TE-1102 or equivalent)
D1, D2—1N60 diode
J1—Open-circuit phone jack
M1—0-50 microampere meter (Lafayette TM-70 or equivalent)
Q1, Q2—2N508 transistor
R1—1.8-megohm, ½-watt, 10% resistor
*R2—2.7 megohms**
*R3—27,000 ohms**
*R4—2700 ohms**
*R5—300 ohms**
R6—680,000-ohm, ½-watt, 10% resistor
R7, R10, R12, R13—2700-ohm, ½-watt, 10% resistor
R8—1000-ohm miniature potentiometer
R9—330,000-ohm, ½-watt, 10% resistor
R11—1000-ohm, ½-watt, 10% resistor
S1—One-pole, five-position rotary switch
S2—S.p.s.t. toggle switch
1—6¼" x 3¾" x 2" Bakelite case (Lafayette MS-216 or equivalent)
1—Panel for case (Lafayette MS-217 or equivalent)
1—2 1/16" x 3⅜" perforated board (Lafayette MS-304 or equivalent)
Misc.—Phone plug, shielded wire, and alligator clips or test prods for input cable

*½-watt, 1%, deposited-carbon resistor (Aerovox "Carbofilm" or equivalent)



Input cable is made with standard shielded wire; the inner conductor connects to tip of phone plug.

response of the amplifier. Transistor *Q2*'s output, which is proportional to the voltage being measured, is rectified by diodes *D1* and *D2* and indicated on meter *M1*. Variable potentiometer *R8* is the meter calibration control.

Power for the transistorized voltmeter is supplied by a small, self-contained 9-volt battery (*B1*). The current drain on the battery is only about 2 milliamperes.

Calibration. Since the scale of meter *M1* reads from 0 to 50, it's a simple matter to mentally convert it for use on any of the transistorized voltmeter's ranges. On the 500-volt range, *M1*'s readings are multiplied by 10; on the 50-volt range, *M1* is read directly; on the 5-, .5- and .05-volt ranges, divide the readings by 10, 100 and 1000 respectively.

The simplest—but least desirable—method of calibrating the voltmeter uses the a.c. line as a reference. Set the instrument to its 0-500 volt range and connect the input cable across a wall outlet. Next, flip on *S2* and adjust *R8* for a reading of 110 volts ("11" on *M1*'s scale). Though the line voltage is closer to 117 volts in some localities, this minor dis-

(*Continued on page* 108)

Across the Ham Bands

By
HERB S. BRIER
W9EGQ

NEW 75-WATT PHONE/C.W. TRANSMITTER KIT

THE Hallicrafters company has at last entered the kit field, and we recently had the opportunity of looking over and testing their first transmitter model. The HT-40K, a six-band (80 through 6 meters) crystal-controlled c.w. and phone unit, looks like a winner. Its power input rating is 75 watts on both c.w. and phone. Housed in an attractive, two-tone gray cabinet measuring $7\frac{3}{16}''$ x $13\frac{3}{8}''$ x $8\frac{1}{4}''$, it weighs in at 17 pounds. The kit is priced at $89.95; a factory-assembled version (the HT-40) sells for $109.95.

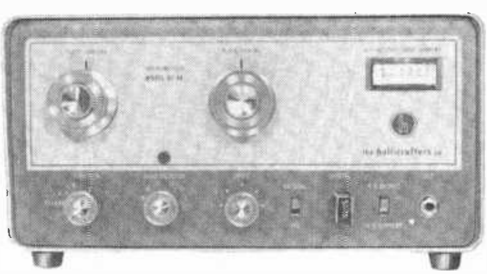
Circuit Details. The HT-40K's crystal oscillator is the triode section of a 6CX8. It drives an r.f. amplifier/frequency multiplier using the pentode section of the same tube. Output of the 6CX8's pentode section is fed to a 6DQ5 power amplifier, and a pi-network output tank circuit with variable loading matches the 6DQ5 to the antenna.

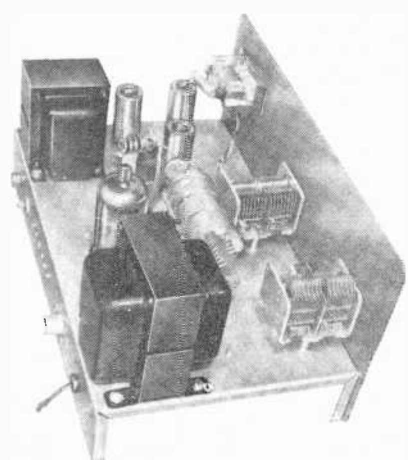
For c.w. operation, both tubes are keyed in their cathode circuits. On phone, a 12AX7 amplifies the output of a high-impedance microphone to drive a 6DE7 as a cathode-follower screen modulator for the 6DQ5. The built-in power supply utilizes a pair of silicon rectifiers (in a voltage-doubler circuit) and a brute-force filter system.

A panel meter measures final amplifier grid current or r.f. power output, making tuning a simple operation. Provision is made for tuning the driver stage or checking the transmitter frequency on the station receiver without putting a signal on the air. Also on the front panel is a crystal/VFO switch which permits the use of an optional external variable-frequency oscillator.

On the rear of the transmitter's chassis are the microphone gain control, microphone connector, coaxial antenna connector, and a terminal strip to which the station receiver is connected for single-switch "transmit-receive" operation.

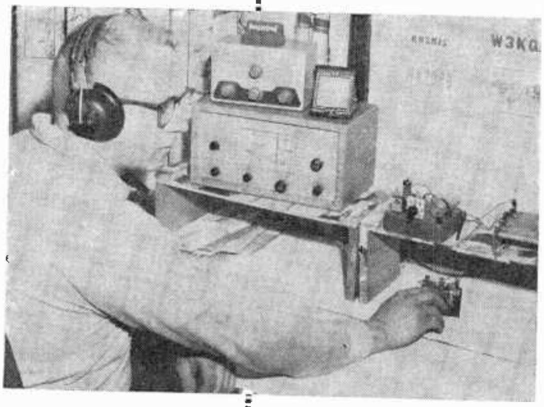
Assembling the Kit. Successfully assembling the HT-40K requires only the ability to follow clear, well-illustrated instructions and to handle a soldering





The HT-40K is Hallicrafters' first entry in the transmitter kit field. Covering six bands, the crystal-controlled unit is rated at 75 watts input on both c.w. and phone. Interior layout is neat, and the well-illustrated instructions are easy to follow.

Novice Station of the Month



Frank Gates, KN3NQP, 317 11th Ave., Juniata, Altoona, Pa., submitted the winning entry in the September Novice photo contest. Frank transmits on 7179 kc. with an 11-watt rig and his antenna is only 13 feet high. Yet, in three months of operation, he has managed to work over 100 stations in 20 states.

Frank will receive a 1-year free subscription to P.E. for his photo. If you'd like to try for a similar award, send us a picture of your station—preferably with you at the controls, and include some information about yourself, your equipment, and your activities. Maybe you'll be one of the lucky winners. Entries should be sent to Herb S. Brier, % POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana.

iron, pliers, and screwdriver. In fact, the 69-page instruction manual will even teach you how to solder—if that should be necessary.

Supplementing the step-by-step instructions are drawings of every part in the kit, down to the last nut and bolt, and clear photographs and detail drawings showing the placement of all components. It took an experienced builder about 30 hours to put the kit together; an inexperienced person might take a bit longer. All parts, including wire, solder, and tubes are supplied with the kit, but the key, microphone, crystals, and antenna must be purchased separately.

Although the parts are packed in transparent plastic bags, finding a specified component is apt to be a time-consuming process. An hour or so of assembly time could be saved if the manufacturer would attach to each bag a list of the parts it contains.

Performance. After our assembled HT-40K was checked for possible construction errors, we put it through its paces. The c.w. power output was measured at 50 watts plus on 80 through 15 meters, 45 watts on 10 meters, and 28 watts on 6 meters. An assortment of crystals was tested in the transmitter and all keyed well, although some exhibited a slight keying chirp on the higher frequency bands.

Switching from c.w. to phone reduced the unmodulated power output, as is normal with any form of screen modulation, but the power increased to its rated values on modulation peaks. The modulated waveforms looked quite clean on an oscilloscope, and 100% modulation was obtained—when we talked normally into a standard ceramic microphone—at the ¾-open position of the microphone gain control.

During the "on the air" tests of the HT-40K, several stations were contacted—all reporting excellent c.w. and speech quality. Moreover, the unit's built-in TVI-preventative measures worked like a charm; no interference was noticed on a TV set located in the same house with the transmitter. In areas where TV signals are exceptionally weak, however, it may be necessary to resort to the standard procedure of installing a low-pass filter at the transmitter's antenna terminal.

(*Continued on page* 111)

Barbara Slutzkin, WV2PZH, hopes that her picture will inspire more girls to take up ham radio as a hobby. See "News and Views" (page 112) for more information on WV2PZH and her station.

Hobnobbing with Harbaugh

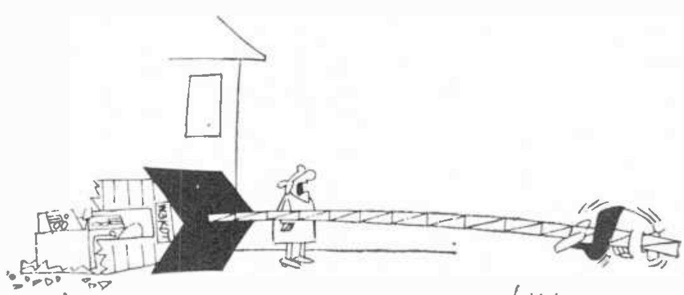
The XYL has a word for it!

"All right, enough's enough!"

"Well, why don't you call up this Troposphere and tell him to stop bending your v.h.f. signal?"

"Wouldn't pen pals be cheaper?"

"What could W3TZO want this time of day?"



"I told you not to climb it."

SPRAY CAN SHORT CUTS

By KEN MURRAY

2 Handle-and-trigger assembly removed from an old coffee maker enables you to hold and aim a spray can in "pistol-fashion."

1 Attach a coat hook to a spray can with a rubber band and you can hang it anywhere. Cap can be wedged between bottom of hook and side of can.

ELECTRONIC EXPERIMENTERS are being bombarded with pressurized spray cans containing everything from clear acrylic and enamel to non-arc, non-short coatings. Even penetrating oil and a fire extinguisher for the workbench are now packaged in pressurized cans. In fact, about the only other "tool" the modern experimenter needs to clean and degrease, prime, prevent rust, eliminate static, and perform a host of other operations is a fingertip.

Helpful though they are, spray cans can never be as handy as they might be unless you know some of the inside tricks for using them. Here are a few "short cuts" to help you make the most of all the various spray cans now on the market.

Clean Nozzles. One thing many of these pressurized products have in common is the need to keep their nozzles clean. As their labels command: "When finished spraying, invert can and press trigger to remove excess from tube and spray head." Otherwise, they will clog —kaput!

When you happen to use a burst of acrylic or print-coat a dozen times during the day, there'll be a generous amount of waste if you clean the feed tube and head each time—you may waste as much as half the pressure in a can that way. A good trick is to plaster a piece of masking tape over the nozzle after using it. The tape will stop evaporation, and you can clean out the feed tube, as directed on the label, at the end of the day.

Can Hook. If you don't have a satisfactory place to set a spray can when it's not in use, hang it from a ladder rung or a nail. Just cut the screw point from a wire coat hook, turn it upside down, and fasten it to the side of the spray can with a heavy rubber band (see Fig.

3 All you really need is a pencil to learn how much liquid is left in a spray can.

4 An accessory spray head (below) produces a "spatter-type" finish for old cabinets, enclosures, panels.

5 Any rotary device, such as the electric drill shown here, can be a big help in spraying small parts evenly.

1.) As a bonus feature, the lower end of the hook will make a handy clip for the can's dust cap.

