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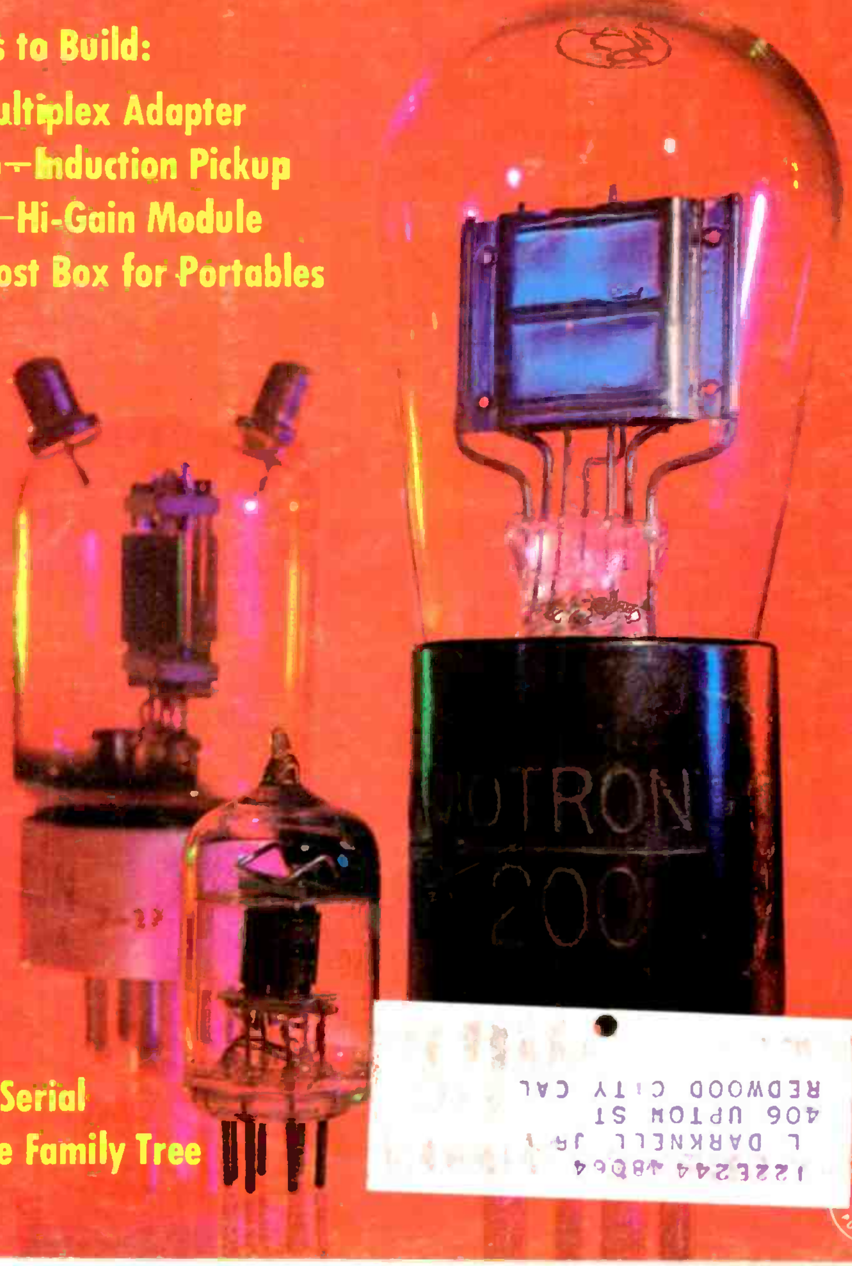

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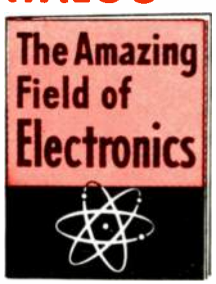

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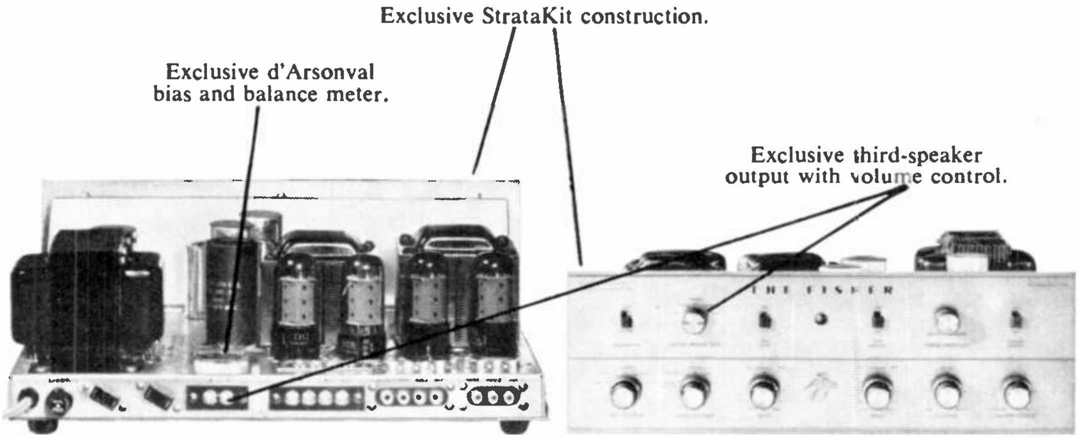

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This month's cover photo by Bruce Pendleton

VOLUME 18 MAY 1963 NUMBER 5

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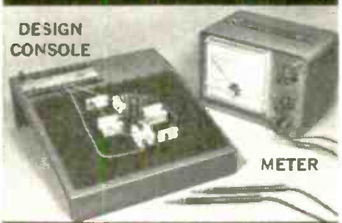

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FCC Report

By **ROBERT E. TALL**
Washington Correspondent

A VIRTUAL TORRENT of last-minute comments on the FCC's proposals to rewrite the Citizens Radio Service (CB) rules is coming into the agency as this column is being written. The wide divergence of views on the rule proposals, along with heavy Congressional interest, make it clear that the FCC staff will give all comments a thorough reading.

The agency's stated intentions to get CB'ers under control again, however, indicate that it will not waste time, and that it will come out with its final rules version—even if revisions from the original proposals are considered in order—as quickly as possible.

New CB License Forms. The FCC has moved into high gear on its program for using electronic data processing equipment in handling CB and amateur radio licensing chores. The first result of the program is a revised CB application Form 505 tailored to EDP procedures.

The new forms, the Commission pointed out, are scheduled for distribution by July 1. They are to be used when applying for Class B, C, or D Citizens Radio Service licenses. The agency noted that it will *not accept* applications submitted on old 505 forms after August 31, and cautioned heavy users of the present form "not to overstock."

Through the end of August, CB applications may be filed on 505 forms dated either April 1962 or October 1962. The new 1963 version of the form can be used "as soon as distribution has been made," the Commission said, "but in no event earlier than July 1."

Data machine processing of license applications has been sought for some time by FCC officials. It reportedly offers much faster license handling, with some predictions even approaching "same-day" granting of applications received.

One internal problem of the FCC occasioned by the switch to EDP is centered around the Gettysburg, Pa., satellite office. The FCC recently transferred the handling

FCC Report

(*Continued from page* 6)

of most CB and amateur applications to Gettysburg. Plans now are to close this office, since the data machinery will be located in Washington, D.C.

Changes in amateur application forms and licensing procedures are expected to follow within a month.

Lawyers Urge FCC Reform. Certain to draw Congressional attention before Capitol Hill closes its doors this year are recommendations of a special committee of the Federal Communications Bar Association. Congress and President Kennedy are being urged to take an overall look at the present regulation of the communications field by the FCC, and come up with some sweeping changes to put communications regulation on an up-to-date basis.

The FCBA committee suggested even doing away with the Commission as it is presently constituted, if necessary to accomplish needed reforms. And the report, while heavily emphasizing the need for more enlightened regulation of the broadcast field, also included suggestions involving the non-broadcast radio communications field.

The group proposed that the adjudicatory and administrative functions of the present FCC be assigned to a new Communications Court and a new Communications Administrator, respectively, and suggested retention of a bi-partisan Commission of at least five members for "policy-making and rule-making functions."

Apparently, the theory is that such a split in functions would eliminate the present situation where the FCC is both "judge and jury," and in some cases even "prosecutor," on a given problem. By making the agency stick strictly to policy-making and rule-making, it was noted, a better job could be done in those areas.

Non-broadcast radio lawyers have also emphasized the need for a more complete division of broadcast vs. non-broadcast considerations, since under the present setup the latter rarely get adequate attention from the FCC Commissioners.

160-Meter Band Changes. A complex rearrangement of amateur radio sharing privileges on frequencies used by the LORAN system of radionavigation in the 1800-2000 kilocycle band, and deletion, at least for the time being, of single-sideband operations in the band, has been ruled by the FCC. This was in partial approval of a request by the American Radio Relay League.

The Commission said that this action in-

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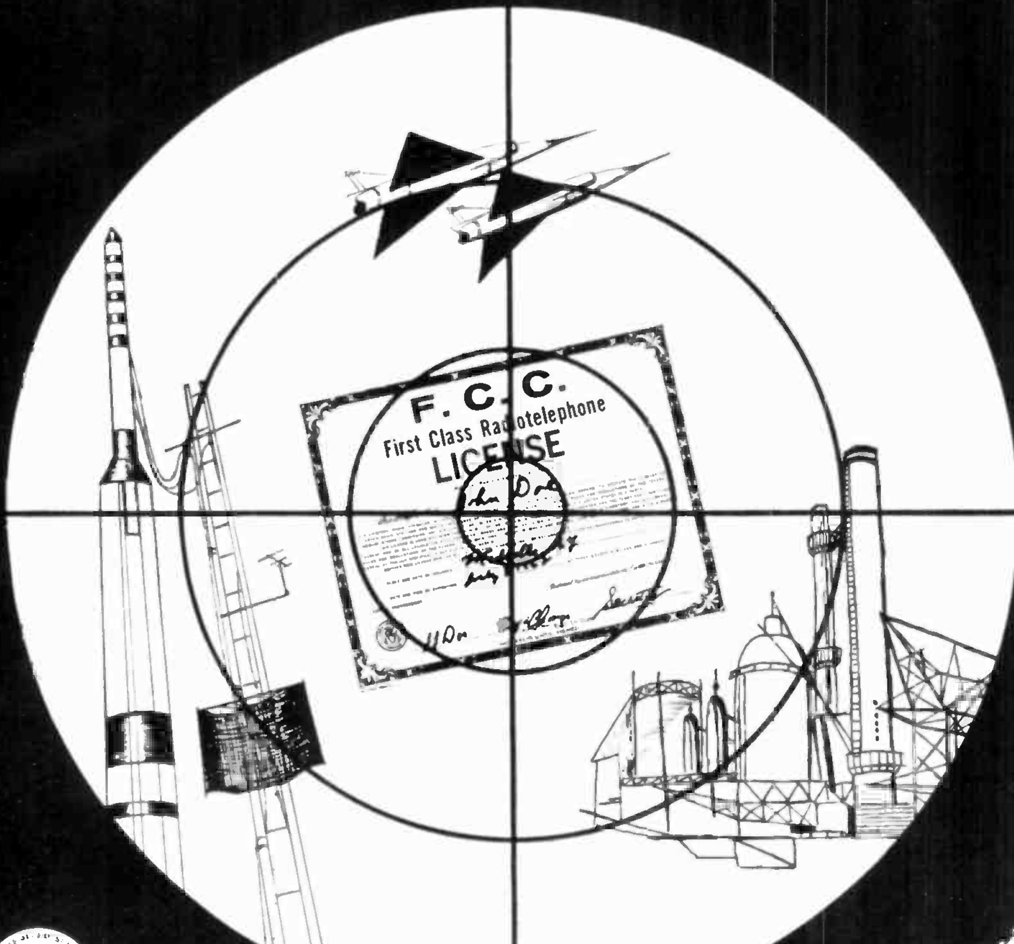

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FCC Report

(Continued from page 8)

creases amateur operating privileges in the 160-meter band "in a majority of the areas concerned," but calls for power reduction in a few areas "where the degree of protection from interference required by LORAN stations in the immediate future cannot otherwise be provided."

The single-sideband prohibition in the band, and the power reductions called for, were scheduled to go into effect the middle of April. The Coast Guard, it is understood, is studying the SSB interference problem, and may in the future change its position to permit resumed SSB operation.

The FCC rule changes make at least 25 kilocycles of additional space available to amateurs in geographical areas where they already had operations; permit access to the band by amateurs in parts of Texas, Louisiana, Mississippi, Alabama, Alaska, Georgia, Florida, Puerto Rico, Virgin Islands, Guam and other possessions, which had been excluded; and provide for power increases in about half of the areas listed in FCC rules covering the subject. —30—

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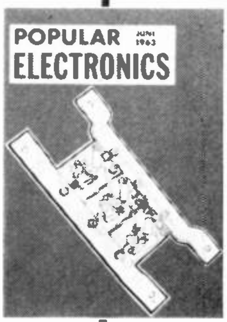

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  This handy gadget, aimed at the amateur photographer, uses a brand-new light-sensitive diode as a trigger.

LETTER TRAY

Address correspondence for this department to:
Letters Editor, POPULAR ELECTRONICS
One Park Avenue, New York 16, N. Y.