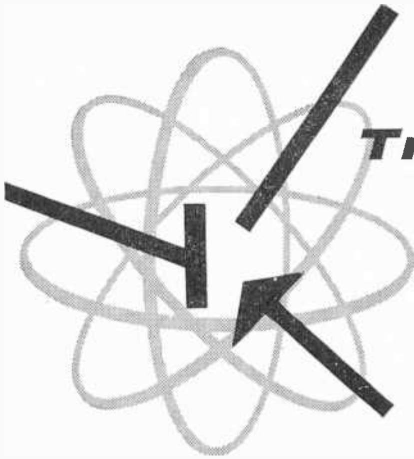
Handle and Trigger. With the addition of a longer metal band to fit the spray can, the handle from a glass coffee maker can provide a comfortable hand grip. The trigger shown in Fig. 2 is a semi-circular piece cut from 3/16" tempered Masonite. Bolt or rivet it to one side of the handle, and add a bolt near the end to depress the spray-can release.

How Much in the Can? If you can distinguish one tone from another, you can easily and quickly estimate how much liquid remains in a spray can. All you do is grasp a wooden pencil firmly, then lightly tap the can with the rubber eraser from top to bottom, as shown in Fig. 3. With a little practice, you'll find that the sound of the tapping changes pitch when the eraser passes the level of the liquid inside the can. As a test, try tapping the side of an open tin can partly filled with water.

Spatter Head. An old cabinet can be given a new look with the "spatter" treatment. Simply replace the regular spray head on a can of enamel with another that spatters instead of sprays —see Fig. 4. When spatter painting, hold the can about three feet from the work. Newspapers or a drop cloth should be draped around the article being painted to protect the area which surrounds it.

Rotate for Even Spraying. A short burst from a spray can will coat small parts evenly and give them a professional finish if they are being rotated by a slow- or medium-speed drill (see Fig. 5.) You can refinish split-shaft knobs, for example, by using a split bolt for the spindle. Cover the chuck and shaft of the drill with a paper sleeve and a piece of masking tape.

—30—



Transistor Topics

By LOU GARNER

EVERY ONCE IN A WHILE, the week-to-week trickle of new semiconductor devices becomes a veritable flood, and we have to discuss several in a single column. All of the new devices this month are of potential interest to hobbyists, experimenters, and equipment designers, although not all are available from distributor stock as yet. However, most can be purchased direct from the manufacturers in small quantities (usually at high "sample" prices).

Westinghouse's Semiconductor Department (Youngwood, Pa.) is now producing a line of high-gain *npn* silicon power transistors. While these new devices do not have *betas* as high as the ARA composite transistors (described in November, 1960), a typical unit can deliver a current gain of 1000 at collector currents of 2 amperes. Two series are currently in production: the WX118X, with minimum gains of 400 at 10 amperes; and the WX118U, with minimum gains of 100 at the same current. Prices in small quantities range from $87.00 for a 50-volt WX118UA to $238.00 for a 150-volt WX118XC.

Germanium "backward diodes" (see Fig. 1) are now being offered by Philco (Lansdale, Pa.). Don't be alarmed if the expression is a new one—yours truly had to check his reference book for a definition when he first saw the announcement. A backward diode has a high forward conductance at low (even zero) applied voltages and some characteristics roughly opposite to those of tunnel diodes; hence the name. These diodes can be used as d.c. restorers and are particularly valuable as isolating devices in digital and communications circuits employing tunnel diodes. Philco's 1N3353 sells for approximately $4.00 in small quantities.

A new type of semiconductor switch is now being produced by Tung-Sol's Semi-

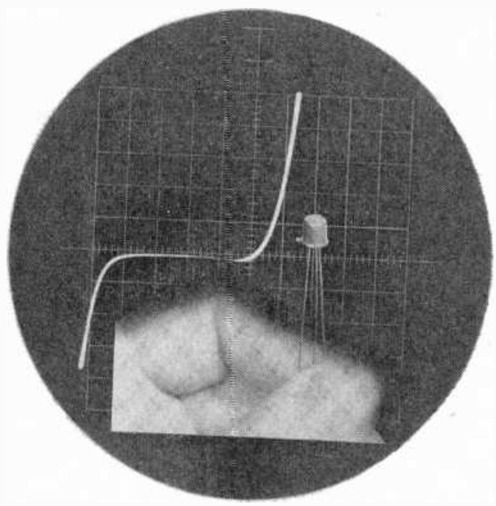


Fig. 1. Philco's germanium backward diode and its characteristic curve.

conductor Division (One Summer Ave., Newark 4, N. J.). Dubbed the "Dynaquad," it's a germanium-alloy junction device made up of four alternate layers of *p*-type and *n*-type semiconductors, as shown in Fig. 2(A). In a typical application, the Dynaquad will permit a heavy flow of collector current when turned "on" by the application of a negative signal current to its base. It will remain on until turned "off" by the application of a strong positive signal to its base, or until the collector current is interrupted. The unit's equivalent circuit is given in Fig. 2(B), its schematic symbol in Fig. 2(C).

The Dynaquad's performance approximates that of a regenerative d.c. amplifier using *pnp* and *npn* transistors in a complementary circuit. In operation, the device has two stable states, "on" when conducting heavily and "off" when acting as a high impedance. Referring to Fig. 2(B), the first stable state occurs when the Dynaquad is in an "off" condition. The only external current is that due to interelectrode leakage. If a negative signal current is applied to *Q1*'s base under these conditions, its collector current increases to a value equal to *beta* times the base current. Transistor *Q1*'s collector current, however, becomes *Q2*'s base current, and *Q2*'s collector current increases by a factor determined by its *beta*.

For practical purposes, therefore, *Q2*'s collector current is the product of both *betas* (*Q1*'s and *Q2*'s) times the original signal current. However, since *Q2*'s collector current is also *Q1*'s base current, the action is cumulative and both transistors are driven rapidly to saturation. The resulting external current reaches a maximum (determined by the load and power supply) and the device conducts heavily in its "on" condition. The Dynaquad then remains "on" until its collector current is interrupted or until a positive signal is applied to *Q1*'s base. This positive "turn-off" signal must be of sufficient amplitude to overcome *Q1*'s self-developed base bias (that is, *Q2*'s collector current).

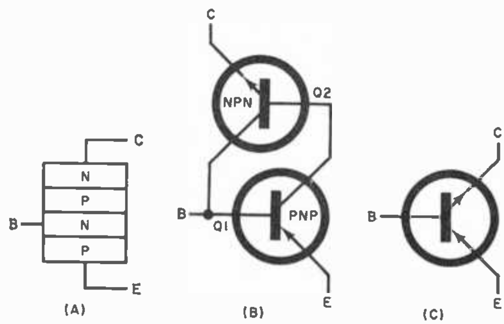


Fig. 2. Basic construction (A), equivalent circuit (B), and schematic symbol (C) of Tung-Sol's new "Dynaquad."

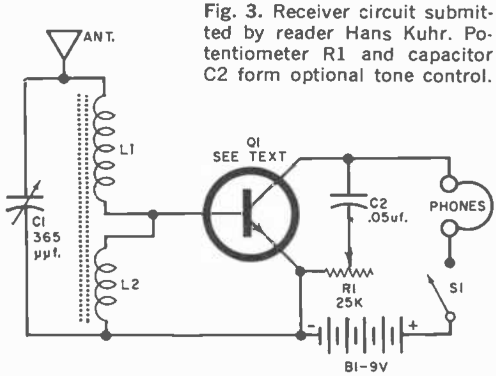


Fig. 3. Receiver circuit submitted by reader Hans Kuhr. Potentiometer R1 and capacitor C2 form optional tone control.

Reader's Circuits. Two circuits have been submitted by Hans Kuhr, 5707 Le Jeune Dr., Orlando, Fla., who feels that they are specially suited to the beginner and the hobbyist with a limited budget. One is a simple receiver (shown in Fig. 3); the other an unusual "wireless light meter" (in Fig. 4, on page 82).

Referring to Fig. 3, a single *npn* transistor (*Q1*) is used in the common-emitter arrangement as a combination detector/amplifier. In operation, r.f. signals picked up by the antenna are selected by tuned circuit *C1-L1/L2* and coupled to the transistor's base-emitter circuit. Coils *L1* and *L2* together form an impedance-matching auto-transformer and serve to match the high impedance of the tuned circuit to the transistor's moderate input impedance, thus maintaining tuned circuit "Q" and insuring good selectivity. Operated without base bias, *Q1* demodulates and amplifies the selected signal, driving the magnetic headphones which serve as a collector load. Resistor *R1* in conjunction with *C2* form a simple "losser" type tone control; as *R1*'s value is reduced, *C2* becomes more and more effective as a high-frequency bypass across the output circuit. Operating power is supplied by a 9-volt battery, *B1*, controlled by s.p.s.t. switch *S1*.

You should be able to assemble a duplicate of Hans' receiver in a single evening, using either fiberboard or metal chassis construction. Capacitor *C1* is a 365-μμf. variable unit, *C2* a 0.05-μf. ceramic or paper unit; *C2*'s working voltage is not critical. The coil is made up by winding 10 to 15 turns of No. 28 enameled wire on the "ground" end of a J. W. Miller 6300 ferrite antenna coil; the added winding serves as *L2*, the original coil as *L1*. Although Hans used a 2N35 for *Q1*, any standard *npn* transistor should give acceptable results—a 2N169A, 2N438A, 2N647, or a 2N649, for example. A variety of values can be used for *R1*, with anything from 5000 to 25,000 ohms being quite satisfactory. Or, if you prefer, the tone control can even be eliminated.

Although moderate impedance (600- to 4000-ohm) magnetic headphones are recommended, crystal phones can be used if shunted with a 10,000-ohm, ½-watt resistor to provide a d.c. path for the transistor's collector current. Either a toggle, slide, or rotary switch will do for *S1*. Depending on individual preferences, the power supply can be a single 9-volt battery (such as a Burgess 2N6) or six penlight or flashlight cells connected in series.

When construction and wiring are completed, all connections should be checked for possible errors *before* the battery is connected. A moderately long external antenna (50 feet) should be used for local stations, and a long antenna (over 100 feet) for maximum sensitivity. Stations within the AM broadcast band (550 to 1600 kc.) are tuned by adjusting *C1*.

In the rather unique "wireless light meter" circuit shown in Fig. 4, a *pnp*

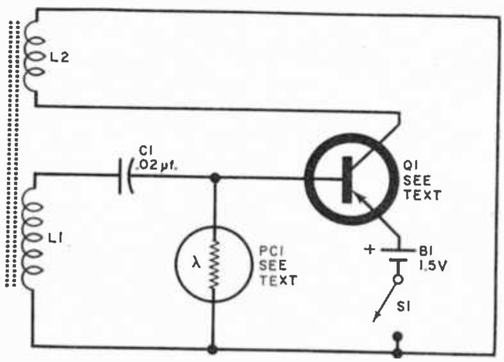


Fig. 4. Reader Kuhr's "light meter" transmits a tone that varies with the output of photocell PC1.

transistor is used as a tickler feedback r.f. oscillator. Although the basic operating frequency is within the AM broadcast band, there is sufficient feedback to cause "blocking" at an audio rate. The blocking rate, in turn, is controlled by photocell *PC1* which acts as a light-sensitive resistor. In operation, the unit radiates a low-power, tone-modulated r.f. signal which can be picked up on a nearby AM receiver. The audio tone, as heard over the receiver's speaker, varies with the amount of light falling on the photocell.

Referring to the diagram, transistor *Q1* is used in the common-emitter arrangement. The oscillator's basic r.f. frequency is determined by coil *L1*, tuned by distributed wiring capacities and by its ferrite core; *L2* provides the feedback necessary to start and sustain oscillation. The audio blocking rate is controlled by the time constant of coupling capacitor *C1* and base-bias resistor *R1*. Operating power is supplied by a 1.5-volt penlight cell or mercury battery, *B1*, controlled by a s.p.s.t. push-button switch, *S1*.

The instrument can be readily assembled in a small plastic box. Coil *L1* is a J. W. Miller 6300 ferrite antenna coil, and *L2* about 12 to 15 turns of litz wire scramble-wound directly on top of *L1*. Capacitor *C1* is a 0.02-µf. ceramic or paper unit, and *PC1* a Clairex CL-3 photocell mounted so that light falls on its sensitive area. Almost any r.f. *pnp* transistor may be used for *Q1*—Hans suggests a 2N1265, 2N1266, 2N112, or a 2N136.

Once the wiring is completed, the unit should be held near an operating AM receiver. With *S1* closed, the receiver should be tuned *carefully* over its entire band. If you pick up a signal close to a local broadcast station, readjust *L1*'s core until the instrument is operating on a "dead" part of the dial. If no signal can be received, reverse *L2*'s connections. Once a signal is received, turn the instrument so that more or less light falls on the photocell, noting any changes in the pitch of the audio tone. Under some conditions, a low-frequency buzz or a "putt-putt" sound may be heard. If a different tone range is desired, *C1* can be replaced with a larger (0.05-µf., for example) or smaller (0.005- to 0.01-µf.) capacitor.

According to Hans, the instrument's maximum range is about three feet with a receiver of average sensitivity. This may be increased somewhat by using a

(*Continued on page* 106)

By
JOHN T. FRYE
W9EGV

Carl and Jerry

Off To a Bad Start

DARKNESS was falling over the campus of Parvoo University this early September evening as Carl and Jerry sat in their room on the third floor of Men's Housing Unit Number III. Actually they were only thirty-five miles from home, and this was just the end of their first day at school; but somehow everything connected with home seemed far away and long ago. As they watched the winking lights of a commercial airliner taking off from the university airfield, saw batteries of windows lighting up in building after building, and realized that some twelve thousand men and three thousand women students were sharing the campus of the big land-grant school with them, they felt very small and insignificant.

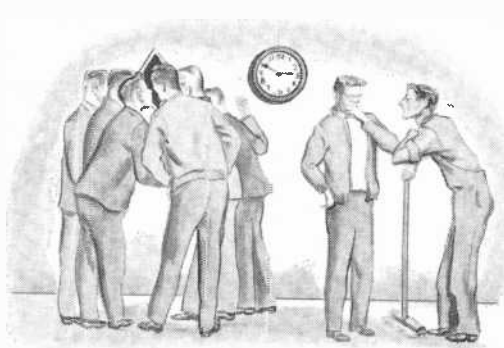
The boys had taken advantage of advance enrollment back in July and had gone through their placement tests and many other preliminaries at that time; so actually there had not been too much for them to do on this first day. Thanks to their high school records and their showing in the tests, both were "honor" students and were enrolled in a Freshman Engineering course that was plenty stiff—just how stiff they mercifully did not know at this point. Their brand-new green beanie caps—which they had already learned to call "freshman pots"—were resting on their beds.

Carl was sitting in a chair in front of the open window looking at the Coeducational Recreation Gymnasium across the way. From behind the "Co-Rec" building he could hear faintly the shouts of students enjoying the two outdoor swimming pools and the tennis courts that would be flooded in winter to form an ice-skating rink. Carl reflected idly that there was another heated pool inside the building, plus facilities for dancing, roller-skating, basketball, volley ball, squash, riflery, archery, gymnastics, etc.; but none of these appealed to him at the moment.

"Say, Jer," he said slowly, "do you feel kind of funny? I mean, are you a little shook by all this?"

"Yep," Jerry admitted from where he sat at his combination desk-and-bureau toying with his new Log-Log-Duplex-Decitrig slide rule. "I feel as green as that stupid-looking freshman pot. Wonder if we ever will learn our way around this place?"

"I dunno," Carl answered with a sigh. "While you were at the bookstore this afternoon, I wandered into a building and came across a bunch of fellows who were peering through a little diamond-shaped window set into the wall. When I asked what was going on, the other freshmen said they weren't certain but they felt pretty sure that Parvoo's nuclear reactor was behind that window. They said you could see rods moving back and forth, probably in and out of an atomic pile in the basement. Then



I looked, and sure enough, there were some slender rods going up and down.

"About that time," Carl continued, "a janitor came by and asked us what we were doing. When we explained that we were watching the nuclear reactor, he grinned widely and said he hated to disillusion us but that we were merely looking into the elevator shaft through an inspection porthole. The 'rods' we had been watching were actually elevator cables moving up and down!

"We slunk out of there very quietly and went our separate ways. None of us wanted to associate with those other stupid jerks!"

JERRY chuckled at his friend's story, then slid his rule back into its case that smelled pleasantly of new leather, and came over to stand behind Carl's chair.

"I'm not homesick," he announced firmly, "but I sure do miss things. Especially, I miss our car. I know that not being permitted to drive in this county while we're freshmen and sophomores is a good rule, but we could explore the campus a lot faster if we had our wheels."

"I know what you mean," Carl sympathized; "and I miss our electronic lab even more. When I realize we're way out here without even so much as a volt-ohmmeter, it sort of scares me. If we were back at the lab, I'll bet we wouldn't be just sitting around staring out a window."

"Maybe we shouldn't give up so easily," Jerry muttered as he looked down at students dropping cards and letters into a mailbox on the sidewalk just below their window. "I always figure that a really *good* technician is one who can get the most out of the equipment he has at hand. Carl, do you remember that *Candid Camera* show with the mailbox that talked?"

"Sure," Carl answered as he stood up to see what Jerry was staring at. "Are you thinking that we could give that mailbox down there a voice? I don't see how. We don't have an intercom set."

"Maybe we could make one," Jerry mused. "After all, an intercom is nothing but an audio amplifier and two speakers. One speaker acts as a microphone while the other functions normally on the output of the amplifier. A switch alternates the roles of the remote speaker and the unit speaker so that either can be used for talking or listening.

"We both have our transistor radios," he continued. "We could take a speaker out of one and drop it down inside the mailbox for use as the remote. The audio section of the other radio can serve as the amplifier. Then all we need is a switch to swap the set speaker and the remote speaker back and forth between input and output of the amplifier, and down at the radio store this afternoon I just happened to pick up this bat-handle d.p.d.t. toggle switch from the bargain counter."

"Hold it!" Carl interrupted as he bolted for the door. "We'll need a two-wire cable of fine wire to run to the slave speaker, and if we're in luck, I know where we can get it. I'll be back in a sec."

He was, too; and in his hand was a pair of very beat-up hair clippers. "I just remembered that the guy next door threw these into his wastebasket when he unpacked this afternoon and discovered they had been clobbered on the trip from home. They're the cheap vibrator type with a coil of fine wire inside. We can unroll all we want and twist a couple of lengths together to form a cable that will never be seen."

"Fine," Jerry applauded. "Now the only thing that bugs me is how we're going to unsolder connections inside the receivers and solder new leads to the switch, speaker, and so on."

"Leave that to me," Carl said as he slid back his closet door and took a small traveling case down from the top shelf. After he had spread his electric razor, toothbrush, hairbrush, and after-shave lotion out on his bed, he dived back into the bag once more and came up triumphantly with a small pencil-type electric soldering iron and a little roll of rosin-core solder.

"You may get old Carl away from home without his wallet, his toothbrush, or even his pants; but you're not going to get him away without some kind of soldering iron," he boasted. "We can split that clipper cord and make leads out of it to go to the switch. You go ahead and solder the switch into your

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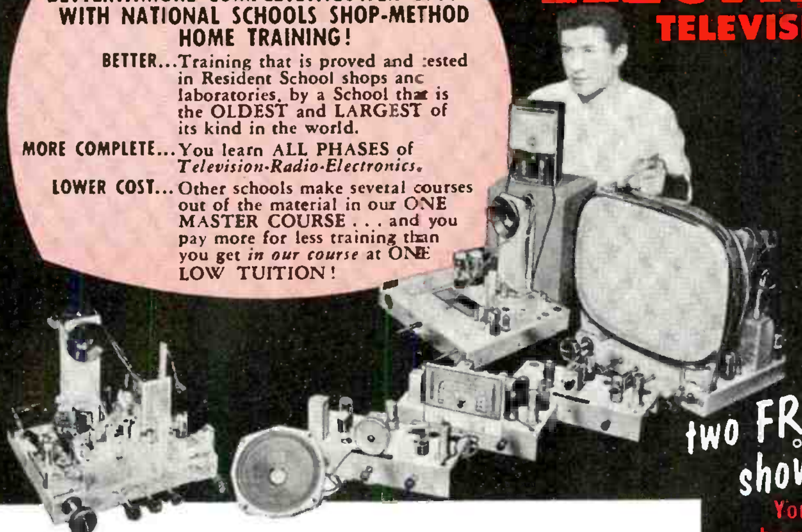

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Edgar Wesotzke

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

Rev. Enoch P. Sanford

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

Louis A. Tobat

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

Alvin Spera

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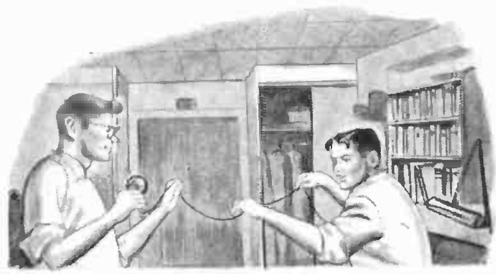
radio while I take the speaker out of mine and bring out leads from the output transformer."

BOTH BOYS were thoroughly familiar with the circuit of their identical sets; so it didn't take long to carry out Carl's suggestions. Then they removed the coil of fine wire from the electric clippers and started winding it in a big loop around the backs of the two desk chairs placed at opposite sides of the room. Two such loops were made, and then the ends were fastened together and the loops unwound simultaneously while the wires were twisted together to form a two-wire cable of fine enameled wire easily long enough to reach down from the boys' window to the mailbox below. They connected one end of this cable to the speaker from Carl's radio, and the other end to the toggle switch and the ground connection of Jerry's receiver.

With the switch in one position, the remote speaker voice coil was connected to the output winding of the transformer in Carl's receiver; the plate winding of this transformer was across the volume control of Jerry's set. With the switch in the other position, the voice coil output of Jerry's speaker went through Carl's output transformer back to the volume control, and the remote speaker was connected to the secondary of the radio's output transformer. Carl took the little remote speaker out into the hall to check on the operation of the haywire arrangement; and, as haywire arrangements frequently do, but shouldn't, it worked perfectly.

Dusk was falling rapidly by this time; so no one noticed as the boys removed the screen from their window and let the little speaker down the side of the



building. Then Carl went outside and quickly fed the fine wire along a little groove cut in the sod beside the sidewalk running out from the building.

When Carl reached the main sidewalk, he ran the wire into a section notch that led to the foot of the mailbox. The speaker, with a short length of dark twine fastened to it for retrieving purposes, was dropped into the mailbox; and both the twine and the fine wire were Scotch-taped to the side of the box so that they would be as inconspicuous as possible. After this was done, Carl scampered back up to the room.

They did not have to wait long for a victim. Almost immediately a car swung to the curb, and a tall, gray-haired, pleasant-looking man stepped out and dropped a letter into the box.

"Thank *you*!" Jerry said into the speaker of his receiver. "We'll take care of this immediately. Not snow, nor rain, nor heat, nor gloom of night—and all that rot, you know." He snapped the switch.

The man turned on his heel and stared down at the mailbox for a few seconds. Then the grinning boys heard his pleasant, well-modulated voice coming from the speaker: "Thank *you*! I knew our post-office department was accommodating, but I didn't realize it went quite this far."

"Don't you feel a little silly talking to a mailbox?" Jerry asked.

"No, not at all," the man said, calmly taking a penlight from his breast pocket and beginning to examine the box. "I'm afraid I frequently talk to much less receptive ears."