Instant Intercom

■ Congratulations to James Fred for his January P.E. article, "Give Your Radio Instant Sound." I installed a 750-ma., 450-PVI diode in a 83Y297 Knight-Kit intercom by bypassing the enclosed switch and adding a s.p.d.t. toggle. This simple modification has saved me about $20 on the cost of a transistorized intercom with instant "warm-up."

LARRY REID
Oakland, Calif.

Our readers who have tube-type intercoms should like this one.

Bouquet for "Add-On S-Meter"

■ I find the "Add-On S-Meter" (February, 1963) to be a very satisfactory piece of equipment. This is the first time that I have tried to build anything from your magazine. The time requirement was about four hours. I would like to congratulate Mr. Winklepleck on his fine design.

STEVEN LAUBER, WPE2JMX
Summit, N.J.

WPE2 Club Anyone?

■ I noticed the "CQ WPE5's" letter in the February *Letter Tray,* and wonder if P.E. could help me, too. Would you publish a letter asking all WPE2's who are interested in joining an SWL club to send me their names, addresses, WPE registrations, information on equipment, and any suggestions they may have on joining such a club?

HARVEY KRAMER, WPE2FSR
1253 E. 54 St.
Brooklyn 34, N.Y.

Okay, Harvey, there you are. All WPE2's interested in joining a club should contact WPE2FSR at the above address.

Project Test Data?

■ Although I've had some success with P.E. projects I've constructed, there have been some problems, too. Why not include a list of tests that can be made—and the proper results—with each project? Probably most P.E. readers have or can borrow basic test equipment.

E. W. AIKENS, JR.
Mobile, Ala.

This is a good idea, and P.E. does try to include some tests, especially where adjustments are crit-


The wind blows just as hard over your rooftop as it does over the police station...
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Letter Tray

(Continued from page 12)

ical. On the other hand, it would be impossible to list all possible maladies that a certain piece of equipment might suffer from and corresponding tests to correct the trouble. In the final analysis, logic and plain old horse sense must play a big role in any kind of trouble-shooting. We try to see that the projects featured in P.E. never reach the trouble-shooting stage.

"Variable Voltage . . ." with Relay

■ I have just completed the variable voltage power supply described in the January, 1963, issue, p. 63 ("Variable Voltage—You Pick It"), and am quite pleased with the results. Since I like to experiment, I made some changes in the circuit; in

addition to substituting 40-μf. capacitors for *C1* and *C2*, I installed a relay and pilot light circuit to indicate when the B+ is on.

DAVE LITTLEJOHN
Apalachin, N. Y.

Mail From India

■ I am 12 years old and would like to correspond with boys my age who are interested in electronics and DX'ing. I would also like to congratulate you on the quality of your magazine, which I have been reading for the past few years. I have made quite a few of the transistor projects you have featured, and would appreciate an article on a two- or three-tube radio, all-wave, using some common valves.

RASHAD MOHAMAD
93 Mowbrays Rd.
Madras 18, S. India

Thank you for the comments, Rashad; we're glad to hear that P.E. reaches South India regularly. Perhaps some of our readers would like to exchange schematics and information with you. Or you could try the 6U8A regenerative receiver described in Across the Ham Bands *in our March, 1962, issue. More projects of the type you are interested in will be featured in future issues.*

Hams View CB

■ In reference to the letters in the January *Letter Tray* from CB'ers Jones and Schulze, I would like to state that the ratio of bad to good hams is insignificant compared to the ratio of bad to good CB'ers. The record of amateur radio throughout the years in things like disaster work and research and development far outweighs the puny efforts of a few "lids" to destroy it. Mr. Jones complained about hams who call CB'ers "lids." The term "lid"

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1B3	.79	6AW8	.90	6SA7GT	.99	12CX6	.54
1DN5	.55	6AX4	.66	6SH7	1.02	12D4	.69
1G3	.79	6AX5	.74	6SJ7	.88	12DE8	.83
1J3	.79	6BA6	.50	6SK7GT	.95	12DL8	.88
1K3	.79	6BC5	.61	6SL7GT	.84	12DQ6	1.04
1R5	.77	6BC8	1.04	6SN7	.65	12DS7	.84
1S5	.75	6BE6	.55	6SQ7GT	.94	12DT5	.76
1T4	.72	6BF5	.90	6T4	.99	12DT7	.79
1U5	.65	6BF6	.44	6T8	.85	12DT8	.78
1X2B	.82	6BG6	1.70	6U8	.83	12DW8	.89
2AF4	.96	6BH8	.98	6V6GT	.54	12DZ6	.62
3AL5	.46	6BJ6	.65	6W4	.61	12ED5	.62
3AU6	.54	6BJ7	.79	6W6	.71	12EG6	.62
3AV6	.42	6BK7	.85	6X4	.41	12EK6	.62
3BC5	.63	6BL7	1.09	6X8	.80	12EL6	.50
3BN6	.75	6BN6	.74	7A8	.68	12EZ6	.57
3BU8	.78	6BQ6	1.12	7AU7	.65	12F8	.66
3BY6	.58	6BQ7	1.00	7EY6	.75	12FA6	.79
3BZ6	.56	6BU8	.70	7Y4	.69	12FM6	.50
3CB6	.56	6BX7	1.11	8AU8	.90	12FR8	.97
3CS6	.58	6BZ6	.55	8AW8	.93	12FX8	.90
3DG4	.85	6BZ7	1.03	8BQ5	.60	12GC6	1.06
3DK6	.60	6C4	.45	8CG7	.63	12J8	.84
3DT6	.54	6CB6	.55	8CM7	.70	12K5	.75
3GK5	.99	6CD6	1.51	8CN7	.97	12L6	.73
3Q4	.63	6CG7	.61	8CS7	.74	12SF7	.69
3S4	.75	6CG8	.80	8EB8	.94	12SK7GT	.95
3V4	.63	6CL8	.79	8FQ7	.56	12SL7	.80
4BQ7	1.01	6CM7	.69	9CL8	.79	12SN7	.67
4CS6	.61	6CN7	.70	11CY7	.75	12SQ7GT	.91
4DT6	.55	6CQ8	.92	12A4	.60	12U7	.62
4GM6	.60	6CR6	.60	12AB5	.60	12V6	.63
5AM8	.79	6CS6	.57	12AC6	.55	12W6	.71
5AN8	.90	6CS7	.69	12AD6	.57	12X4	.47

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5AT8	.83	6CU6	1.08	12AE7	.94	17DQ6	1.06
5BK7	.86	6CY5	.70	12AF3	.73	18FW6	.49
5BQ7	1.01	6CY7	.71	12AF6	.67	18FX6	.53
5BR8	.83	6DA4	.68	12AJ6	.62	18FY6	.50
5CG8	.81	6DE6	.61	12AL5	.47	19AU4	.87
5CL8	.76	6DG6	.62	12AL8	.95	19BG6	1.39
5CQ8	.84	6DJ8	1.21	12AQ5	.60	19EA8	.79
5EA8	.80	6DK6	.59	12AT6	.50	19T8	.85
5EU8	.80	6DN6	1.55	12AT7	.76	21EX6	1.49
5J6	.72	6DQ6	1.10	12AU6	.51	25AX4	.70
5T8	.86	6DT5	.81	12AU7	.61	25C5	.53
5U4	.60	6DT6	.53	12AV6	.41	25CA5	.59
5U8	.84	6DT8	.94	12AV7	.82	25CD6	1.52
5V6	.56	6EA8	.79	12AX4	.67	25CU6	1.11
5X8	.82	6EB5	.73	12AX7	.63	25DN6	1.42
5Y3	.46	6EB8	.94	12AY7	1.44	25EH5	.55
6AB4	.46	6EM5	.77	12AZ7	.86	25L6	.57
6AC7	.96	6EM7	.82	12B4	.68	25W4	.68
6AF4	1.01	6EU8	.79	12BD6	.50	32ET5	.55
6AG5	.70	6EV5	.75	12BE6	.53	35C5	.51
6AH4	.81	6EW6	.57	12BF6	60	35L6	.60
6AH6	1.10	6EY6	.75	12BH7	.77	35W4	.42
6AK5	.95	6FG7	.69	12BK5	1.00	35Z5	.60
6AL5	.47	6FV8	.79	12BL6	.56	36AM3	.36
6AM8	.78	6GH8	.80	12BQ6	1.16	50B5	.69
6AQ5	.53	6GK5	.61	12BR7	.74	50C5	.53
6AS5	.60	6GK6	.79	12BV7	.76	50EH5	.55
6AT6	.49	6GN8	.94	12BY7	.77	50L6	.61
6AT8	.86	6H6	.58	12BZ7	.86	70L7	.97
6AU4	.85	6J5GT	.51	12CN5	.56	117Z3	.85
6AU6	.52	6J6	.71	12CR6	.67	807	.75

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Letter Tray

(*Continued from page* 14)

is reserved for a licensed operator who does not measure up to standards. CB'ers are not "lids" because they are not operators; they are roughly equivalent to users of the common telephone.

CB'ers do not have to pass a test to get on the air. This is only right, for people who have no interest in radio should not be forced to learn about it in order to use it. However, if CB'ers have no interest in radio as a hobby, why do they form clubs, send out QSL cards, and talk about things like "policing our own ranks?" If CB'ers do not consider themselves hams, why then do they act like hams?

MICHAEL A. NAZZARO II, WA2VBX
Rocky Point, L.I., N.Y.

■ I would like to see the Citizens Band straightened out—there is no reason for anyone getting fined or in deep trouble over a little 5 x 7 CB rig. In our area, the Foothills Radio Club holds several code and theory classes, so that anyone who is interested can become a ham. CB should be used for what it was intended. The Citizens Band is for the peoples' benefit—they should take care not to lose it.

CHARLES BAGLEY, K3TJY
Greensburg, Pa.

Heathkit GW-22 Owners: Take Note

■ Here's an item of interest for those of your readers who are also Heathkit GW-22 owners. If their sets distort due to overloading when receiving strong local stations, all they need do is connect the a.v.c. voltage to pin 4 of the r.f. interstage transformer. The a.v.c. may be taken from pin 2 of the antenna coil which is close by.

ERNEST R. DAVIS, 6W3120
Esom Hill, Ga.

CORRECTION NOTICE

Our December, 1962, issue, on pages 61 and 62, contained an article on how to construct a "BLINKY" nite-light blinking bee.

Gold Seal Company of Bismarck, North Dakota, has since informed us that it owns the trademark "BLINKY" for use on toys and has registered "BLINKY" in the United States Patent Office as Registration No. 728,813. Gold Seal Company also advises us that it owns United States Letters Patent No. 2,647,222 covering blinking eyes and other blinking parts in toy animals and other toys.

We have no intention to violate the rights of Gold Seal Company in its "BLINKY" trademark. We call to our readers' attention the claim of Gold Seal Company that its patent rights will be violated by the making of the nite-light blinking bee in accordance with our article. We regret any inconvenience to Gold Seal Company.

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William E. Eckenrod

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 have paid for all my equipment with money earned servicing TV sets. Yes, N.T.S. gave me my start in television.
Louis A. Tabat

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

SEE OTHER SIDE

ALL 8 PHASES IN ONE MASTER COURSE

PHASE 1 TELEVISION INCLUDING COLOR TV
90% of homes have at least one set. Color TV is becoming more popular daily. TV Stations grow in number, need technicians. Maintenance and repair offer big opportunities.

PHASE 2 RADIO—AM & FM
Radios in homes, cars, schools, all need expert upkeep. Stations expand as FM becomes popular. Now transistors boom entire field.

PHASE 3 INDUSTRIAL ELECTRONICS
Computers, Data-Processing machines, Electronic Controls, Guided Missile Systems are new fields where Electronics play a vital role.

PHASE 4 SOUND SYSTEMS
New popularity of Hi-Fi-Stereo, as well as industrial sound systems and business intercoms make this a highly specialized and important field.

PHASE 5 FCC LICENSE PREPARATION
FCC License holders have a wide range of top jobs open to them. FCC License now a requirement for most Communication jobs.

PHASE 6 RADAR AND MICROWAVES
These are the communications systems of the future, already used in tracking and contacting satellites.

PHASE 7 AUTOMATION & COMPUTERS
Automation and Computer electronics are the new tools of industry and commerce. Skilled Technicians in these fields are in great demand at top pay.

PHASE 8 BROADCASTING & COMMUNICATIONS
In the entertainment industry, or in commerce, communications and broadcasting have great importance. Installation and maintenance of equipment requires trained technician know-how.

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New Products

"SERVICE BENCH" VTVM

Special features of the new Heathkit IM-13 VTVM include an easy-to-read, 6", 200-μa. meter, and a gimbal bracket which permits bench, shelf, or wall mounting. Thumbwheel nuts on the side of the case hold the meter firmly in any position. The circuit of the IM-13 is the same as that used in the preceding model, the IM-32, plus vernier-driven zero and ohms adjust controls, and a single a.c./ohms/d.c. test probe for operating convenience. Meter voltage

ranges, d.c. and a.c. (r.m.s.), include 0-1.5, 5, 15, 50, 150, 500, and 1500 volts. The unit features seven ohmmeter ranges, and measures up to 1000 megohms with internal battery. The d.c. accuracy is within ±3% of full scale, a.c. accuracy ±5% of full scale. Price, $32.95. (*Heath Company*, Benton Harbor, Mich.)