As he finished speaking, he located the string and carefully lifted the little speaker from the box; then he pulled the cable taut, and it pointed an accusing finger straight at their window. The man snapped the wire loose from the speaker and started walking toward the building.

A COUPLE of minutes later the boys heard a knock at their door. Carl opened it to reveal the tall, gray-haired man standing there holding out their speaker.

"I believe this belongs to you," he said pleasantly. "May I come in?"

(*Continued on page* 92)

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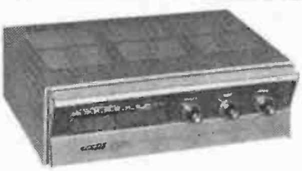

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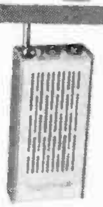

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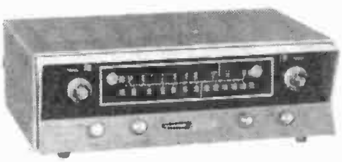

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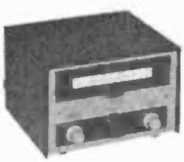

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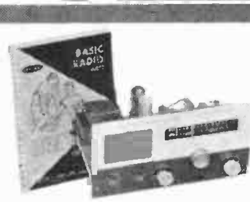

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The stammering youths pushed the guest chair toward him and sat down at their respective desks.

"Now, I don't like to be a kill-joy," the man began, "but I wonder if you two have ever heard about the severe penalties exacted for tampering with the U. S. mails or post-office department properties."

Neither boy uttered a word.

"Well, they are rather serious," the man continued, as he casually looked over the rat's nest of wires on the window ledge. "If you had bothered to look, you would have seen that the mail is supposed to be picked up from that box about this time. In fact, there's the truck now. If the mailman had found your speaker and reported it, as he is supposed to do, you might have gotten into a bit more trouble than you anticipated. That's why I brought your speaker back to you."

He took hold of the doorknob as he finished speaking. "I like to see students who have imagination and ingenuity," he commented, "and I trust that before long you two will have enough demand on these qualities from your studies so that there won't be much left over for pranks."

"Thanks a lot, sir," Jerry recovered himself enough to say. "We never thought about tampering with the mails. Are you an instructor here at the university, or something?"

" 'Or something' possibly covers it," the man admitted with a smile. "Pardon me for not introducing myself. I am Mr. Hedde, the president of this university. And I see by the nameplate on the door that you are Jerry Bishop and Carl Anderson. Welcome to Parvoo University, men. I hope your stay here is a pleasant and richly rewarding one and that you will bring credit to our school. Good night."

He was gone, leaving behind two white-faced youths staring open-mouthed at each other.

"Good gravy," Jerry breathed; "fifteen thousand people on the campus and we have to pick out the president to get smart with! We're certainly off to a great start."

"Yeah," Carl said shakily. "Let's put those radios back together and turn in before we get expelled!" —30—

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Make .... Model ....

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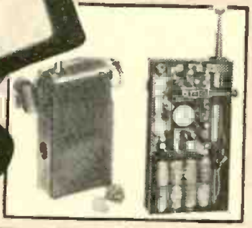

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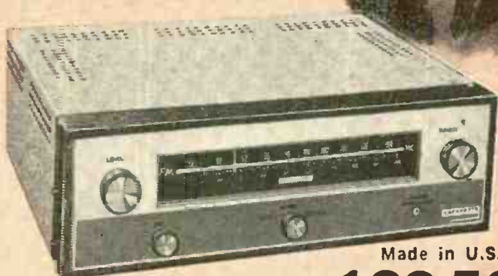

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- 50-Watts Monophonically—25 Watts Each Stereo Channel
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Pacesetting quality, performance and design. Features include: unique "Blend" control for continuously variable channel separation—from full monaural to full stereo, 4-position Selector, Mode, Loudness and Phase switches. Also provides outputs for 4, 8, and 16 ohm speakers. Hum-free operation is insured by use of DC on all preamp and tone control tubes. Individual bias and balance controls. Harmonic distortion, less than 0.25%. IM distortion, less than .5%. Hum and noise 77db below full output. 14½Wx-12¾Dx5½"H. Shpg. wt., 28 lbs.

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- Response 5-40,000 cps ± 1 db
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Sensitivity 2.2 mv for 1 volt out. Dual low impedance "plate follower" outputs 1500 ohms. Less than .03% IM distortion; less than .1% harmonic distortion. Hum and noise 20 db below 2 volts. 14x10⅝x4½". Shpg. wt., 16 lbs.

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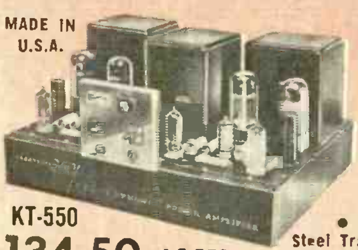

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Cooking Up Blueprints

(*Continued from page* 61)

cover the words starting with "one" after the desired exposure time. Total exposure for each section of strip "B" was: "One"—30 seconds; "Two"—1 minute; "Three"—2 minutes; "Four"—4 minutes; "Five"—8 minutes; "Six" and "Seven"—16 minutes.

Strip "C" was exposed in the same manner, although it was placed at a distance of 20 inches from the sun lamp. In addition, the total time was extended to give "Seven" an exposure of 32 minutes. The other sections were exposed exactly as they were on strip "B." On strip "C," the word "Five" has about optimum exposure—8 minutes.

Obviously, the background will be too dark if exposure is insufficient. Similarly, the lines get thin and start to fade if exposure is excessive.

Helpful Hints. When typing material for duplication, place a piece of carbon paper with its coated side against the back of the sensitized sheet. This will make a darker copy, since the type will appear on the front of the sheet with the carbon copy directly behind it on the back of the same sheet. Alternatively, tissue, "onion skin," or tracing paper can be used to reduce the required exposure time, since a thinner paper will pass more light.

In order to get a more even distribution of the ammonia fumes so that developing will take place uniformly at the top and bottom of the jar, you can make an arrangement like that shown on page 61. A vertical wire in the center of the jar was wrapped with a cloth which was then saturated with ammonia. The bottom end of the wire was bent to form a base that would rest on the bottom of the jar.

If you can't find a wide-mouth glass jar that is large enough, try the restaurants. They get pickles and other foods in one-gallon glass jars 10″ high with a screw-on lid approximately 4¾″ in diameter. You'll need more ammonia with these jars, of course, but you'll find that they are almost "made to order" for the purpose. —30—

The Monitor Meter

(*Continued from page* 55)

Connect a signal generator to the antenna, or hold the unit's antenna near a grid dip oscillator (GDO) or a variable frequency oscillator (VFO). Advance the *Gain* control *(R1)* halfway, set *S3* to the *Low* position, and feed in any signal between 3 and 7.5 mc. Capacitor *C1* should now be tuned for a maximum reading on the meter, and the gain reduced or increased so that the meter reads 100%.

Next, set the oscillator to the 80-meter band, tune *C1* for maximum meter reading, and mark the dial accordingly. Do the same for the 40-meter band, then set *S3* to the *High* position and repeat the calibration for 20, 15, 11, and 10 meters.

Operation. Set switch *S2* to the calibrate (*Cal*) position. Using *C1*, tune in the transmitter's signal for maximum indication on the meter, and then adjust the *Gain* control (*R1*) so the meter reads exactly 100%. (Move your hand away from the Monitor Meter to eliminate any possible detuning.) Now set *S2* to *Mod* and speak into the microphone. The peak meter reading is the percentage of modulation.

To be certain the transmitter is not overmodulated, adjust the transmitter's modulation control so that the meter peaks at about 85% modulation. As far as the receiving station is concerned, there is no appreciable difference between 85% and 100% modulation (85% modulation is 1.5 db below 100%, and a difference of 1.5 db in speech is barely detectable). However, the 1.5-db reserve will keep the occasional "high peak" from overmodulating the transmitter.

To check audio quality, insert a set of headphones into the monitor jack, throw *S2* to *Cal*, and adjust *R1* for a meter reading of 100%. When high-impedance phones are used, the audio can be monitored simultaneously with the percent reading.

The Monitor Meter can also be used as a sensitive field strength meter (FSM) by simply setting *S2* in the *Cal* position and advancing *R1*. Again, be careful that you don't exceed the 100% mark on the meter scale. —30—

Operation Telephone 1965

(*Continued from page* 44)

when your line is busy. But to do this, the phone company has to wire in separate circuits, including special relays at the central office. Once the circuit is in, it is permanent. And since extra labor and equipment are involved, it is relatively expensive.

With the electronic system, no wiring changes at all are required. The computer which controls the system has memory circuits. Instruct it to ring another phone when your phone is busy, and it complies without so much as a single wiring change.

Other arrangements which are now completely impossible will be a snap with the electronic system. For example, our present setup cannot let you reach regularly called numbers by dialing only two digits instead of the usual seven. But the computer finds this chore simple. And since the electronic giant acts with such tremendous speed, it can take care of thousands of such special requests without interrupting its normal service.

The new system even diagnoses its own troubles, and in some cases repairs them. If a certain circuit goes out of order, the computer automatically switches in a spare. Then it runs a number of checks on the bad unit, diagnoses the trouble, and writes instructions for replacing the faulty part on a teletypewriter. It also periodically checks some 800 critical voltages throughout the system and lists them on the teletype. If any voltages are off, technicians can cure the developing trouble before it becomes serious.

The system's teletype, by the way, is a vehicle for two-way communications—technicians also use it for "talking" to the computer. Let's say, for example, that you want all incoming calls to your office switched to your home phone from five o'clock every afternoon to nine each morning. You simply call the telephone company, and an operator—using the teletype—"tells" the computer what you want. Your phone service is then automatically switched as you directed, without your having to worry about it again.

If you move, technicians can use the teletype to instruct the computer to take your line out of service. Or they can call on it to add additional services to a particular telephone, run special checks, and so on. You can even ask the computer what time it is, and it will respond with the month, day, hour, and minute.

Experimental Systems. The first experimental electronic "central" mentioned earlier went into regular commercial operation for the first time only a few months ago. But Bell Laboratories scientists actually began working toward such a system in the early 1930's. Even at that time, they saw that electronic switching would offer many advantages which could be achieved in no other way. Experimental systems were built and tested—and they worked. But they were not practical for regular use.

In the first place, the number of vacuum tubes required for a full-scale system was enormous—and enormously expensive, since the tubes gobbled up a lot of power. Then, too, the power generated tremendous amounts of heat, and the heat created additional problems of its own. Furthermore, building a memory section for the computer would require *millions* of tubes. And with that many of the little bottles, reliability would become an overwhelmingly difficult problem. In use, it was calculated, tubes would "pop" faster than technicians could replace them.

The first big breakthrough came in the late 1940's when Bell scientists invented the transistor. This solved the problem of the switching circuits, but a practical, inexpensive, large-scale memory was still not available.

In 1954, Bell executives decided to launch a multi-million dollar research program to develop such a memory, and to incorporate it into a full-scale, practical electronic-switching system. Before the project was over, scientists assigned to it had designed and built two "memory" devices. One was for semi-permanent information which would be stored in the computer, such as a list of which telephones are connected to which lines. The other, with a "temporary" memory, "remembers" information the system must retain for only a few minutes, hours, or days—such as the number you are calling, or where you can be reached for the next few hours if you've left instructions for your call to be transferred.

Future Possibilities. Although the electronic system now in operation in Illinois performs many unusual services, the range of possibilities has hardly been touched. When R. W. Ketchledge, director of Bell's electronic central office development project, was asked just what the system could do, he leaned back in his chair and smiled.