PORTABLE TAPE RECORDER

Containing nine transistors, one diode, and a thermistor, the Sony Model 801-A tape recorder operates on 110 volts, 60 cycles, or 220 volts, 50 cycles, a.c.; or on 9 volts d.c. (six size "D" flashlight batteries). The dual track recorder, which accepts up to a 5" reel, has switch-selected speeds of 3¾ and 1⅞ ips, and a frequency response of 90 - 9500 cycles at the higher speed and 90 - 5000 cycles at the lower

speed. Weighing only 13 pounds and measuring approximately 13" x 2" x 4", the device has a built-in microphone as well as

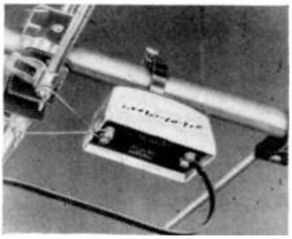
Products

(*Continued from page* 19)

a jack for an external microphone. Push-button controls, a VU meter for recording level and battery condition indication, a built-in 3" x 5" speaker, a footage indicator, and a variable back-spacing lever are some of the other features the Model 801-A has to offer. Price $250.00; leather carrying case, $10.00. (*Superscope, Inc.*, 8150 Vineland Ave., Sun Valley, Calif.)

TV ANTENNA BOOSTER

A new transistorized antenna amplifier has been announced by The Winegard Company. Called the "Red Head," Model RD-300, the amplifier incorporates a high-pass interference filter and a two-set coupler. It is a.c.-powered and recommended for use in areas where all signals are under 20,000 microvolts. Price, $29.95. (*The Winegard Company*, Burlington, Iowa.)



"DARK HEATER" TRANSMITTING TUBE

A transmitting tube similar to the popular 6146, but one that can take wide variations in heater voltage, has been announced by Westinghouse. A "dark heater" and an improved cathode in the new tube, the WL-8298, assure dependable operation with a continuous heater supply of 8 volts and an intermittent supply of up to 10 volts. (The "dark heater" operates at about 350°F less than conventional heaters but maintains the same cathode temperature.) Heater current is 1.165 amperes at 6.75 volts. Additional information on the WL-8298 is available from the *Westinghouse Electronic Tube Division*, Box 284, Elmira, N. Y.

RECHARGEABLE HAND LIGHT

Powered by a rechargeable nickel cadmium battery, the Channel Master "Bright-Mite" hand light is as small as a cigarette lighter and weighs only two ounces. The unit has a built-in spare bulb, and will give an hour of bright light or about five hours of soft light before recharging is necessary. The "Bright-Mite" is unconditionally guaranteed for two years. Price, $4.95; with recharger, $6.90. (*Channel Master Corp.*, Ellenville, N.Y.) —30—

POP'tronics Bookshelf

TROUBLESHOOTING WITH THE VOM AND VTVM

by Robert G. Middleton

Books written by Bob Middleton on TV servicing are rapidly becoming legion. It is impossible to imagine a black-and-white or color TV problem that this author hasn't discussed in print. In his latest opus (at least, as this is being written), he explains how most TV servicing can be done with only two test instruments. We know it sounds hard to believe, but the "how to" details are all very carefully outlined.

Published by Howard W. Sams & Co., 4300 West 62nd St., Indianapolis 6, Ind. 160 pages. Soft cover. $2.50.

ESSENTIALS OF ELECTRICITY, Third Edition

by W. H. Timbie and A. L. Pike

While it is not usually our custom to review books dealing strictly with electricity—as opposed to electronics—the third edition of *Essentials of Electricity* merits some words of praise. Professor Timbie, now deceased, originally wrote this valuable classroom text in the late 1920's; the fact that only one other revision has been needed in recent years is a tribute to his competence and foresight. The extensive overlap between electronics and electricity is clearly visible in this third edition. As the title indicates, electricity (Ohm's law, motors, batteries, etc.) are reviewed in considerable detail. There is no doubt that this will be a popular text for use in schools, and as a refresher for some old-timers.

Published by John Wiley & Sons, Inc., 440 Park Ave. S., New York 16, N.Y. 302 pages. Hard cover. $5.75.

TUBE AND TRANSISTOR HANDBOOK

If you have occasion to use a tube or transistor manufactured outside of North America, you should have this book. Published for "Radio Bulletin," which is the Netherlands equivalent of POPULAR ELECTRONICS, it supplies easily understood tube and transistor specs—plus circuit diagrams em-

Bookshelf

(*Continued from page 22*)

ploying the tube or transistor, with typical parts values. The presentation is very colorful. In the tube section, orange pages are diodes, green pages are triodes, yellow are tetrodes, purple are cathode-ray tubes, etc. In the transistor section, green stands for audio-frequency types, red for power output transistors, and the frequency converters are gray. American units are also included.

Available in U.S.A. from Continental Dynamics, P.O. Box 3125, Beaumont, Texas. 504 pages. 4⅜" x 8½". Plastic cover. $3.75.

HOW TO DETECT AND MEASURE RADIATION

by Harold S. Renne

The "staffers" at POPULAR ELECTRONICS have a fond spot for Harold Renne, since it wasn't too many years ago that he spent a short term as our Technical Editor. Since then, Harold has gone on to bigger and better things, including this up-to-the-minute book on nuclear radiation. The seven chapters are packed with photos, wiring diagrams, and all sorts of valuable information on counters, dosimeters, solid-state detectors, etc. Space age applications, radiation effects, and nuclear standards are covered in a succinct writing style so that they may be appreciated by the non-nuclear technician. One chapter, on home-made counters, includes complete building instructions.

Published by Howard W. Sams & Co., 4300 West 62nd St., Indianapolis 6, Ind. 160 pages. Soft cover. $3.95.

Capsule Reviews

ELECTRONIC CONSTRUCTION PRACTICES *by Robert Lewis.* Dealing mostly with metal-working, finishing, shielding, and component assembly, this is a very practical book for the newcomer who wants to build his own. The tightly written text and superb photos make it a good workbench library addition. *Published by Radio Publications, Inc., Wilton, Conn. 136 pages. Soft cover. $2.95.*

. . . . **11,000 TUBE SUBSTITUTES** *by H. G. Cisin.* Here's a handy item for your tube caddy—the book title tells the story. Receiving tubes, TV picture tubes, and even crystal diodes and transistors are itemized. *Published by Harry G. Cisin, Amagansett, L.I., N.Y. 72 pages. Soft cover. $1.25.* —30—

Tips and Techniques

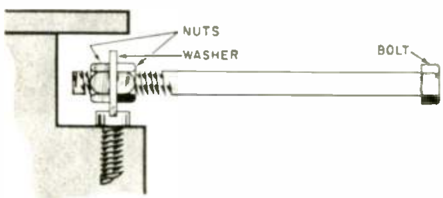
CONVERSION: HEAVY-DUTY STAPLES TO PUSH-IN FASTENERS

The little push-in fasteners that are used to hold the backs on small table radios get lost quite easily, presenting a replacement problem. Keep a few heavy-duty staples around—the kind used on large cartons—and you can make quick, inexpensive replacement fasteners. Just bend the staples so that they look like the ones shown in the lower portion of the photo, and they'll fit right into place.

—*Homer L. Davidson*

EMERGENCY OFF-SET SCREW DRIVER

If you don't have an off-set screw driver, you can put one together in about a minute. All you need is a bolt or machine screw, a washer and two small nuts to fit the screw. Sandwich the washer between the two nuts

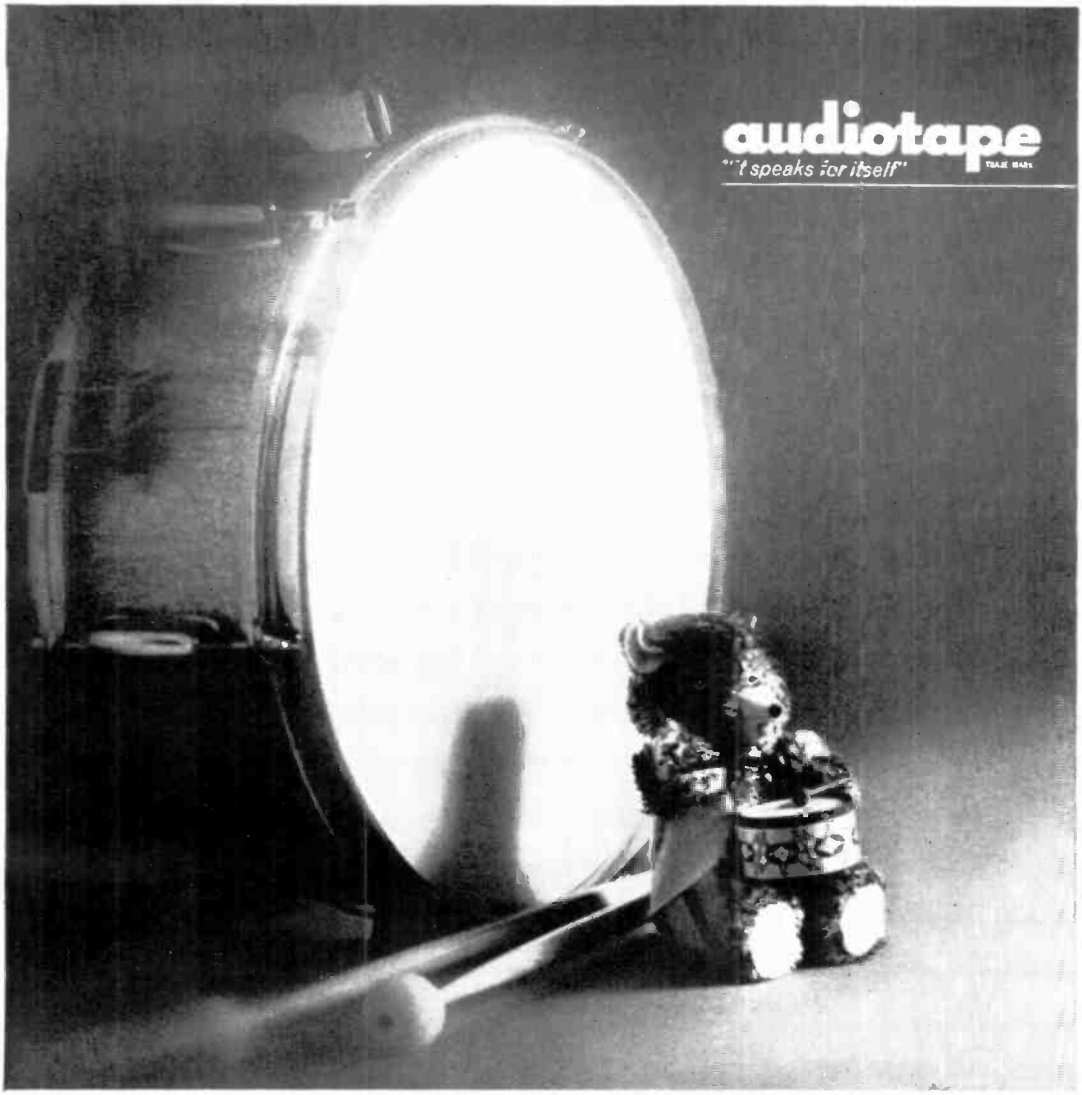


a suitable distance from the tip of the bolt or screw, and you'll have your off-set screw driver.

—*John A. Comstock*

ALLIGATOR CLIPS ON SHIELDED CABLE

Test leads and other shielded-cable leads terminating in alligator clips can be a bother: the shielded wire frays, breaks, or shorts something out. If this is your problem, cut the shielding as if you were attaching a coaxial connector—leave about ¼" of shielding exposed and fold it back over the



let the drums roll out

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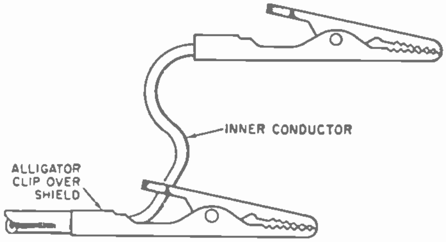
Tips

(*Continued from page 26*)

outer insulation of the cable. Open up the tabs at the back of an alligator clip, place them around the shield and crimp them closed. To insure good contact, solder can



be applied where the two tabs meet. Attach the clip to the center conductor as you normally would. —*Joel Fentin*

TRACING PAPER KEEPS WORK CLEAN

To keep track of how far you've gone on a construction project, it's a good idea to mark the schematic in some manner. However, this makes for a very messy schematic when the job's finally done. Instead, you can simply place a sheet of tracing paper over the schematic and trace each wire and component as you connect it. When the project is finished, a quick comparison of the traced schematic with the original one will show any omissions, and the original schematic will still be clean and readable. —*J. A. Singer*

ONE TO NINE VOLTS FOR TRANSISTOR CIRCUITS

Here's a quick, easy, and inexpensive way to have a variety of voltages available for transistor circuits. Just use two "C" batteries like those shown in the photo—their screw-type terminals eliminate the need for battery holders or soldering. The batteries (Burgess 5360 or equivalent) measure about $2\frac{13}{32}$" x $2\frac{7}{32}$" x $2\frac{21}{32}$" and are readily available—at a cost of about 88 cents each—from most electronic supply houses. There are three voltages per battery—1.5, 3, and 4.5 volts—and with two batteries, additional voltages of 6, 7.5, and 9 volts are possible. —*Robert E. Kelland*

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Extra plus feature: Pre-assembled, factory-tested DC/AC-OHMS probe (WG-299D) included with every kit.
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- Big 6½" meter—one of the most readable ever designed into a VTVM—electronically protected against burnout
- Color-coded scales different ate peak-to-peak and rms readings
- ±3% accuracy full-scale on both AC and DC measurements.
- Less than 1% tracking error
- Precision multiplier resistors accurate to ±1%
- Rugged die-cast aluminum case with leather handle
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MEASURES:
- AC voltages (0.1 to 4200 volts peak-to-peak and 0.1 to 1500 volts rms)
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- Resistances (0.2 ohms to 1,000 megohms)

RCA Senior VoltOhmyst WV-98C, also available factory-wired and calibrated, $79.50*

OTHER OUTSTANDING RCA KIT VALUES

RCA VOLTOHMYST® KIT WV-77E(K)

Only $29.95*

Famous VoltOhmyst® quality and performance at a low price! Special test features include: separate 1.5-volt rms and 4-volt peak-to-peak scales for accurate low AC measurements. Measures AC and DC voltages to 1500 volts, resistances from 0.2 ohm to 1,000 megohms. Complete with ultra-slim probes, long flexible leads, special holder on handle to store leads.