"There's only one way we can answer that," he said. "And that's, 'What did you have in mind?' "

He went on to explain that the computer can be instructed to make virtually any kind of interconnection you can dream up, and all without changing a single wiring connection. A couple of the possibilities Bell officials think might be popular with customers are:

● The "Baby Sitter." Before you go out for the evening, you dial a special code, then the number where you can be reached. If the baby sitter needs you, she'll simply pick up the phone and wait for five seconds. The computer will recognize this as a special signal and ring the number you specified before you left. The service could, of course, be left in operation permanently for any number you call frequently.

● The "Camp-On." You call a friend and his line is busy. You're anxious to reach him, but don't want to keep dialing his number over and over again. Besides, he might complete his call and dial another number before you get through. With the "camp-on" system in operation, a pleasant voice notifies you that his line is busy. But if you hang on, the voice says, the system will ring his line the instant he puts his phone down.

So impressive is the operation of the prototype electronic "central" that officials are rushing plans to extend the system to the entire country. Since it takes a long time to standardize designs, set up production lines, and install these immensely complex systems, you won't have an all-electronic phone next month, or even next year. Officials hope, however, to have electronic central office equipment in normal operation in some places not later than 1965. -30-

Inductance Quiz Answers

(*Questions on page* 59)

1 True. When the switch is opened, the inductance of the coil tends to maintain the same value of current flow in the circuit. And the higher the value of the series resistance, the greater the e.m.f. which will be developed.

2 True. Since current lags voltage by 90 degrees in a purely inductive circuit, current will continue to flow after the voltage has dropped to zero.

3 False. Because of the back e.m.f. induced in the coil as the current through it changes, the greater the rate of current change, the greater is the opposition to such change. Thus, the higher the frequency of the current through the coil, the greater the inductance, and the smaller the voltage delivered to the lamp.

4 True. Closely spacing a number of turns in a coil will increase the strength of its magnetic field and thus its inductance.

5 True. A swinging choke is an inductor which is designed to reach a maximum amount of magnetization or "saturation" at low values of rated current. From this point on, an increase in the amount of current reduces the degree of magnetization and hence the inductance. A greater portion of the source voltage therefore becomes available to compensate for the larger resistive voltage drops occurring within the power supply.

6 False. Eddy currents induced in the brass will produce a magnetic field which opposes that of the coil and thus effectively reduces the coil's inductance.

7 True. The iron core serves to increase the coil's inductance, leaving only a small voltage available to light the lamp. Removing the core therefore increases the voltage applied to the lamp.

8 False. The current in this type of coil flows in opposite directions in adjacent turns. Back e.m.f.'s of self-induction are produced in all of the turns; but since the back e.m.f.'s of mutual induction will all have the opposite polarity, they cancel out the back e.m.f.'s of self-induction and thus make the coil "non-inductive."

9 True. When the slug is moved out of the coil, the "core" consists of air, and the inductance of the coil is decreased. Since the smaller magnetic field is able to expand and contract at a faster rate, the coil is now able to transfer its electrical energy into the resonating capacitor at a higher frequency.

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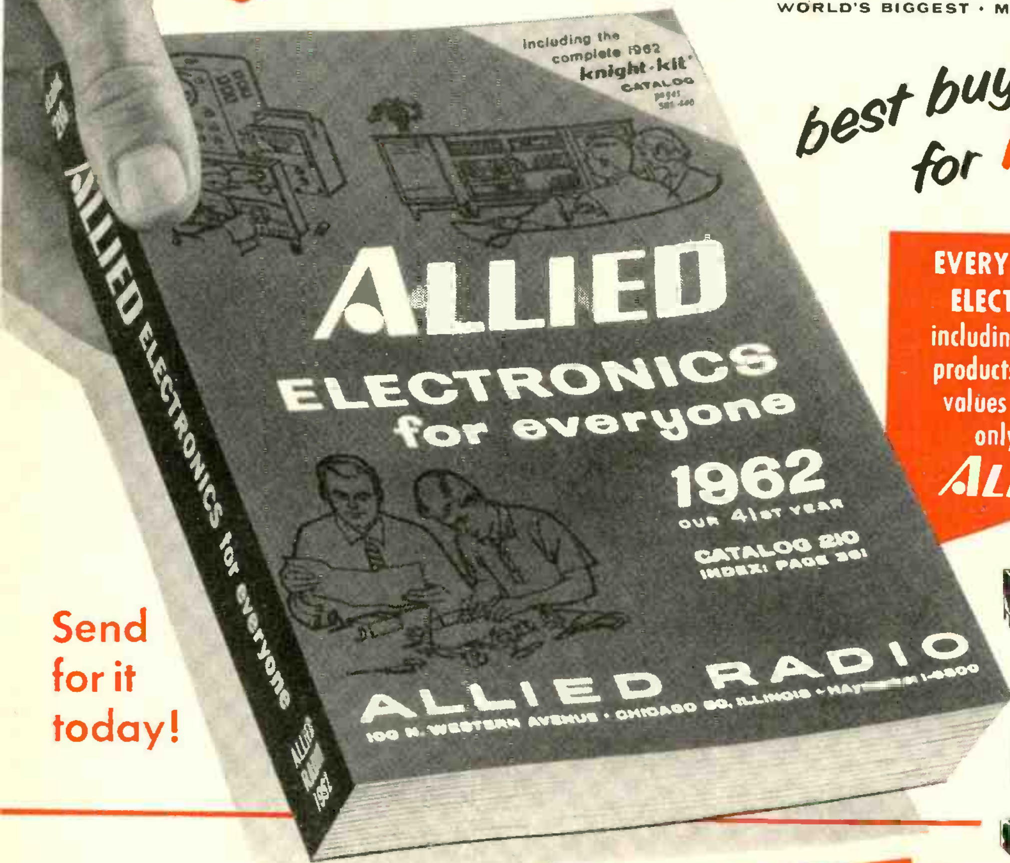

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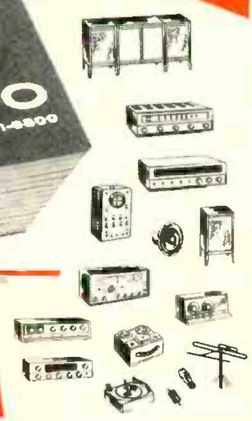

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Transistor Topics

(*Continued from page* 82)

short antenna coupled to a 3-5 turn coil added to *L1*. However, to avoid violation of FCC regulations, no attempt should be made to increase range appreciably.

Look, Ma—No Tubes! If your local paper reports technical news, you may have already heard that two well-known firms, CBS and Philco, have discontinued production of vacuum tubes. In the future, both firms will concentrate on developing and manufacturing semiconductor devices. To some, this news may come as a shock; to others, it may seem like a foregone conclusion in view of the rapid swing-over from tube to transistor circuitry on the part of many equipment manufacturers.

According to Philco, its decision was forced by economic factors arising out of the increased use of transistors. Since 1955, when mass production of transistors was achieved, the use of receiving tubes for initial equipment by American manufacturers of electronic gear has declined by 31%.

Product News. If you encounter a superhet receiver which seems to have several "i.f. transformers" but no transistors, don't do a double-take. These may be self-contained r.f. and i.f. modules which include a transformer, transistor, and supplementary components. A Japanese firm, Toko Radio Coil Laboratories, Ltd. (59 Yukigaya-Cho, Ota-Ku, Tokyo) has introduced a full line of self-contained modular stages. In most cases, a complete stage is not much larger than a standard i.f. transformer.

The Bristol Motors division of Vocaline Company of America, Inc. (Old Saybrook, Conn.) has introduced a transistorized motor which permits the advantages of d.c. motor operation without the drawbacks of sparking and brush noise. Units can be supplied in speed ranges from 1/20 to 1400 rpm on special order.

That's the news for now, fellows. More next month . . .

—*Lou*

Radar Speed-Trap Detector

(*Continued from page* 52)

Will the Sentry detect the new meters?

No. The difference in frequency is too great, and this necessitates new equipment. However, the same principle of operation applies, and the manufacturer will undoubtedly introduce "K"-band speed meter detectors when they are needed. Radatron is also considering a composite model which would be designed to receive simultaneously on both frequencies.

Is the radar speed meter signal the only one a Sentry will pick up?

No. It will react to any signal on the frequency to which it is tuned—2455 mc. In addition to traffic control devices, aeronautical and marine radars operate in the "S" band. But the latter do not offer much interference—in fact, they are a good check on whether the Sentry is operating properly.

How do you identify an aeronautical or marine radar?

Such radars "search" with rotating antennas and may sweep by the reception zone of the Sentry at any time. The signal from these transmitters is a short "swish" or "blurp," not the clean, clear-cut tone of the speed meter.

Why doesn't POPULAR ELECTRONICS publish plans on building a detector similar to the Sentry?

The Sentry discussed in this article has a number of patent applications outstanding, and the manufacturer does not want to reveal the exact circuitry. In addition, the sensitivity of any such detector would depend upon its being tuned to 2455 mc. This is not as easy as it sounds, and getting a "test signal" on this frequency would be a problem for most experimenters.

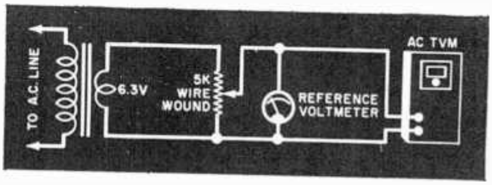
POPULAR ELECTRONICS is nevertheless currently investigating a slightly different "home-brew" speed meter detector and plans to report on it in the November issue. —30—

A.C. Transistorized Voltmeter

(*Continued from page* 74)

crepancy will not seriously affect the instrument's accuracy.

A more accurate calibration method involves the use of a reference voltmeter. Connect a good a.c. voltmeter in parallel with input jack *J1*, set the transistorized voltmeter at its 0-5 volt range, and connect the meters to a 6.3-volt filament transformer and 5000-ohm wire-wound potentiometer (see below). The 5000-ohm pot is adjusted for a 5-volt reading



Suggested circuit for calibrating the voltmeter.

on the reference voltmeter, then potentiometer *R8* is adjusted for a 5-volt ("50" on *M1*'s scale) reading on the transistorized voltmeter.

Either of the methods described above will effectively calibrate the voltmeter for 0 - .05, 5, 50 and 500 volts. The author found, however, that the calibration for the 0 - .5 volt range did not readily fall into line with the others. You can check the accuracy of the 0 - .5 volt reading with the same reference voltmeter circuit discussed above, in the following manner.

After carrying out the calibration, adjust the 5000-ohm potentiometer for a .5-volt deflection on the reference meter and set the transistorized voltmeter to its 0 - .5 volt range. If *M1's* reading is less than "47" (.47 volt), correct it by decreasing the resistance of *R1* (try other 10% resistors of the same value as *R1* in place of it until you find one which gives the proper reading).

If *M1* goes off-scale, reduce the setting of the 5000-ohm potentiometer until *M1* reads "50" (.5 volt), and check the reference meter. A reading of less than .47 volt on this meter means that you'll have to increase the value of *R1*. Again try different 10% resistors, repeating the test procedure each time until you find one that works. —30—

On the Citizens Band

(*Continued from page* 69)

each person a badge displaying his first name and call-sign. This can be just a simple card pinned to a coat or shirt pocket, but it will certainly be an "ice-breaker." Another charter member should call the meeting to order promptly, introduce himself and the other founders, and immediately ask for volunteer committees to investigate a constitution and bylaws, officers, meeting programs, and, of course, dues.

While most people will not object to paying for soft drinks and doughnuts served at the end of the first few meetings, a fund should be set up as soon as possible to take care of refreshments. Also, other expenses, such as the publication of a club newsletter and postage for meeting notices and press releases, should be budgeted.

Keep all business sessions at the meetings as short as you can—it is important to devote as much time as possible to the activity planned for a particular meeting. (You can save some time by publishing the minutes of the previous meeting in the club newsletter.) On the other hand, make certain each member has an opportunity to participate in all business phases of the club.

Meeting Activities. Planning meeting activities can be difficult. It's a good idea to change the people in charge of this phase frequently so they won't become discouraged. Several possibilities you might consider are listed below.