RCA WV-77E available factory-wired and calibrated: $43.95*

RCA WV-38A(K) VOLT-OHM-MILLIAMMETER KIT

Only $29.95*

The V-O-M with the extras! · 0.25-volt and 1.0-volt DC ranges · Big easy-to-read 5¼" meter · Non-breakable sealed plastic case—no glass to crack or shatter · Jacks located below switches to keep leads out of the way · Spring clips on handle to hold leads · Attractive, scuff resistant, rugged carrying case, only $4.95* extra.

RCA WV-38A available factory-wired and calibrated: $43.95*

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Satellites On The Air

The following satellites, launched by the United States, were reported to have beacon and telemetry transmissions as of March 13, 1963. The satellites are listed by their code names, according to frequency; because some transmit on more than one frequency, they appear more than once.

Transit IVA	54.000 mc.
Courier IB	107.970 mc.
TIROS I	107.997 mc.
TIROS III	108.000 mc.
Vanguard I*	108.024 mc.
TIROS III	108.030 mc.
Telstar	136.050 mc.
Explorer XV	136.101 mc.
Relay I	136.140 mc.
Transit IVA	136.200 mc.
Explorer XVI	136.200 mc.
TIROS IV	136.230 mc.
TIROS V and TIROS VI	136.235 mc.
Ariel	136.408 mc.
Explorer XIV	136.440 mc.
Injun SR-3	136.500 mc.
Alouette	136.590 mc.
Relay I	136.620 mc.
Traac*	136.650 mc.
OSO I	136.744 mc.
Transit IVB	136.800 mc.
Anna IB	136.815 mc.
Explorer XVI	136.858 mc.
TIROS IV	136.920 mc.
TIROS V and TIROS VI	136.922 mc.
Alouette	136.979 mc.
Transit IVA	150.000 mc.
Transit VA	150.000 mc.
Transit IIA	161.990 mc.
Transit IIA	215.990 mc.
Midas IV	228.200 mc.
Midas IV	232.400 mc.
Transit VA	400.000 mc.

*Signal may be very weak

There are several more satellites in orbit which may be transmitting. However, these are so-called "secret" satellites launched by the U.S. Air Force.

If you're interested in eavesdropping on satellites, and missed our June 1962 article on the NASA-136 converter, we recommend that you look it up. Easy to construct, this sensitive converter can intercept the satellites operating in the 136-137 mc. band.

TRY THIS STEREO TEST RECORD!!

Special to our readers for only...$3.98

Featuring Tests Never Before Available To The Hobbyist

Why We Make the Model 211 Available Now

Although there are many stereo test records on the market today, most critical checks on existing test records have to be made with expensive test equipment.

Realizing this, HiFi/STEREO REVIEW decided to produce a record that allows you to check your stereo rig, accurately and completely, just by listening! A record that would be precise enough for technicians to use in the laboratory—and versatile enough for you to use in your home.

The result: the HiFi/STEREO REVIEW Model 211 Stereo Test Record!

Stereo Checks That Can Be Made With the Model 211

- ✓ Frequency response — a direct check of eighteen sections of the frequency spectrum, from 20 to 20,000 cps.
- ✓ Pickup tracking — the most sensitive tests ever available to the amateur for checking cartridge, stylus, and tone arm.
- ✓ Hum and rumble — foolproof tests that help you evaluate the actual audible levels of rumble and hum in your system.
- ✓ Flutter—a test to check whether your turntable's flutter is low, moderate, or high.
- ✓ Channel balance — two white-noise signals that allow you to match your system's stereo channels for level and tonal characteristics.
- ✓ Separation—an ingenious means of checking the stereo separation at seven different parts of the musical spectrum—from mid-bass to high treble.

ALSO: ✓ Stereo Spread
Speaker Phasing
Channel Identification

PLUS SUPER FIDELITY MUSIC!

The non-test side of this record consists of music recorded directly on the master disc, without going through the usual tape process. It's a superb demonstration of flawless recording technique. A demonstration that will amaze and entertain you and your friends.

UNIQUE FEATURES OF HiFi/STEREO REVIEW'S MODEL 211 STEREO TEST RECORD

- Warble tones to minimize the distorting effects of room acoustics when making frequency-response checks.
- White-noise signals to allow the stereo channels to be matched in level and in tonal characteristics.
- Four specially designed tests to check distortion in stereo cartridges.
- Open-air recording of moving snare drums to minimize reverberation when checking stereo spread.

All Tests Can Be Made By Ear

HiFi/STEREO REVIEW's Model 211 Stereo Test Record will give you immediate answers to all of the questions you have about your stereo system. It's the most complete test record of its kind—contains the widest range of check-points ever included on one test disc! And you need no expensive test equipment. All checks can be made by ear!

Note to professionals: The Model 211 can be used as a highly efficient design and measurement tool. Recorded levels, frequencies, etc. have been controlled to very close tolerances — affording accurate numerical evaluation when used with test instruments.

DON'T MISS OUT—ORDER NOW AND SAVE $1

The Model 211 Stereo Test Record is a full 12" disc, made from the finest virgin vinyl. For a limited time only, it is being sold by Popular Electronics for $3.98. Starting July 1, 1963 we will sell this record for $4.98. Order now and save $1. Make sure you don't miss out on this special offer. Fill in and mail the coupon, together with your check ($3.98 per record) today!

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SORRY—No charges or C.O.D. orders!
(Special price offer of $3.98 expires on June 30, 1963) PE 53

OPERATION "ASSIST"

SINCE the first appearance of this column in the March issue, hundreds of readers have called upon OPERATION "ASSIST" to help locate schematics and technical information on old or unusual electronic gear.

Here's how it works: Check over the requests for assistance which appear below. If you can help, please write directly to the reader needing information. If, on the other hand, *you* are the owner of an old or uncommon piece of equipment and *you* need technical data, jot down your name and address on a postcard along with the name, model number, and other information pertaining to the unit in question, and send the card to:

OPERATION "ASSIST"
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Due to the large number of requests for information received, the Editors of POP'tronics reserve the right to select those which are unusual in nature and for which other sources are not readily available. Help someone today—next time you may be on the receiving end!

SCHEMATIC DIAGRAMS

"Midwest" (Model 216, #2162067) radio receiver built in 1947 or 1948. (A1c Wilbur W. Martin, Jr., Box 3146, Altus AFB, Okla.)

McMurdo Silver (Orpheon Model) made in Chicago about 1939. (Edgar J. Reynolds, 207-32 27th Ave., Bayside 60, N.Y.)

King-Hinner's Radio Co. (King Quality Products, Buffalo, N.Y.) "Neutrodyne" radio receiver of 1925 vintage (Model 25, #A.5703). Also need five UV201A tubes for unit. (Larry R. Splitter, Geneseo, Kan.)

Radio-Marine Corp. of America TRC transmitter made for the Navy early in W.W. II. (Warrenton High School Radio Club, K7BMM, c/o Richard B. Knotts, Warrenton, Ore.)

"Radiola III" radio receiver made in 1918 by Westinghouse. (Leslie Bueckert, Box 134, Clyde, Alberta, Canada)

"Neutrowound" (Superpower Model), 1927 vintage, made by Neutrowound Radio Mfg. Co., Homewood, Ill., under license from the U. S. Navy Dept. (Leonard L. Eggleston, 230 S. Walnut St., Orrville, Ohio)

Zenith (Model 5S29) five-tube AM-s.w. receiver of about 1934 vintage. (Bob Zulinski, WPE8FAV, 1936 Wiltshire Rd., Berkley, Mich.)

Hickok Elect. Inst. Co. (Model RFO-5) oscillograph. (William Davis, 3 Carpenter Ave., Tuckahoe 7, N.Y.)

Montgomery Ward (Model 35JDR 8421) home entertainment amplifier. (James E. Dirden, 1515 D Picadilly St., Norfolk 13, Va.)

Europhon (Model ES 59) AM-FM-s.w. radio made in Italy. (Tony Donentino, 123 West Bergy St., Wadsworth, Ohio)

Philco (Model 42-1008, Code 122) AM-s.w. receiver with 78-rpm phonograph, 1941 vintage; Wireless Specialty Apparatus Co. (Boston) radio receiver, "range 300-8000 meters," (Model I.P. 501); also "Two Step Amplifier Type Triode B." (C. G. Otto, WAØAHM, 5039 Winona, St. Louis 9, Mo.)

Newcomb Audio Products Co. (Model 30) 30-watt p.a. amplifier made about 1946. (David Johnson, RR 1, Genesec, Kan.)

Murdock "Neutrodyne" 5-tube, battery-operated receiver, patented March 27, 1923. (Lloyd Gosa, WPE4FYP, R.F.D. 4, Americus, Ga.)

"RCE" communications receiver (U.S. Dept. of Commerce). (Dave Hershberger, 507 Parker Ave., Scottdale, Pa.)

Philco (Model 40-180) radio. (Gary J. Schlager, 54 Barbara Pl., Cheektowaga 25, N.Y.)

Sparton (Model 768) 3-band a.c. receiver. (Don McCormick, 504 Liberty Ave., Jersey City 7, N.J.)

Military multi-band receiver from a British W.W. II bomber, Type R 1155, Ref. No. 10D/98. (Tom Britton, 381 Elizabeth St., Oshawa, Ont., Canada)

RCA (Model MI-17429B) FM paging receiver. (Hartland B. Smith, 467 Park Ave., Birmingham, Mich.)

Bendix (Model 1521 Super) AM-FM receiver of about 1945 vintage. (A. Birch, 18000 Main St., Cleveland 30, Ohio)

Truetone (Model 28UAW) radio. (James Hatton, 2981 Ridgeway, Overland 14, Mo.)

Military volt-ohm meter made by Westinghouse (Type RX-37; F.S.-.6 M.A.; Style DY-85390-1). (Frank J. Janoch, Rt. 1, 119 Oak, Kemah, Texas)

(*Continued on page* 34)

OPERATION "ASSIST"

(*Continued from page* 32)

Zenith (Model 12-U-159) 1937 a.c. receiver. (John J. Mazur, 149 Kirby Ave., Lackawanna 18, N.Y.)

E. H. Scott 12-tube receiver with 3-tube power pack, all chrome-plated, Serial #K 307. (John Rebhan, 112 Summit Circle, Little Ferry, N.J.)

Crosley (Model 555) radio. (Harry Boyle, Jr., 212 S. 41st St., Louisville 12, Ky.)

Oak Ridge (Model 108) pocket power supply. (Jack Onusconage, 428 Main St., Wilburton 2, Pa.)

Triplett (Model 1183-SC) multimeter, W.W. II vintage. (Ken Wright, KBG3320/WPE2JAQ, 86 Beechwood Place, Staten Island, N.Y.)

Belmont Radio Corp. (Model 525) AM receiver. (Paul Montle, 170 Gray St., Arlington 74, Mass.)

Zenith (Model 6S222) AM-s.w. receiver. (Gene B. Randall, Jr., 116 N. Eddy, Fort Scott, Kan.)

Stromberg Carlson console radio, chassis P-24420X, "All Wave Selector" PC-24318. (Charles Mitchell, 2833 N.E. 12th Terrace, Pompano Beach, Fla.)

Trans-Tel (Model T-2560FM) FM car tuner. (Charles Karayan, 717 Pleasant View, Glendale 2, Calif.)

Sun Craft Inc. (Model A-1) Cold-Quartz Ultra-Violet & Ozone Apparatus made in Chicago. (Charles A. Elberg, 6141 Medford Dr., Orlando, Fla.)

E. H. Scott Radio Labs., Inc. (Model SLR-F) communications receiver made during the 1940's. (R. Wong, 812 Forest Ave., Palo Alto, Calif.)

Transitronic (Model TEC S-15, #4788) transistorized stereo amplifier. (Augustin Leon, 5308 Centennial Hall, Univ. of Minnesota, Minneapolis 14, Minn.)

TECHNICAL DATA

Telefunken (Model 664WK) made in Germany about 1938; tubes are AZ1, ACH1, AL4, ABC1, AF3. Modifications and U.S. tube substitutions. (Fred Bradford III, 1673 Delaware Ave., St. Paul 18, Minn.)

Hickok (Model 195B) oscilloscope; Supreme (Model 580) signal generator; instruction manuals. (M.O. Jeck, 10940 Dickens, Westchester, Ill.)

(*Continued on page* 36)

Starfire
$124.95

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Space Station
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Power Pack
12-volt $18.00
6-12 volt $22.70

Monocall Encoder $39.95
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2. Starfire - most performance per dollar in Metrotek line - power packed 5 watt input - 5 crystal controlled transmit and receive - superhetrodyne tunable receiver.
3. Metrostar - a double conversion unit - built in mobile power supply - S meter - tunable receiver - 8 position crystal controlled transmit and receive.
4. Space Station - superb modern styling in walnut cabinet for 110 volt instalation. Desk mike - S-meter - 5 transmit - 5 receive - plus tunable.
5. Monocall - your individual selective squlch system - no personal channel monitoring - dependable unique dual tone operation - can be adapted to your present unit. Patent pending.
6. Metrotek 66 - new six meter transceiver - highly sensitive - double conversion - 25 watt unit input minimum 13 watt output with built in mobile power supply - crystal controlled or tunable functions.

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OPERATION "ASSIST"

(Continued from page 34)

Pilot (Model TV-127) 12½" TV set with FM radio. (Douglas Leek, 196 Bellmore Rd., East Meadow, N.Y.)

Peirce (Model 55B) wire recorder. (Michael J. Intlekofer, 3249 27th Ave., W., Seattle 99, Wash.)

Bendix (Model 160) oscilloscope made in Baltimore, Md. (Curt Schild, KØYMN, 3421-A Osage, St. Louis 18, Mo.)

"Philharmonic" (Model 400) AM-FM console with phonograph. (Jack Happel, R.F.D. 1, Plymouth, Ill.)

Daco (Model 606-P5, #N1595) tube tester made by Dayton Acme Co., Cincinnati, Ohio, about 1948. Ideas on bringing unit up to date. (Jim Sterken, R2, Zeeland, Mich.)

"R.S.C." radio receiver, Pat. 1916-1923, Toronto, Canada; contains three W.D. 12 Westinghouse tubes. (W. Barton, Box 24, Warren, Ontario, Canada)

Philco (Model 38-116) pre-war receiver. (James Laws, 7001 Rutledge Pk., Knoxville 14, Tenn.)

VM-Columbia (Model 575, #5757, No. 1404F, #7011) tape recorder; has VM deck, Columbia amplifier. (Steven Zeigler, WPE3ARC, 1415 Beaver Rd., Sewickley, Pa.)

Military (TS-34A/AP; NO as-4585; 1468 CW) oscilloscope used by U.S. Navy; any data or name of manufacturer. (S. Huisman, Wollebrandtstraat 22, Alkmaar, Holland)

RCA (Model 6-XD-5A) receiver. (Bo Yeargan, WPE4DVU, 120 Westmore Rd., Rome, Ga.)

Wurlitzer amplifiers, Model 550, #5506603, 1935 vintage; Model 501, #771588, 1942 vintage; Model 503, #2058616, 1945 vintage. (William A. Smyth, Jr., 18 Gilmore Dr., Gulf Breeze, Fla.)

Affiliated TV Labs, Inc. 40-socket tube tester made in Jamaica, N.Y., need tube chart and data; Superior Instruments Co. cross-bar generator. (Kenneth Miller, 10027 Calvin St., Pittsburgh 35, Pa.)

PARTS

Hallicrafters (Model S22R) receiver; need main dial and bandspread dial. (John Austin, 6356 Sundown Dr., Jacksonville 10, Fla.)

Raytheon (Model 21-C-T-1) color TV; require flyback transformer, Raytheon #12526091-274235, new, used, or rewound. (Abe Weissman, 1755 Rainbow Park, Columbus 6, Ohio)

-30-

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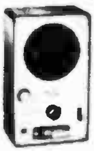
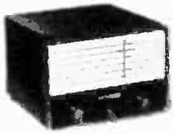


TRANSISTOR CODE PRACTICE OSCILLATOR #706
Complete with battery. Select variable tone, flashing light, or both together. Phone jack for private use. Efficient speaker: clean loud signals.
Kit $8.95 Wired $12.95

New!



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Approaches crystal stability. 80 through 10 meters.
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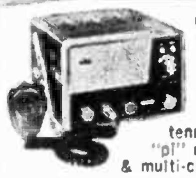

CITIZENS BAND TRANSCEIVERS U. S. Pat.
770 Series
Superhet; pre-aligned xmitter osc; match antennas by variable "pi" network. Single & multi-channel models.
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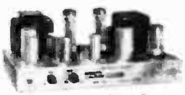

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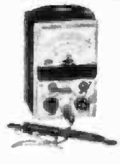

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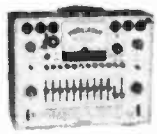
Kit $25.95 Wired $39.95

DC-5MC LAB & TV 5" OSCILLOSCOPE #460
Kit $79.95
Wired $129.50
5" GENERAL PURPOSE SCOPE #427
Kit $69.95 Wired $109.95



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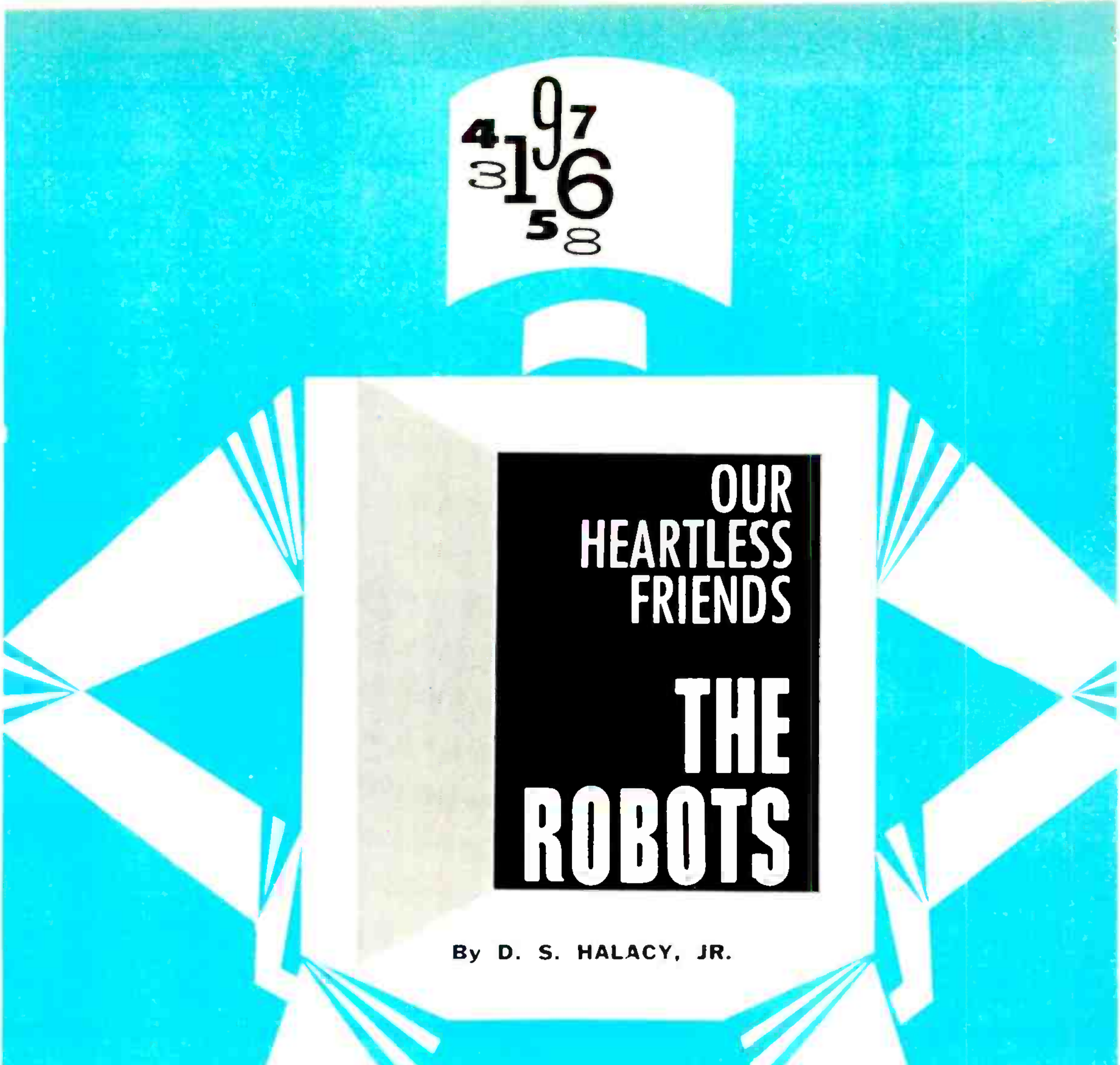
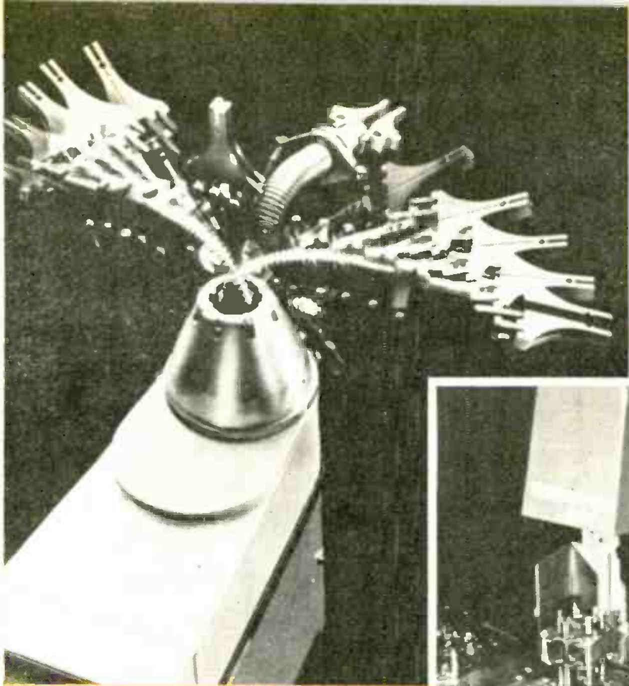


OUR HEARTLESS FRIENDS
THE ROBOTS

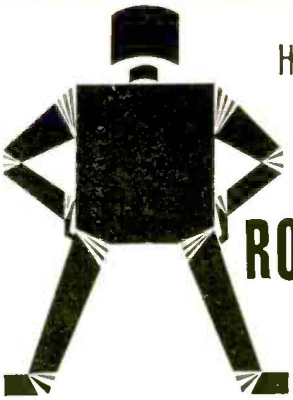
By D. S. HALACY, JR.

WHEN a clock manufacturer needed production line workers recently for a ticklish assembly job, he ordered them from a firm called U.S.I. Robodyne. The workers weighed a bit over 50 pounds, and the clockmaker didn't hire them—he bought them outright for about $2500.00. Slavery involving midgets? No, these workers, each doing a man's or woman's job, are robots produced by the Robodyne Division of U. S. Industries, Inc., at Silver Springs, Md. These "TransfeRobot 200" mechanical midgets, while not the first automated devices to displace human workers, are unique in some respects. First, they are not custom made, but are standard "off-the-shelf" items available immediately. Second, they are not one-job workers, but can be programmed



CLUTCHING HAND is actually a robot that can grasp 25 lb. or less at any point around it. This device, a "Fleximan" automatic manipulator, can be programmed.

ROBOT WORKERS replaced humans on clock assembly line, are also putting together typewriters and auto parts. Studies are under way to determine how adjustment to automation can be made most easily.



OUR HEARTLESS FRIENDS

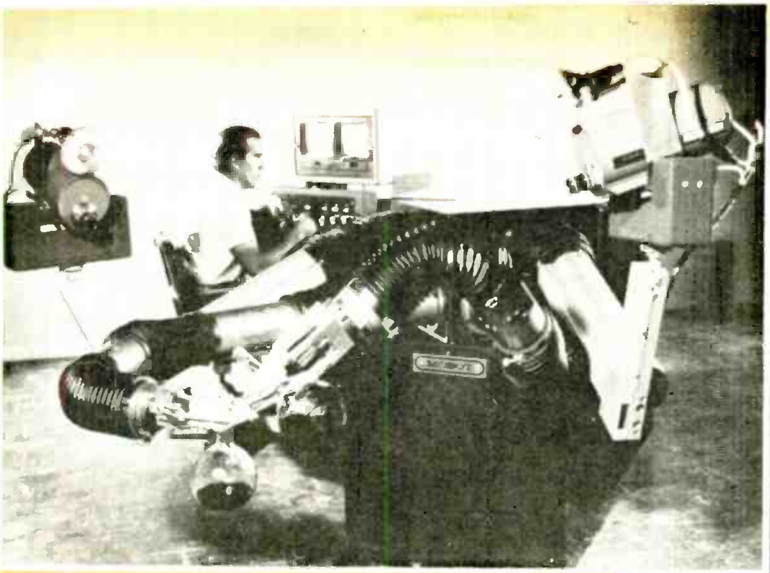
THE ROBOTS

to handle many production jobs within the scope of their electronic brains and mechanical fingers. Finally, they pay union dues!

Perhaps because they operate in a more dramatically human fashion than most automation equipment, Transfe-Robots are in the spotlight of attention being given by both management and labor to the technological and economic problems created by progress. In addition to the clockwork assemblers already mentioned, there are many more such small robots building a variety of items—including typewriters and auto parts.