- Have manufacturers' representatives or public relations people talk on their CB products. Your local electronics parts wholesaler can help you here, because he sees these people regularly.
- Invite commercial licensees to talk on radio procedure in general. As an example, we all know about the "Mayday" call which is illegal in 99 out of 100 cases for CB, but what about the "Security" call which covers those cases where life and property are involved?
- Try to arrange an emergency plan whereby your club can help provide local communications in the event of a flood or hurricane. We CB'ers have a great

advantage over amateurs here, since our equipment is simpler and needs only the supervision of the licensee for "laymen" to operate. Local police and fire officials will probably be happy to work with you on this once they are convinced you have a safe and workable plan.

● Get your members out of doors on simulated emergency and special event drills. Set up a base station and dispatch mobiles from place to place, asking for reports when they get there. Keep the "wild-goose chases" down; and if you "make up" messages, remember that the FCC requires identification of these transmissions as "drill messages."

Don't forget the basic goals of the club. Make each meeting (with the exception of an annual picnic) contribute to your goals. Let the local press and radio know what you're doing and invite their representatives to some of your best planned meetings.

When your club is fully established, it's a good idea to contact a lawyer. Any well-established club should have legal counsel.

Tech Notes. It's widely known that a simple quarter-wave mobile "whip" antenna does not reflect a 52-ohm load—in fact, it's closer to 22 ohms. You'll be able to radiate more power if you connect your mobile antenna to your transmitter with *two* lengths of 52-ohm coaxial cable in *parallel.* Simply use standard "Tee" connectors at the transmitter and the antenna. Or carefully solder the inner conductors together at both ends, twist the outer braids of each cable together at the ends, and attach standard fittings. This modification does not apply to those special-design antennas which use helices or other devices to give a true 52-ohm match.

"CUBICAL QUAD FOR CB" DIMENSIONS

Due to an unfortunate set of circumstances, the dimensions specified for the "CB Cubical Quad" antenna (July 1961 issue) were incorrect—the dimensions given covered a 15-meter version of the "Quad." For an 11-meter Citizens Band version, the following changes should be made:

Dimension	Specified Length (inches)	Correct Length (inches)
Loop Side	140	111
Element spacing	66	50
Reflector stub	20	16
Balun sleeve	92	77
Pole length "D"	100 (approx.)	76 (approx.)

Our sincere apologies go to those of our readers who have already completed the "Quad."

Club Notes. The Bux-Mont (Pa.) Citizens Radio League now boasts a membership of over 100—and they got that way in about eight months of operation. This club has formed an emergency alert system and has already provided communications support for a number of local events. They recently had Mr. Joseph Welch of the FCC as guest speaker for one of their meetings. . . . The Tri-State Radio Club Inc. (Tennessee, Alabama and Georgia) reports that a local minister has a CB base station in his church office and a mobile unit in his car which assist him greatly in his personal calls and various church activities. . . . Last June, the Transceivers of Southern California Inc. provided communications at the Golden West Invitational Track Meet. They relayed results from the judges on the field to the announcer's podium and the press box, in addition to having roving units coordinating the movement of athletes from the warm-up area to the field.

The Five-Eleven Radio Club (Pittsburgh, Pa.) is offering engraved, stainless steel warning plates for attachment to transmitters. Similar to the type illustrated in this column some months ago, these plates carry a strongly worded message to potential meddlers that the two-way radio set is licensed by the Federal Government and that tampering with it is a Federal offense. Available with either red or black printing, they cost a dollar each, plus postage; clubs ordering a sufficient quantity can get them for 65 cents each, plus postage. If you're interested, write to Clifford Klein, Secretary, Five-Eleven Radio Club, 868 Glass Run Road, Pittsburgh 36, Pa.

Help Wanted. We would like to compile a list of active CB clubs for possible publication in this column. To have your club listed, simply send us a post card (no letters, please) stating the name of the club, its address, the names of its principal officers and the number of members it has. Mail the card to Dick Strippel, CB Editor, POPULAR ELECTRONICS, One Park Ave., New York 16, N. Y. —30—

Across the Ham Bands

(*Continued from page* 76)

News and Views

Ivor Strafford, VK3XB, 16 Byron St., Box Hill South, E11, Victoria, Australia, has reached his goal of working Novices in the 50 states on 7 mc., and he has the QSL cards to prove it. Along the way, Ivor made 442 contacts with 350 different Novices—he worked some of them as many as six times, but he called literally hundreds of others without success! If you would like to work VK3XB, listen for him on 7150 kc. between 0300 and 0430 EST, the only time the 7-mc. Novice band is free of commercial interference in Australia. He tunes the entire band, so don't worry about being on the wrong frequency. Ivor and his wife **Mavis, VK3KS,** have a new goal now—they are attempting to work the 50 states on the *21-mc.* Novice band. You can probably find them in or near that band around 9:00 p.m., EST (0200 GMT) any evening.

Bill, K4JQV/VP9, Prospect Hill, Bermuda, will be on 3748, 7175, 7200, and 21,225 kc. until November looking for Novice contacts. Bill runs 90 watts input, uses dipole antennas, and receives on a National NC-98. He reports that Novices put "terrific signals" into Bermuda. Eighty meters is best for interference-free contacts, 40 meters is a "mess," and fading is bad on 15 meters at times. Bill's mailing address is: Bill Watts, ET2, USN, Lorac Support Team #3, % Fleet Post Office, New York, N. Y. If you write him for a sked, give him a choice of alternate times. Although Bill didn't suggest it, I would advise you to enclose a self-addressed airmail envelope (7 cents postage) for a speedy reply.

Mark Alan Rowland, W4UCZ, P. O. Box 1, McIntyre, Ga., is the former K5TST of Little Rock, Ark. In Little Rock, he worked all states as a Novice. As a General, he worked all continents, and close to 100 countries. He sent out 1200 QSL cards and received 929 in return. Mark now has his Heathkit Apache transmitter and Hallicrafters S-85 receiver hooked up to 75- and 40-meter dipoles and is banging away again from his new location in Georgia . . . . **Milt Jensen, K5FPO,** Rt. 1, Box 154, Virden, New Mexico, via Duncan, Ariz., uses an EICO 720-K transmitter and receives on a National NC-60. Three antennas, folded dipoles for 80 and 40 meters, and a Hornet tri-band beam help make conversation in the neighborhood. Milt's record is 21 states worked and confirmed in two months as a Novice. His Conditional license has just arrived . . . . **Pat Nelson, WA6DYO,** 8944 Rathburn Ave., Northridge, Calif., pushes 65 watts into his Heathkit DX-35 to excite a ½-wave vertical antenna and a half-size, 2-element, 20-meter beam, which he rotates by hand. An RME-4300 takes care of the receiving chores, and a Heathkit VFO sets the transmitter frequency. Forty-eight countries and 49 states—45 of the states confirmed—make up Pat's "brag list."

J. E. Brazee, KNØCWW, Sumner, Nebr., calls himself a 34-year-old beginner. In five months as a Novice, he has worked 26 states, mostly on the 40-meter band. His EICO 720-K transmitter feeds a 40-meter dipole, and the dipole feeds incoming signals into a Hammarlund HQ-145 receiver. J. E. is not very active on the air just now because he is concentrating on getting his General Class ticket, which he must do alone since the nearest local ham lives 30 miles away . . . . **Chris Nelson, KN9CCW,** 925 Ridgewood, Rockford, Ill., works 40 and 15 meters most of the time. Chris transmits with an EICO 723 transmitter and has worked 21 states, plus Puerto Rico. He has been receiving on a Knight "Span Master" but is now assembling a new Knight R-55 all-band receiver.

Barbara Slutzkin, WV2PZH, 1225 Ave. R, Brooklyn, N. Y., thinks that more girls should become hams. A Junior at James Madison High School, she is a member of the school radio club. At home, Barbara has a Johnson Viking II transmitter with a Johnson "Matchbox" antenna coupler; a Hallicrafters SX-25 receiver, with a preselector; a 2-meter rig; a "long wire" for 80, 40, and 15 meters; and a 2-meter beam. But her pride and joy is a home-brew electronic key. Barbara gets a 90% return on QSL cards; in her collection are cards from SM3ATX, KX6AF, TG9RB, DL7DW, and GM3EOJ . . . . **Rich Bonkowski, K9VLQ,** 5145 Honore St., Chicago 9, Ill., has been on the air for a year as a Novice and General. His Heathkit DX-40 excites either a 40-meter dipole or a Hornet tri-band beam. A National NC-109 does the receiving, and a Johnson T/R switch electronically switches the antennas from receiver to transmitter as required. Rich has 35 states confirmed and 18 countries worked—most of his DX'ing has been done on 15 meters in the month since he has had the beam. K9VLQ QSL's all ham contacts and informative SWL cards 100%. Try him.

And send *your* "News and Views," pictures, and suggestions for construction projects to: Herb S. Brier, W9EGQ, P. O. Box 678, Gary, Indiana. Until next month, 73,

Herb, W9EGQ

Short-Wave Report

(*Continued from page* 64)

Here is a resume of the current station reports. At time of compilation all reports are correct, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used.

Afghanistan—Kabul is on the air at 1300-1430 daily in French on 15,225 kc., according to the DX program from *R. Australia. (WPE5AVL, BL)*

Albania—Tirana is operating at 1400-1700 on 7088 kc., which replaces all other channels. It was noted around 1530 in Italian. Other reports show additional xmsns from 1700 in French and in Eng. at 1730-1800. *(WPE2FAH, WPE3NF, CB)*

Belgium—Brussels has been noted on 11,805 kc. (replacing 11,850 kc.) at 1815-2000 to N.A. and at 1300-1600 on 17,840 kc. to Africa. The latter channel is dual to 15,335 and 15,435 kc. English news is given at 1945 on Mondays and Fridays on 11,805 kc. *(WPE1AAC, WPE1AMU, WPE2FAE, WPE2FCD, WPE2LH, WPE4BC, WPE4CYB, WPE4FI, WPE9CHD, WPE0BMQ, AP1PE1A, AT)*

Brazil—ZYB22, *R. Rio Mar*, Manaus, again active on 9695 kc., was noted at 0500-0715. *(WPE4FI)*

Canada—Many DX'ers continue to report reception of CFRB, Toronto, on 6070 kc. This

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is in reality CFRX, the short-wave counterpart of CFRB, 1010 kc. The "CFRX" is given infrequently after newscasts. *(Ed.)*

Colombia—*Radiotelevision Nacional de Colombia*, Bogota, began operations on May 8 over HJCP, 6180 kc.; HJCQ, 4955 kc.; and also on 3290 kc. (call-sign not known). The complete schedule is not available as yet though s/off time varies from 2350 to 0000. *(WPE6BPN, CB, RH)*

According to a recent program schedule, *R. Sutatenza*, Bogota, operates Monday through Saturday at 0545-0730 and at 1445-2210 on 5095 and 6075 kc.; at 0545-0900 and 1345-2210 on 5075 and 3250 kc.; and Sundays at 1145-2100 on all four channels. *(WPE8MS)*

Costa Rica—TIGPH, *R. Monumental*, San Jose, has moved from 6150 to 6230 kc., where it is heard at 1900-2300. *(WPE4FI)*

Cuba—The government station with ID of *R. Havana Cuba* now operates at 1200-1400 on 21,630 kc., with an Eng. period at 1300-1330, to Europe. It also operates at 1900-2200 on 11,770 kc. (and from 2000 on 11,760 kc.) in Spanish; at 2200-2300 on 11,770 kc. and at 2300-0000 on 11,875 kc. in English. On special occasions, 11,760 and 11,770 kc. may also be used at 1200-1400 and the evening Spanish xmsns extended beyond 2200, in which case the Eng. segments are omitted. *(WPE1AGM, WPE2FHU, WPE2FKG, WPE3AME, WPE3BEB, WPE4AXY, WPE4BC, WPE4CN, WPE5AG, WPE5ASW, WPE5BDG, WPE5BGX, WPE5XX, WPE6AA, WPE6BPN, WPE6BRW, WPE6BTH, WPE7ANC, WPE8FV, WPE8HF, WPE9AGB, WPE0ATE, WPE0BCT, CO2PE7C, VE5PE2S, RF)*

Dominican Republic—HI2D, *R. Hit Musical*, Santiago de los Caballeros, 3385 kc., was noted at 1940-2030 with Eng. vocals and many ID's. *(WPE2FGX)*

Ecuador—*Radiodifusora Nacional del Ecuador*, Quito, is operating on 4940 kc. with all-Spanish programs and requests for reports. The schedule, however, is in doubt; some reports give s/off time as 0000 while others list 0205 and 0300. Reports should go to the

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Stanley Schwartz *(WPE1AAC)*, Bridgeport, Conn.
Jim Silk *(WPE1AGM)*, Madison, Conn.
Walter Wigmore *(WPE1AMU)*, Squantum, Mass.
James Nagle, Jr. *(WPE1CNH)*, Pittsfield, Mass.
Jim O'Mara *(WPE1CR)*, So. Boston, Mass.
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Johnny Chane *(WPE1KW)*, Winchester, Mass.
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C. Murphy *(CM)*, Scotia, N. Y.
Alan Teller *(AT)*, Flushing, N. Y.
Matti Takala *(MT)*, Helsinki, Finland

station at Guayaquil 1242, Apartado Postal 1316, Quito. The call-sign is HCXZ1. *(WPEØATE, RH, BL)*

HCJB, Quito, is widely reported with "Caribbean Call" at 1830 daily on 15,115 and 11,915 kc., and with "Morning in the Mountains" at 0900 daily (except Mondays) on 15,115 and 17,890 kc. Station HCJB has dropped the Russian program on 9745, 11,915, and 15,115 kc. at 2330-0000 in favor of Eng., which now runs through from 2100 to 0000. *(WPE1HY, WPE2ENK, WPE2FBB, WPE4CSS, WPE4CZE, WPE6BYB, WPE6CIH, WPE7ALO, CB)*

Finland—The schedule from Pori reads: May 7 to Sept. 6—Eng. on Mondays and Fridays at 1530-1600; Sept. 7 to May 6—Eng. on Tuesdays and Saturdays at 0630-0700. Channels used: OIX4, 15,190 kc., 100 kw.;

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	L.A.—Latin America
B/C—Broadcasting	N.A.—North America
Eng.—English	R.—Radio
ID—Identification	s/off—Sign-off
kc.—Kilocycles	xmsn—Transmission
kw.—Kilowatts	xmtr—Transmitter

and OIX2, 9555 kc., 15 kw. OIX8, 11,805 kc., has been discontinued until further notice. *(WPE2DTO, WPE8CUS, VE2PE1H)*

Formosa—Taipei has been noted on the unannounced frequency of 11,725 kc., dual to 17,890, 15,225, and 6095 kc. at 0505-0550 in Eng. and to 0620 s/off in Japanese. *(WPE1AAC, WPE2LH, WPE4BC, WPE6BWO)*

French Guiana—*R. Cayenne* has moved up to 6175 kc., still with 1000 watts, and has evidently adjusted the schedule since it is now noted at 1710; French news is given at 1728 and music is broadcast from 1733 to 1803 s/off. *(PY2PE1C)*

Germany—*R. Berlin International*, Leipzig, 9730 kc., has replaced the Eng. xmsn at 1700 with one in Russian. *(WPE2AXS)*

Ghana—Accra can be noted on 4915 kc. at 0030-0200 with home news on the hour and "Radio Newsreel" at 0115-0200. *(WPE2DLT)*

India—*All India Radio* can be heard on 11,760 kc. (Madras) at 0630-0730 with Indian music to S.E. Asia, and on 9635 kc. (Delhi) at 1445 with an Eng. ID. Other programs being heard are broadcast to W. Africa on 15,240 kc. in Eng. at 1450-1545; to S.E. Asia on 11,895 and 9525 kc. with Eng. news at 1930-1940; and to S.E. Asia on 17,705 and 15,105 kc. in Tamil at 1915-2015 but with an Eng. ID at 2015. *(WPE3NF, WPE4FI, WPE8MS)*

Indonesia—YDF8, Djakarta, has definitely resumed use of 9867 kc. to Europe with Eng. at 1400-1500, but still works on 9586 kc. during the 0600 Eng. xmsn. *(WPE3NF)*

Ireland—Army Signal Corps, Curragh Camp, County Kildare, on 17,860 kc., has been noted at 1130-1145 with a xmsn to Irish troops in the Congo. Reports requested. *(ZS-PE1A)*

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Italy—Caltanisetta now carries the Second Program in Eng. at the new time of 1900. *(WPE2AXS)*

Japan—Tokyo has replaced 9505 kc. with 11,780 kc., dual to 15,235 and 11,815 kc., at 0600 with Eng. news. Other transmissions noted: to Hawaii at 0030-0200 on 15,235 and 17,725 kc. (Eng. to 0110); to N.A. at 1930-2030 (Eng. to 2020) on 17,715, 15,125, and 21,520 kc.; and to N.A. and L.A. at 2200-0000 (Eng. at 2315-0000) on 11,800, 15,125, 17,725, and 21,520 kc. *(WPE2LH, WPE6CGT)*

Jordan—Hashemite Jordan B/C Service, P. O. Box 909, Amman, has Eng. and Arabic to N.A. on 7155 kc., with Eng. at 2045-2115. A new outlet has been noted on 15,170 kc. at 1800-2000 in Arabic and Spanish to South America. *(WPE1AGM, WPE1CNH, WPE2BWA, WPE2EFE, WPE2EKC, WPE2FFM, WPE2FGX, WPE3CHG, WPE4AJ, WPE4BC, WPE4CUU, WPE4FI, WPE5AG, VE2PE1H, CM)*

Liberia—ELWA, Monrovia, is now on 15,155 kc., replacing 15,085 kc., at 1000-1430. The 1430-1630 xmsn to N. Africa has been heard on 15,120, 15,125, or 15,155 kc. This station is also heard well on 11,825 and 21,535 kc. at 2100-2245 broadcasting in English. *(WPE4FI, WPE4CDH, WPE9CPH)*

ELBC, Monrovia, 3255 kc., has been noted at 1630-1645 with music and at 0207-0215 with English news. *(WPE8CUS, PY2PE1C)*

Monaco—*Norea Radio* xmsns from *Trans-World Radio* in Monte Carlo are broadcast from 1230 in Norwegian and from 1300 in Swedish on 11,805 kc. Reports go to Norea Radio, Grensen 19, Oslo, Norway, or to Norea Radio, Tegnergatan 34, Stockholm, Sweden. Reports for Trans-World Radio go to Box 141, Monte Carlo, Monaco. There are religious programs in Eng. from 1400 to 1500/close. *(WPE2AXS, WPE4CXV, WPE8MS, MT)*

Netherlands—Hilversum now carries the "Happy Station Program" on Sundays at 1600-1730 to S. America on 11,780 kc. Other Sunday xmsns are scheduled at: 0100-0225 to Australia and New Zealand on 11,950 and 9715 kc.; 0530-0700 to Europe on 9745 and 6020 kc.; 1100-1230 to Africa, Mid-East, and Europe on 21,480, 15,445 and 6020 kc.; and 2100-2230 to N.A. on 11,730 and 6025 kc. *(WPE2BRH, WPE4CON, WPE4DES, WPE4FI, WPE6BRW, WPE8CVR, WPE9CFS, WPE9CKR, WPE9CQN)*

New Hebrides—The only way to log these islands may be through the two radiotelephone stations, one at Vila on Efate Island, the other on Santo Island. Both of these stations operate on 6900 kc. at and around 1700 and 2330. *(VE7PE2M)*

New Zealand—*R. New Zealand,* Wellington, has a DX program on the first Wednesday of the month at 0140 and at 0530 on 11,780 and 6080 kc. The commentator is

POPULAR ELECTRONICS

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September 1961

Arthur Cushen, one of the world's foremost DX'ers. *(WPE2LH)*

Nicaragua—Medium-wave DX'ers might look on 825 kc. for YNOL after WNYC s/off at 2100. At 2125, check for the program called "Back to the Bible." *(WPE2DDW)*

Peru—*R. El Sol,* OBX4C, Lima, has returned to the air on 15,170 kc. after a long absence and is heard well at 2000-2300. At closing, they announced that OBX4C was dual to OBX4Q on 3970 kc. in the 49-meter band; this is obviously incorrect since it was not found there, nor on the listed 5970 kc. *(WPE4FI, WPE6BPN)*

OAX7C, *R. Tahuantisuyo,* Cuzco, 6218 kc., has been noted around 2145 with music and some ads, all-Spanish. The frequency is given on the air as 6175 kc. *(PY2PE1C)*

Portuguese India—According to a card from Goa, they request reports for their broadcast on 21,580 kc. which is aired at 1130-1330. *(WPE1AAC)*

R. Goa is also heard on 15,385 kc. in Eng. at 2330-2345 with news, music to 2350, news commentary to 2355, and music to 0000 s/off. *(CB)*

Southern Rhodesia—Salisbury, on 3396 kc., has been noted running past the listed 0000 s/off with Eng. news from 0000 to 0015/fade or s/off. This is dual to 4911 kc., which is readable to 0030. *(WPE3NF)*

St. Pierre—In addition to the 18,000-kc. (approx.) frequency reported previously, the St. Pierre radiotelephone utility has also been heard on 12,100 kc. (approx.) with a recorded test anmt in Eng. and French. Reports should go to St. Pierre Radio-Telephone, French Liasion Center, St. Pierre Island. *(WPE8AGY)*

Switzerland—Berne has opened two new channels: 11,715 kc. at 0045-0145 and 1200-1745 to Africa; and 17,795 kc. at 0945-1130 to S. Asia, dual to 15,315 kc. *(WPE4FI)*

Berne is also noted at 2030-2215 and 2315-0000 on 9535 kc. (Eastern N.A.); 11,865 kc. (Western N.A.); and 6165 kc. (Central America). *(WPE3BOG, WPE3CHB, VE1PE4R)*

Tonga Islands—Another excellent possibility for medium-wave DX'ers is ZCO, *The Voice of the Tonga Islands,* in Nukualofa. Look for this one on 1020 kc. around 0200 in English. *(CB)*

Tunisia—Tunis has shifted from 5985 to 6115 kc. and is noted around 1645 with Arabic music and an excellent signal. *(WPE1HY, WPE3NF)*

United States—WW2XAJ is an experimental station at Mayaguez, Puerto Rico, operating for propagation purposes. It transmits unmodulated carrier 24 hours a day on 9757.5, 11,927.5, 15,102.5, and 17,882.5 kc. Power is 100 watts. *(WPE4FI)*

Uruguay—*R. Australia* reports that a new station with the call-sign CXA3 is on the air at 1900-2300 on 11,852 kc. Has anyone heard it? *(BL)*

Yugoslavia—A letter from Belgrade gives this partial Eng. schedule: 1530-1600 and 1645-1700 on 9505, 11,735, and 15,240 kc.; and 1830-1900 on 6100 and 7200 kc. Reports should go to *Radio Television Belgrade,* P. O. Box 880, Hilendarska 2, Belgrade. *(WPE1KW, WPE8AGY)* —30—

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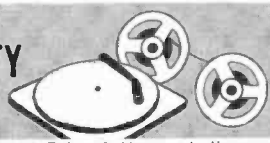

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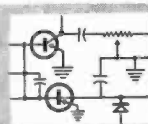

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GUARANTEED RAD-TEL TRANSISTORS SET TESTED

All Transistors Germanium PNP

AF ST* AF Driver. Use as: Driver Low Power Output, Code Osc., DC Amp., Control, Test Instr., Pre-Amp., Timers, Organ, etc. **39c ea.**

RF ST* as Converter in an American set. Use as: Converter Sq. Wave Gen., RF Osc., Amp. Regen. Det., etc. **49c ea.**

IF ST* as 455kc IF in an Amer. set. Use as: IF Amp., Grid Dip Osc., Electronic Computer, RF Osc., Switch, Amp., etc. **49c ea.**

AUTO OUTPUT ST** as Audio Power Output into Speaker. 90% of Auto Radios so Powered. Use as Power Amp., Mobile Power Supply, Voltage Regulator, Osc., DC to DC Converters. **79c ea.**

HI POWER ST** as Hi Power AF Output. Ideal as DC to DC Converter, Multivibrator replaces Vibrator supply. **$1.39 ea.**

HI CURRENT SILICON RECTIFIERS
15 AMPS
20 ma max
Reverse I at PIV

PIV	Price Each	Lots of 10	Lots of 50
50	2.25	2.00	1.75
100	2.50	2.25	1.90
200	2.75	2.50	2.25
300	3.25	2.95	2.70
400	3.95	3.50	3.00

500 MA SILICON RECTIFIER Epoxy construction, size of 1-watt resistor
I reverse at 450 Volts .3 ma

30c ea. lots of 20 | 35c ea. lots of 10 | 45c ea.