President John Snyder, Jr., of U.S. Industries, and Al Hayes, President of the International Association of Machinists, head a foundation which is working toward a smooth and painless-as-possible integration of automation into production work in this country. And that's where the dues come in. Each Transfe-Robot (via its employer) pays $25 a year as soon as it goes to work. U.S.I.'s larger equipment pays more, ranging up to a maximum of $1000 a year.

Critics, perhaps with human workers in mind, have described these machines as robot dolls—"you wind them up and they make money for the boss"—but both sides of the bargaining table realize that human workers must make money, too, or they can't buy the goods the robots produce.



MOBOT MIXER pours chemicals from one flask to another under command of operator at control console. A vehicle which can move by remote control, the "Mobot" has a delicate touch, handles dangerous jobs at a distance from the operator.

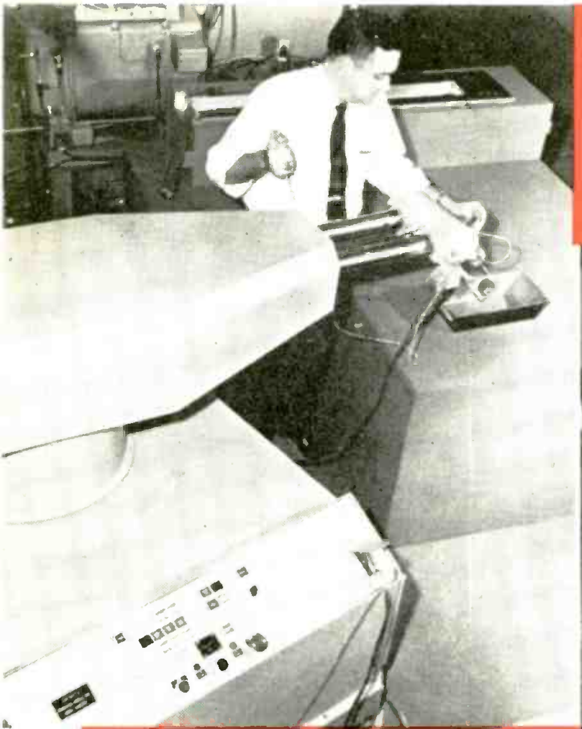
PERFECT GENTLEMAN is hand-type automatic manipulator which lights cigarette for model Mary Locke. Device can also feed drill presses, assemble parts, run conveyors, do other kinds of routine chores.

TransfeRobot has a big cousin called "Unimate." Built by Unimation, Inc., of Bethel, Conn., Unimate costs ten times the modest price of the smaller robot. It weighs considerably more—a ton and a half—and it can heft loads of 75 pounds and exert a squeeze of 300 pounds with its steel fingers. Its builders list a hundred jobs that Unimate can do, including loading operations, assembly work, painting, welding, and similar tasks. It also has a brain, and can memorize 200 sequential movements after being "led by hand" through a new job just one time. Such a rapid learning capacity makes it sharper than the average worker, and Unimate is capable of round-the-clock operation without tiring, needs no coffee breaks, and is not distracted by pretty girls.

When Is a Robot a Robot? Since most of us have a rather vague knowledge of robots acquired by reading science fiction or watching the movies, it will be helpful to define just what is meant by the word. Webster calls a robot a mechanically efficient worker devoid of sensibility. Robots have other names, including "mechanical men" and "automata," depending on who is doing the name-calling. The more sophisticated term goes well with automation.

Having defined the robot as a mechanical man of sorts, we realize that there are several narrower classifications possible within that general description. An automatic lathe, for example, is a machine capable of working by itself. So is a wrist watch. Less obvious, perhaps, is the time switch that turns on the furnace in the morning or the photocell system that turns on a light at dusk. Such devices rank fairly low on the robot scale.

The next step up the ladder is what some call a "proper" robot—a robot device which does not always function in exactly the same way. A more versatile fellow, the proper robot can cope with unpredictable changes in his environ-



STUDENT ROBOT is "Unimate," which has a brain and can memorize 200 separate steps after being led through them by hand; "teaching" process is shown.

MECHANICAL TURTLES created by Dr. W. Grey Walter have an apparent ability to speculate, circle curiously about a room using sight and touch organs. If they get "hungry," they seek a den equipped with an electrical outlet for recharging their storage batteries.

OUR HEARTLESS FRIENDS THE ROBOTS

ment. If we add a thermostat to our furnace control, or a switch to the corner traffic light so that it changes when a car rolls over it, we have a proper robot. The robot pilot in ships and aircraft is a highly developed proper robot.

There is another type of robot, the "true" robot, whose performance parallels that of an idealized human. The true robot is thus far fictional, but some scientists believe that the existence of man is proof enough that such a machine can be made. Less scientific minds jump to the romantic conclusion that this robot will even be man- or woman-shaped. Developments seem to bear out the former belief, at least, and we may one day be dealing with some very human-like robots; robots that are mobile, that listen and learn, think, show initiative, and act.

"Mobot," "RUM" and "Beetle." TranfeRobot and Unimate are still in the class of robots that simply do their jobs over and over. For factory work, of course, this is the best kind. A cousin of this simple plodding type is a robot that acts more flexibly; not with its own electronic brain but under the guidance of a human being. Impressive mechani-

WEIRD DEVICE is named simply "Hand." Created at M.I.T., it searches the table for blocks and stacks them or puts them in an empty box it it finds one.

"RUM" VEHICLE is designed to crawl on ocean floor at great depths. It carries four TV cameras and an electromechanical arm; drum holds control cable.

cal men of this ilk include Hughes Aircraft's "Mobot" (for *mo*bile ro*bot*).

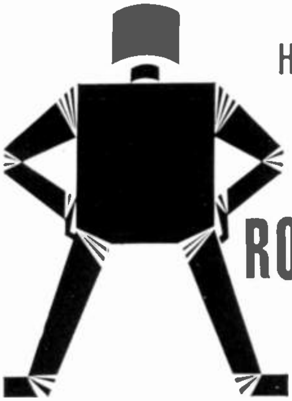
An extension of the mind and hands of a human operator, such a robot works in high-radiation environments in nuclear plants, handles dangerous liquids, twists heavy iron bars, picks up eggs gently, and does even more ticklish tasks—such as fastening zippers for attractive young ladies, a chore that rattles some humans.

In 1960 Scripps Institution of Oceanography built "RUM" for the Navy—a *R*emote *U*nderwater *M*anipulator which operated at depths of four miles. More recently, Shell Oil Company has used a Hughes Mobot in undersea oil explorations. And robot helicopters have been built, adding wings to the arms and legs of the mechanical man. But the majority of "mobots" developed so far are land-based. One of the newest, and surely the largest, is "Beetle." Constructed by General Electric for the Air Force, this giant is used around missiles and was designed particularly for those fueled by nuclear devices.

Deep Into Space. The space age came on the heels of automation, and it is beginning to enlist the services of the robots. Plans to explore the moon include lunar "rovers" that will plod or roll or wiggle, depending on the type of surface they find on that satellite. NASA's "Surveyor" is typical of such space robots, and it will busily poke around and report its findings to earth.

Deep space probes have no tin can man sitting at the controls, of course, but they are robot-manned, nonetheless. These robots read instruments, scan the skies for stars and planets and radiation, and act accordingly.

An interesting idea is that of a human pilot operating a spaceship by remote control using television for his eyes. Already in existence are TV receivers



OUR HEARTLESS FRIENDS THE ROBOTS

that fit the user like a helmet. The operator simply turns his head when he wants to look about, and the transmitter in the robot craft turns similarly. The sensation is described as being so realistic that the operator feels that he is *in* the distant craft. This idea of "tele-coupling" a man and machine seems to have an important future.

Robots That Think. Fascinating as these "mobots" are, other robots are far more intriguing. Operating a machine at the end of a wire, or even by remote control, is no very breath-taking concept despite the technical problems. And the precocious TransfeRobot is just a highly advanced wind-up man. More provocative is the idea of control of robots by the robots themselves.

Such an idea is not new. When James Watt put the flyball governor on his steam engine, he gave us the feedback principle that is the basis for automatic control. Thermostat-operated furnaces and float-controlled valves are simple examples of machine self-control. More recently, we have seen electronic computers exercising judgment in processing bank records and other paper work. Here, for all its size and unlikely appearance, we have a "proper" robot and perhaps the beginnings of a "true" one.

For all the pooh-poohing of the electronic brain, there are such devices as "Perceptron" that truly perceive. This electronic robot sees with photoelectric cells, learns to recognize things, and commits them to memory. There is another machine called "Artron" (for *art*ificial neu*ron*) that learns by reward and punishment in a fashion analogous to human learning. Still another robot, called "Cybertron," solves "alogical" problems—those for which there is no formal answer and which require solution by trial and error. Prodded by a "goof button," Cybertron handles tasks as varied as the classification of radar signals, and the grading of produce.

"Madaline" and "Hand." Late in 1962, scientists at Stanford University demonstrated "Madaline I," an advanced electronic robot that sees, hears, and feels. "Madaline" stands for *M*agnetic *Ada*ptive *Li*near *Ne*uron, and the demonstration included such feminine tasks as balancing a "broom" and taking dictation from the boss. Madaline has a mind of her own, made up of "memistors"—electrochemical resistors similar in function to human neurons. The word "adaptive" is the key to Madaline's importance, for here is a robot not tied to a rigid program.

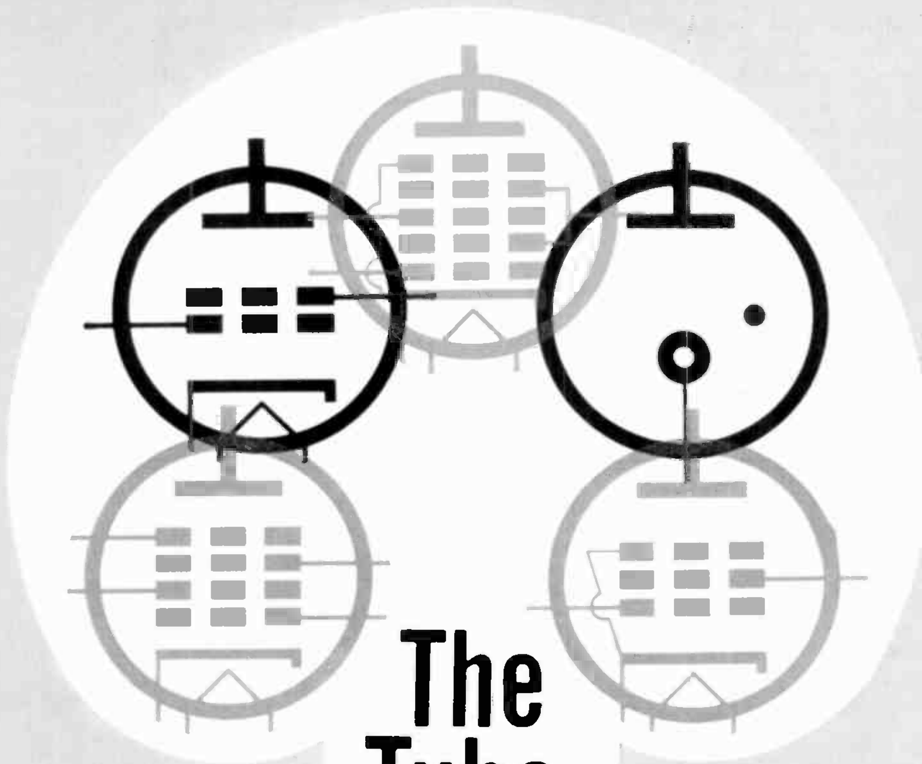
Many nervous watchers of developments have been happy with the fact that the robot brain and muscle have been kept safely separate, but the inevitable is beginning to happen. A young scientist at M.I.T. recently coupled an electronic computer with a mechanical hand-arm of the "mobot" type and created something he called simply "Hand."

Thus far Hand is still in its babyhood and playing with blocks. In action, it carefully searches the surface of a table for such items. When it finds them, it picks them up and stacks them. It feels its way around obstacles, and when it finds an empty box, it explores the inside like a youngster delving into a cookie jar. If the box is the right size, Hand will store the blocks inside.

While Hand is visually blind, there are many robots that are not. Optical readers abound, and now there are machines that hear quite well, too. The Japanese have invented a typewriter that they call the "Sonotype"; it's the lazy man's dream—you just talk into it! In the U. S. there are computers like "Shoebox," so-called because of its size; unlike a real shoebox, it accepts verbal questions and gives verbal answers. Robots, then, not only think and act, but see, hear, and talk.

Robot Baby-Sitters? Years back, robots were suggested as companions for chil-

(*Continued on page* 100)



The Tube Family Tree

PART 1

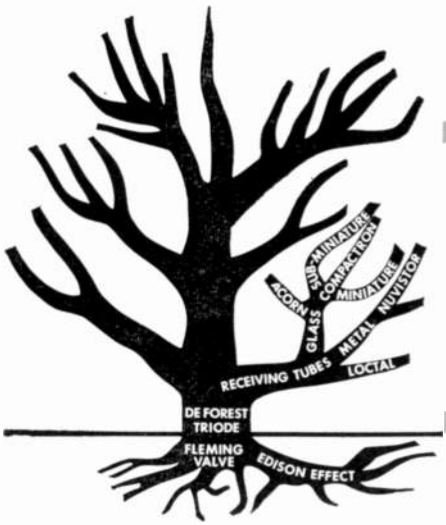
By LOUIS E. GARNER, Jr.