Each rectifier "Performance Tested" on an American TV Set

*SET TESTED IN AMER. TRANSISTOR RADIO OF CURRENT MFR.
**SET TESTED IN AMER. AUTO RADIO OF CURRENT MFR. AT 16 VOLT BATTERY SUPPLY.

Rad-Tel eliminates complicated characteristics and numbers with their "SET-TESTED" Transistors. Transistors Tested to Rad-Tel's specifications—available on request. 100% Satisfaction Guaranteed. Substitute or replace with Rad-Tel Transistors on the basis of similar operating characteristics . . . at Low, Low Prices.

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RAD-TEL TUBE CO.

DEPT. PE-961 55 CHAMBERS STREET, NEWARK 5, N. J.

TERMS: 25% deposit must accompany all orders, balance COD. Orders under $5: add $1 handling charge plus postage. Orders over $5: plus postage. Approx. 8 tubes per 1 lb. Subject to prior sale. Prices subject to change. No COD's outside continental USA.

EACH TUBE INDIVIDUALLY & ATTRACTIVELY BOXED

Qty. Type	Price	Qty. Type	Price	Qty. Type	Price
0Z4M	.79	6BA6	.50	12AE6	.43
1AX2	.62	6BC5	.61	12AF3	.73
1B3GT	.79	6BC7	.94	12AF6	.49
1G3	.79	6BC8	.97	12AJ6	.46
1J3	.79	6BD6	.51	12AL5	.45
1K3	.79	6BE6	.55	12AL8	.95
1R5	.62	6BF6	.44	12AQ5	.52
1S5	.51	6BG6	1.66	12AT6	.43
1T4	.58	6BH6	.65	12AT7	.76
1U4	.57	6BH8	.87	12AU6	.50
1U5	.50	6BJ6	.62	12AU7	.61
1X2	.82	6BK7	.85	12AV5	.97
2AF4	.96	6BL7	1.00	12AV6	.41
2CY5	.71	6BN4	.57	12AV7	.75
2EA5	.70	6BN6	.74	12AX4	.67
3AL5	.42	6BQ5	.65	12AX7	.63
3AU6	.51	6BQ6GT	1.05	12AZ7	.86
3AV6	.41	6BQ7	1.00	12B4	.63
3BA6	.51	6BR8	.78	12BA6	.50
3BC5	.54	6BU8	.70	12BD6	.50
3BE6	.52	6BY6	.54	12BE6	.53
3BN6	.76	6BZ6	.55	12BF6	.44
3BU8	.78	6BZ7	1.01	12BH7	.77
3BY6	.55	6C4	.43	12BL6	.56
3BZ6	.55	6CB6	.55	12BQ6	1.06
3CB6	.54	6CD6	1.42	12BY7	.77
3CF6	.60	6CF6	.64	12BZ7	.75
3CS6	.52	6CG7	.61	12C5	.56
3DG4	.85	6CG8	.77	12CN5	.56
3DK6	.60	6CM7	.66	12CR6	.54
3DT6	.50	6CN7	.65	12CU5	.58
3S4	.61	6CR6	.51	12CU6	1.06
3V4	.58	6CS6	.57	12DE8	.75
4BC8	.96	6CU5	.58	12DL8	.85
4BQ7	1.01	6CU6	1.08	12DQ6	1.04
4BS8	.98	6CY5	.71	12DS7	.79
4BZ6	.58	6CY7	.71	12DW8	.89
4BZ7	.96	6DA4	.68	12DZ6	.56
4CB6	.56	6DB5	.69	12ED5	.62
4CS6	.61	6DE6	.58	12EL6	.50
4CY5	.71	6DG6	.59	12EG6	.54
4DE6	.62	6DQ6	1.10	12EZ6	.53
4DT6	.55	6DT5	.76	12F8	.66
5AM8	.79	6DT6	.53	12FM6	.45
5AN8	.86	6DT8	.94	12K5	.65
5AQ5	.52	6EA8	.79	12SK7GT	.74
5AT8	.80	6EM7	.91	12SN7	.67
5BK7A	.82	6EU8	.79	12SQ7M	.78
5BQ7	.97	6GH8	.79	12U7	.62
5BR8	.79	6H6GT	.58	12V6GT	.53
5CG8	.76			12W6	.69
5CL8	.76	6J5GT	.51	12X4	.38
5EA8	.80	6J6	.67	17AX4	.67
5EU8	.80	6K6	.63	17BQ6	1.09
5J6	.68	6S4	.51	17C5	.58
5T8	.81	6SA7GT	.76	17CA5	.62
5U4	.60	6SK7	.74	17D4	.69
5U8	.81	6SL7	.80	17DQ6	1.06
5V6	.56	6SN7	.65	17L6	.58
5X8	.78	6SQ7	.73	17W6	.70
5Y3	.46	6T4	.99	19AU4	.83
6AB4	.46	6U8	.83	19BG6	1.39
6AC7	.96	6V6GT	.54	19T8	.80
6AF3	.73	6W4	.60	21EX6	1.49
6AF4	.97	6W6	.71	25BQ6	1.11
6AG5	.68	6X4	.39	25C5	.53
6AH6	.99	6X5GT	.53	25CA5	.59
6AK5	.95	6X8	.80	25CD6	1.44
6AL5	.47	7AU7	.61	25CU6	1.11
6AM8	.78	7A8	.68	25DN6	1.42
6AQ5	.53	7B6	.69	25EH5	.55
6AR5	.55	7Y4	.69	25L6	.57
6AS5	.60	8AU8	.83	25W4	.68
6AT6	.43	8AW8	.93	25Z6	.66
6AT8	.79	8BQ5	.60	35C5	.51
6AU4	.82	8CG7	.62	35L6	.57
6AU6	.52	8CX8	.93	35W4	.42
6AU7	.61	8EB8	.94	35Z5GT	.60
6AU8	.87	11CY7	.75	50B5	.60
6AV6	.41	12A4	.60	50C5	.53
6AW8	.90	12AB5	.55	50DC4	.37
6AX4	.66	12AC6	.49	50EH5	.55
6AX7	.64	12AD6	.57	50L6	.61
				117Z3	.61

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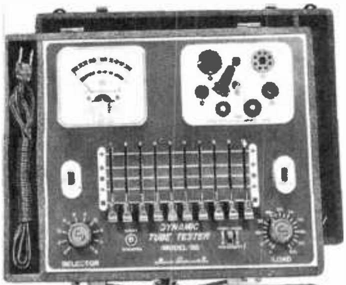
Superior's New Model 85—a DYNAMIC type **TRANS-CONDUCTANCE**

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 79 **SUPER-METER** **WITH NEW 6" FULL-VIEW METER**

A Combination **VOLT-OHM MILLIAMMETER**
Plus **CAPACITY, REACTANCE, INDUCTANCE & DECIBEL MEASUREMENTS**
Also Tests **SELENIUM & SILICON RECTIFIERS, SILICON & GERMANIUM DIODES**

Model 79—Super Meter
Total Price $38.50
Terms: $8.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

The model 79 represents 20 years of continuous experience in the design and production of SUPER-METERS, an exclusive SICO development. It includes not only every circuit improvement perfected in 20 years of specialization but, in addition includes those services which are "musts" for properly servicing the ever-increasing number of new components used in all phases of today's electronic production. For example with the Model 79 SUPER-METER you can measure the quality of selenium and silicon rectifiers and all types of diodes — components which have come into common use only within the past five years, and because this latest SUPER-METER necessarily required extra meter scale, SICO used its new full-view 6-inch meter.

SPECIFICATIONS:

• D.C. VOLTS: 0 to 7.5/15/75/150/750 1,500. • A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 • D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes • RESISTANCE: 0 to 1,000/100,000 Ohms, 0 to 10 Megohms • CAPACITY: .001 to 1 Mfd., 1 to 50 Mfd. • REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms. • INDUCTANCE: .15 to 7 Henries, 7 to 7,000 Henries. • DECIBELS: —6 to +18, +14 to +38, +34 to +58. The following components are all tested for QUALITY at appropriate test potentials. Two separate BAD-GOOD scales on the meter are used for direct readings. All Electrolytic Condensers from 1 MFD to 1000 MFD. All Germanium Diodes. All Selenium Rectifiers. All Silicon Diodes. All Silicon Rectifiers.

Model 79 comes complete with operating instructions, test leads, and streamlined carrying case. Use it on the bench—use it on calls. Only **$38.50**

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

CUT OUT AND MAIL TODAY!

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Dept. D-898 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 79** Total Price $38.50
$8.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ **Model TV-50A** ..Total Price $47.50
$11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ **Model 85** ......Total Price $52.50
$12.50 within 10 days. Balance $8.00 monthly for 5 months.

☐ **Model 83** . Total Price $38.50
$8.50 within 10 days. Balance $6.00 monthly for 5 months.

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

All prices net, F.O.B., N. Y. C.

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Model 83—C.R.T. Tube Tester
Total Price $38.50
Terms: $8.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

SUPERIOR'S NEW MODEL 83

C.R.T. TESTER

Tests and Rejuvenates ALL PICTURE TUBES

ALL BLACK AND WHITE TUBES

From 50 degree to 110 degree types —from 8", to 30" types.

● Model 83 is not simply a rehashed black and white C.R.T. Tester with a color adapter added. Model 83 employs a new improved circuit designed specifically to test the older type black and white tubes, the newer type black and white tubes and all color picture tubes. ● Model 83 provides separate filament operating voltages for the older 6.3 types and the newer 8.4 types. ● Model 83 employs a 4" air-damped meter with quality and calibrated scales. ● Model 83 properly tests the red, green and blue sections of color tubes individually—for each section of a color tube contains its own filament, plate, grid and cathode. ● Model 83 will detect tubes which are apparently good but require rejuvenation. Such tubes will provide a picture seemingly good

ALL COLOR TUBES

Test ALL picture tubes—in the carton—out of the carton—in the set!

but lacking in proper definition, contrast and focus. To test for such malfunction, you simply press the rej. switch of Model 83. If the tube is weakening, the meter reading will indicate the condition. ● Rejuvenation of picture tubes is not simply a matter of applying a high voltage to the filament. Such voltages improperly applied can strip the cathode of the oxide coating essential for proper emission. The Model 83 applies a selective low voltage uniformly to assure increased life with no danger of cathode damage.

Housed in handsome portable Saddle Stitched Texon case—complete with sockets for all black and white tubes and all color tubes. Only **$38.50**

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.

Superior's New Model TV-50A **GENOMETER**

7 Signal Generators in One!

- 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 satisified 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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