Today, there are easier ways of handling electrons. Yet, the vacuum tube was, is, and will remain one of the 20th century's greatest inventions . . .

THERE ARE SOME who say that the electron tube has been doomed by the transistor and its semiconductor "cousins," and that the tube, as the dinosaur, will become extinct. To these statements, the tube, if it could speak, might well reply in the words of the proverbial old man—*I ain't dead yet*. Actually, the tube is very much alive and kicking, with new types being introduced on an almost day-to-day basis, and handling more different kinds of jobs than ever before.

The tube "family tree" is a vigorous, strong, and healthy growing plant. Let's examine it closely, starting with the roots and exploring the many branches and twigs.

Birth of the Tube. The electron tube had its beginnings in distinguished company. Thomas Alva Edison, one of the greatest inventors of all time, was experimenting with his newly invented incandescent lamp bulbs one day when he discovered a curious phenomenon. When he installed a small metal plate in his lamp bulb near the glowing filament, and connected this plate through a sensitive galvanometer to the positive filament connection, he found that a small, but easily measured, current flow took place. Unable to explain the reason for this at the time, he nevertheless realized that it might be potentially significant, so he obtained a patent in 1883 on what came to be called the "Edison effect."



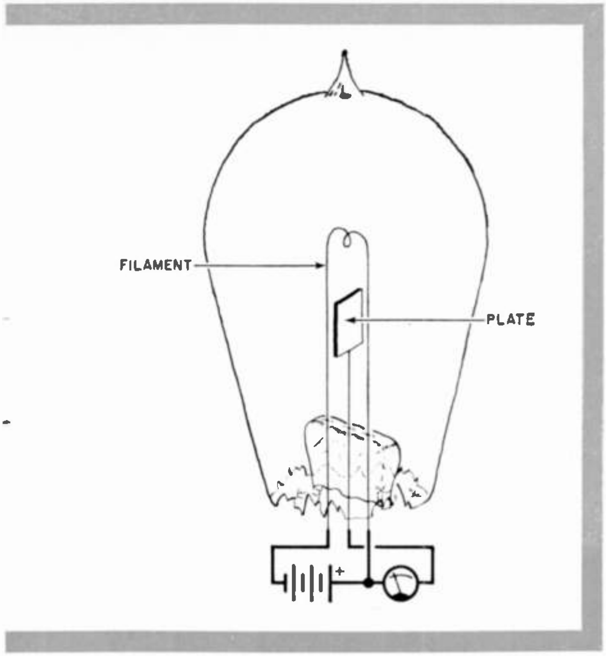
For many years, the Edison effect remained a classroom curiosity without any commercial value. Edison had, however, unknowingly invented the first true electron tube—the elementary two-electrode type we now call a *diode.*

In the meantime, scientists in other fields had started a chain of events which, eventually, would have a profound influence on the application of the barely understood Edison effect. In 1887, Heinrich Hertz had demonstrated that electromagnetic waves operate in accordance with the laws governing light and heat waves, and described the basic theory upon which modern radio communication is based. Just after the turn of the century, J. A. Fleming, searching for an improved detector for electromagnetic waves, found that the Edison effect could be used advantageously. It was Fleming, then, who invented the first *practical* diode—the *Fleming valve.* The name "valve" stuck, incidentally, and, even today, electron tubes are called "valves" in most parts of the world outside of North America.

The next great step forward came when Lee DeForest added a grid-like wire structure between the filament and plate of the diode, patenting his new device, which he dubbed the *Audion*, in 1906. It was DeForest who gave the electrical valve (or electron tube, as you prefer) an entirely new capability—the ability to *amplify* as well as *detect* weak electrical signals. He invented the *triode* tube, and, in so doing, laid the basic foundation for our great radio, television, and electronics industries.

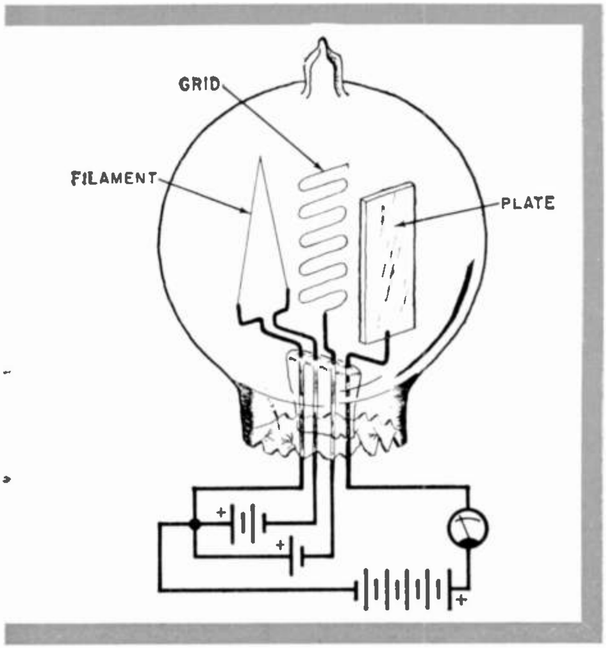
Three Basic Jobs. The electron tube's operation is relatively simple, once the idea of electron emission is accepted. Free electrons are liberated (or *emitted*) by the glowing hot filament. Since these elementary particles are negatively charged, they are attracted to the positively charged plate, moving across the intervening vacuum to it. This current flow is *unilateral*—that is, from filament to plate and not vice versa. It is this property which permitted the early Fleming valve to act as a *detector*. The filament, since it served as a source of electrons, came to be called the *cathode*. Later, this term was applied generally to any electron source in a tube (or other device), whether a filament or not.

When DeForest added his grid-like wire between the filament and plate of



It all started with Edison's observation that electric current flowed back to the battery in this experimental light bulb.

Over 20 years later, DeForest found he could control current flow by placing a grid-like structure between plate and filament.

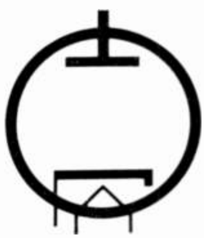


the Fleming valve, he found that a small voltage applied to this structure could influence the plate current. Again, the operation is relatively simple. A *negative* voltage applied to the *grid* (as it came to be called, in deference to its original appearance) repelled the negative electrons and reduced plate current; a *positive* voltage applied to the grid attracted additional electrons and accelerated them towards the plate, increasing plate current. Since the grid, an open-like structure, intercepted few—if any—of the electrons moving towards the plate, its power requirements were very minute—but it could control a relatively large plate current. Thus, a small voltage applied to the grid was able to control plate current and hence *amplify* signals.

The ability to amplify made another feat possible. Once a device can be used to amplify, a small part of the amplified signal can be fed back to the unit's input (grid). The device then serves as its own source of signal, and this feedback can generate alternating currents—so, it becomes an *oscillator*.

With the addition of the grid, the electron tube became capable of performing the three basic jobs it has handled from the first decade of this century to the present day: *detection*, *amplification*, and *oscillation*.

The Tube's Evolution. Fleming's valve was a two-element tube, or diode, and consisted of a filamentary cathode and a plate. If, as was discovered, the filament is operated on 60-cycle a.c. line power instead of d.c., a certain amount of the line "hum" will appear in the plate circuit. This led to the addition of a separate cathode . . . essentially a metal tube coated with chemical elements which emit electrons when heated.



The tube is still a diode, however, with the indirectly heated cathode and the plate serving as its principle elements. The filament is reduced to the simple role of heating the cathode and, quite appropriately, is often called a *heater*.

When DeForest added a control grid, the tube became a three-element device, or *triode*. In practice, the triode was found to suffer from a serious disadvantage when used as a tuned r.f. amplifier. There is a fair amount of electrical capacity between the grid and plate. This permitted a percentage of the signal in the plate circuit to be coupled *back* to the grid, setting up the basic condition for oscillation.

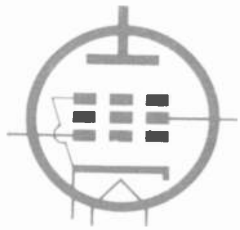
Thus, early r.f. amplifiers tended to be quite unstable, and a variety of schemes were developed to *neutralize* the effects of grid/plate capacitance. In general, these consisted of introducing enough inverse (or negative) feedback from the plate tuned circuit into the grid circuit to counteract the direct feedback inside the tube and prevent unwanted oscillation.

The next forward step came with the introduction of a second grid to serve as a shield or *screen* between the (control) grid and plate. By reducing grid/plate capacity, the four-element tube, or *tetrode*, permitted r.f. amplifiers to be assembled without special neutralization circuits.

It was soon discovered, however, that the tetrode, as the triode before it, had a peculiar disadvantage of its own. For effective shielding, the screen grid was given a positive charge. This accelerated the electrons tremendously in their trip to the plate, causing the electrons to strike the plate with sufficient force to "knock" other electrons off the plate material. In a sense, the plate became an electron emitter, secondary to the cathode.

With the proper combination of plate and screen voltages, more electrons would be emitted by the plate than were received by it, and these, traveling back to the positive-charged screen grid, caused a curious phenomenon. Under certain conditions, an *increase* in plate voltage would cause a *decrease* in plate current . . . as if the tube acted like a *negative resistance*. Again, the net result was instability and the tendency to oscillate when the tetrode was used as an amplifier.

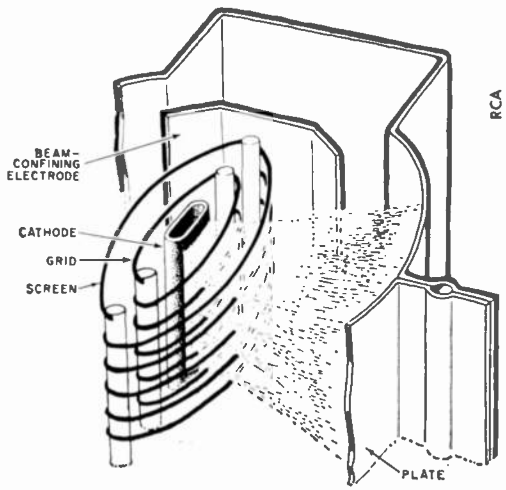
In an effort to reduce, or "suppress," the plate's secondary emission, a third grid was added between the screen grid and plate and connected back to the tube's cathode, creating the five-element or *pentode* tube. This third grid was called, appropriately, the *suppressor grid*. It served to repel the secondary electrons back to the plate without appreciably affecting the normal cathode-to-plate electron flow. Today, the pentode is perhaps the most widely used basic tube type.



Somewhat later, it was found that a single cathode could be used for more than one function if additional electrodes were added outside the normal control range of the grid elements. This, in turn, led to the development of multi-purpose tubes.

Beam Power Tube. The basic screen grid, whether in a tetrode or pentode, requires a fair amount of power for operation—power which does not, however, contribute to the strength of the amplified signal. Where very small amounts

To make greater use of the stream of electrons moving from cathode to plate, this system of beam confining was developed. Practical all modern power amplifier types use these beam-forming plates.



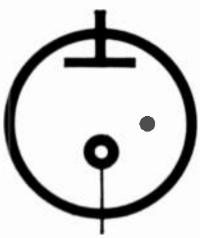
of power are handled, as in weak-signal amplifiers, the power loss is small and relatively unimportant. If a large amount of power is handled, as in tubes designed to handle several watts, then the power loss becomes significant, contributing to a loss in operating efficiency.

This led to the development of the *beam power tube* in which the control and screen grid wires were aligned in the same plane, so that the resulting flow of electrons was formed in parallel sheets or "beams" between the cathode and plate. Beam-confining electrodes were added to shape the resulting beams and confine the electron flow between the grid wires, thus preventing electron movement to the support leads on which the grids were wound.

The resulting tube had much smaller screen currents than earlier tetrodes (and pentodes) with comparable power-handling ability, and thus was more efficient. At the same time, it was found that the beam power tube had much greater *power sensitivity* than earlier types. Today, beam power tubes are used extensively at both r.f. and audio frequencies where more than a few watts are involved.

Gas-Filled Tubes. The majority of electron tubes are designed to operate within a vacuum, so that there will be no gas molecules present to interfere with the free movement of electrons between the cathode and plate electrodes. In fact, during the manufacturing process, a metallic substance is evaporated within the tube, forming a film on its walls and absorbing the last traces of gas: this element is called the *getter*.

For some applications, however, limited amounts of specific gases may be introduced in a tube. Where a gas is present, the gas atoms can, under certain conditions, *ionize*; the gas atoms are partially stripped of their outer electrons and become positively charged *ions*. The gas ions move towards the cathode while the free electrons move towards the plate.



Gas may be ionized by the application of heat and moderate voltages or by the application of relatively high voltages. This latter fact has led to the development of several types of *cold-cathode* tubes—tubes which do not require a filament or heater—the simplest examples of which are diode rectifiers such as the OZ4, voltage regulator tubes, and neon lamps.

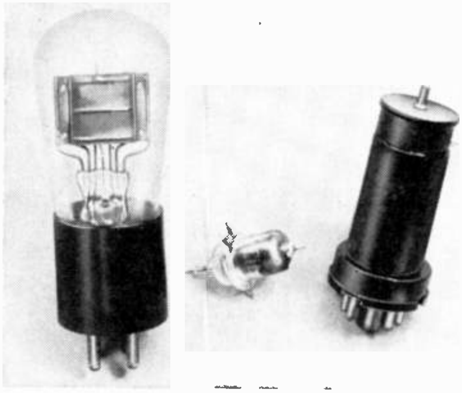
The presence of gas within a tube has several primary effects. First, of course, positively charged gas ions tend to reduce the tube's effective plate-to-cathode resistance, thus reducing its internal voltage drop. For this reason, gas-filled (generally, mercury-vapor) rectifiers are extremely popular where large currents are handled. Second, an ionized gas gives the tube an "all or nothing" characteristic. Until ionization occurs, relatively little current can flow. Once the gas is ionized, however, current reaches a maximum very quickly, and stays at that maximum value (determined by load resistances and supply voltages) until the plate voltage is reduced to a very low value or cut off altogether.

Gas-filled triodes, or *thyratrons*, like gas-filled diodes, have an "all-or-nothing" characteristic, but with one difference. The difference is that the control grid in the thyratron, being relatively close to the cathode compared to the plate, can be used to "trigger" ionization even though the plate voltage is below the value normally required to ionize the gas. Thus, a small signal (or trigger) voltage applied to the grid can switch the tube from a non-conducting state very quickly. Thyratrons are used extensively as relaxation oscillators and for control and switching applications.

A number of gas-filled cold-cathode triodes have been manufactured for special applications. Their operation is somewhat similar to that of the conventional thyratron, except that no filament is used. The most familiar example of this type of tube is the flash tube used in photographic electronic flash lamps.

Receiving Tubes. By far the most popular general class of tubes are low- to medium-power types primarily designed for use in radio and television receivers. This general class encompasses all the basic tube types—diodes, triodes, tetrodes, pentodes, beam power, and multi-purpose tubes.

In the early days, there was little need to identify tubes except by their manufacturer's name, for most units were essentially the same. Later, as more types were developed, identifying *type numbers* were introduced. These served to identify a particular type of tube in terms of its characteristics, permitting tubes produced by different firms but having the same type number to be used interchangeably. The first type numbers were simple numerical designations, such as 01A, 15, 19, 20, 42, 45, 76, and 80.

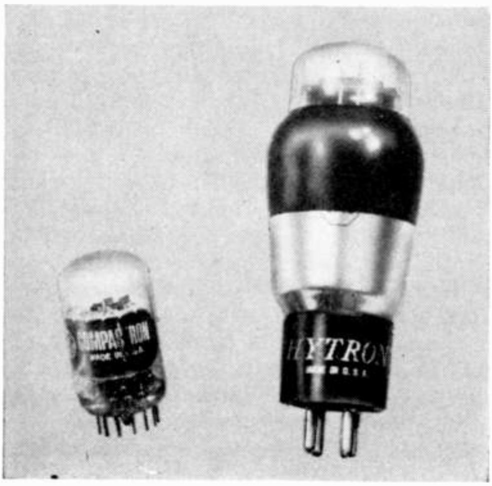


Gone but not forgotten are these three pioneers. The 200A (left) was one of the first mass-produced tubes. A 954 Acorn helped introduce VHF to communication services. At right is an 1851, a super-high-gain tube developed just before World War II.

As more and more types were developed, a different numbering system became necessary. The tube manufacturers decided to adopt a system of numbers and letters such that the type number itself would give an indication of the tube's basic application. With this system, the first number would indicate the tube's nominal filament voltage, a middle letter the intended application (amplifier or rectifier, for example), and the last number the number of active elements. Amplifier type tubes were to receive letter designations from the first part of the alphabet, rectifiers from the end of the alphabet.

How Numbering System Worked. A type 6A3 was a tube with a nominal 6-volt filament (actually 6.3 volts), an amplifier type (A), with three active elements—filamentary cathode, grid, and plate. The 2A3 was a similar type, but with a 2-volt (actually 2.5-volt) filament. Similarly, the 6D6 was a tube with a 6-volt filament, an amplifier (D) type, with six active elements—filament, cathode, control grid, screen grid, suppressor grid, and plate. A 5Y3 was a tube with a 5-volt filament, rectifier type (Y), with three elements—filamentary cathode and two plates; the 5Z4 was similar, but with an extra element—an indirectly heated cathode.

Multiple triode sections in one glass envelope are not as new as you might think. The 6A3 tube of the 1930's (right) had two triode sections, but they were wired together. The current compactron (left) has three triodes in its envelope, and each grid, plate, and cathode goes to a separate base pin.



Unfortunately, even this seemingly ideal system was inadequate, for the introduction of new types soon outran available type numbers. Today, type number designations still use number-letter combinations, and the first number generally (not always) indicates nominal filament voltage, but the remaining part of the type number does not always hold to its original meaning.

Tube Envelopes. Tube construction techniques, too, have undergone many changes as the "family tree" has grown. Originally, tubes were assembled in glass envelopes almost identical to those used for incandescent lamp bulbs. Later, refined designs were introduced with connection pins which allowed tubes to be plugged into their sockets (rather than screwed in, as with lamp bulbs).

Metal envelopes became popular because they carried the advantages of built-in shielding and were less prone

(*Continued on page* 98)

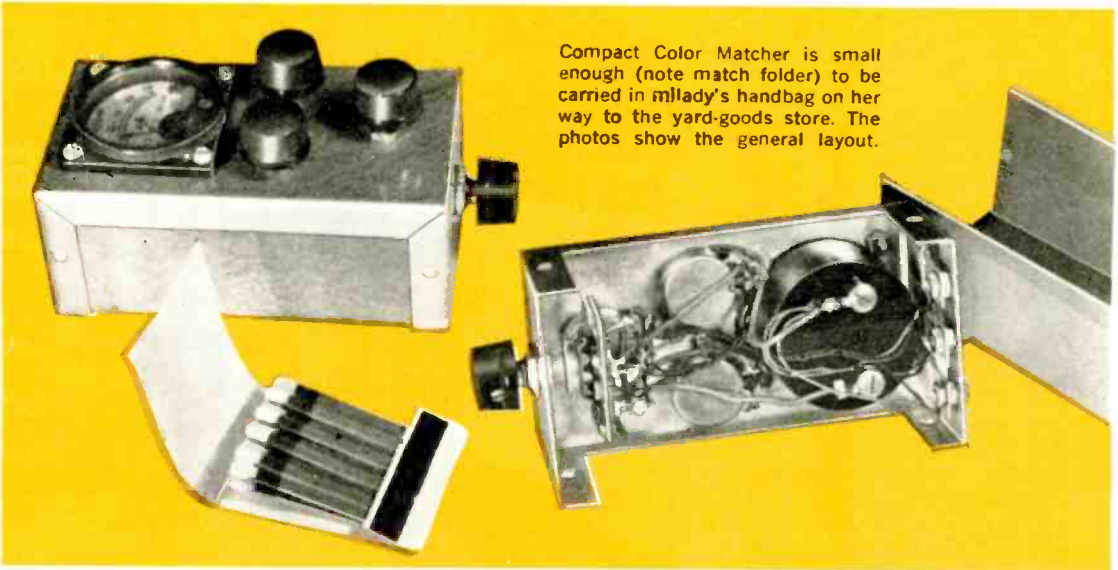
ELECTRONIC COLOR MATCHER

Ever tried to touch up a scraped fender? This interesting, easy-to-build gadget will tell you what shade paint to use

By RUFUS P. TURNER

ARE YOU doing a patch-up paint job? Do you mix inks or other colored fluids? Have you tried to match materials at the dry-goods store? If your answer is yes to any of these questions, you're in the market for a color meter. These devices are seldom found outside laboratories and can be quite costly, but the electronic "Color Matcher" described here can be built at a new-parts cost of $15.00, and is more than adequate for most purposes. Measuring just 4″ x 1 7/8″ x 2 1/8″, it weighs only 12 ounces; no batteries or power supply are needed.

How Color Meters Work. The action of a color meter circuit is the same as that of a simple light meter, except that in the latter the light must pass through either a red, green, or blue filter on its way to the photocell(s). Colors are compared by illuminating the first sample with white light (sunlight, for example), switching to the "red" position and setting the "red"



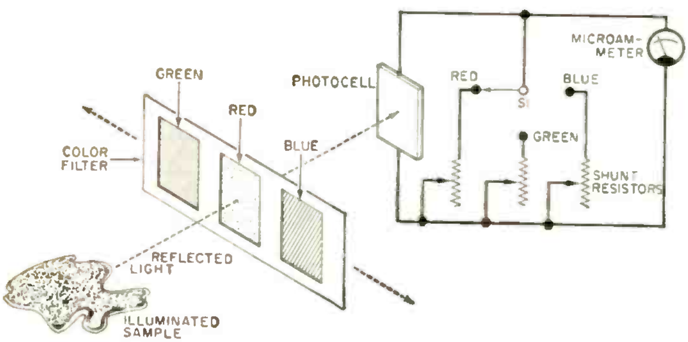
Compact Color Matcher is small enough (note match folder) to be carried in milady's handbag on her way to the yard-goods store. The photos show the general layout.

shunt for a selected deflection, then making the same adjustment for green and blue. When another color sample is substituted, the three readings will be the same if the color is the same, or will indicate a mismatch and excesses or deficiencies of red, green, and blue. The three controls can also be set for a standard deflection while viewing a plain white surface; relative red, green and blue readings will then be obtained with color samples.

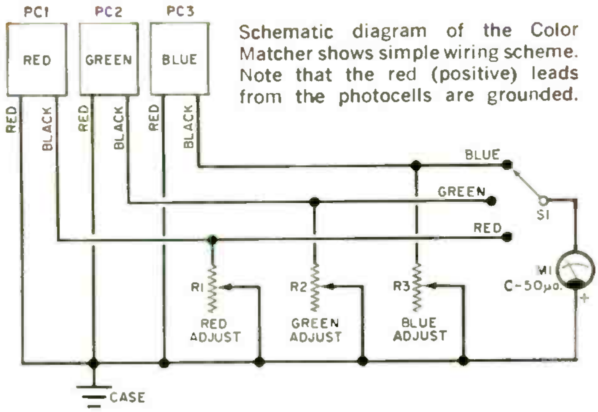
Color Matcher Design. Although some commercial models use a single photocell and sliding filters, the Color Matcher was built around three International Rectifier B2M photocells (*PC1*, *PC2*, and *PC3*). Also needed are three subminiature 50,000-ohm potentiometers (*R1*, *R2*, *R3*), a three-position switch (*S1*), and a 0-50 d.c. microammeter (*M1*).

Using a 1½″ socket punch, cut a hole for the meter at one end of the top of a 4″ x 2⅛″ x 1⅝″ Minibox. At the same end, cut in the side a 1¾″ x ⅞″ window for the photocells. The best tool for this job is a thin-bladed coping saw; start it through a ⅛″ hole. Finally, drill *M1*'s mounting holes, three ¼″ holes for the controls, and a ⅜″ hole for *S1* in the end of the box opposite the "window."

To make the photocells sensitive to color, get some Wratten gelatin filters at a camera store. They come in 2″ x 2″ thin transparent sheets, and sell for 60 cents each. The red is Eastman Kodak No. 25A, the green No. 58, and the blue No. 47. Cut a ½″ x ¾″ strip of each color and tape it to one of the three photocells. Use narrow strips of Scotch tape, masking as little of the film and cell surface as possible. The film must rest flat against the cell face. Avoid touching the



Basic color meter circuit is shown at left; its operation is similar to that of a light meter. The author's model differs in detail—three photocells with fixed filters are used, making a cumbersome, costly, filter switching arrangement unnecessary.



Schematic diagram of the Color Matcher shows simple wiring scheme. Note that the red (positive) leads from the photocells are grounded.

The photographs below show the exterior of the unit. A 1¾″ x ⅞″ window is cut in the chassis for the photocells, a hole punched for the meter, and mounting holes drilled. Out of sight at the other end of the box is switch S1.

PARTS LIST

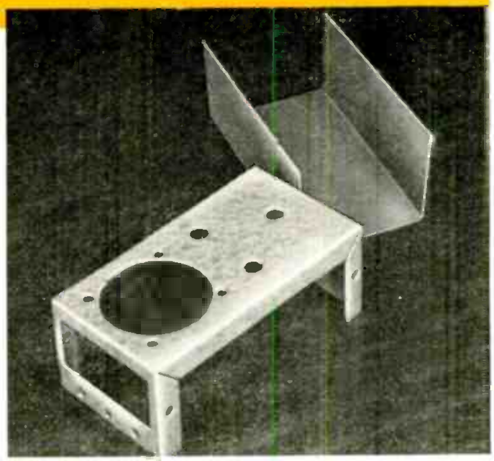
M1—Miniature 0-50 d.c. microammeter (Lafayette TM-200 or equivalent)
PC1, PC2, PC3—Miniature selenium photocells (International Rectifier Type B2M)
R1, R2, R3—50,000-ohm subminiature potentiometers (Lafayette VC-36 or equivalent)
S1—Single-pole, three-position, miniature non-shorting wafer switch (Centralab 1461)
3—Wratten gelatin filters, 1 red, 1 green, 1 blue (Eastman Kodak #25A, #58, #47)
1—4″ x 2⅛″ x 1⅝″ Minibox
Misc.—3 miniature knobs for ⅛″ shafts, 1 for ¼″ shaft; 6-32 hardware, wire, etc.

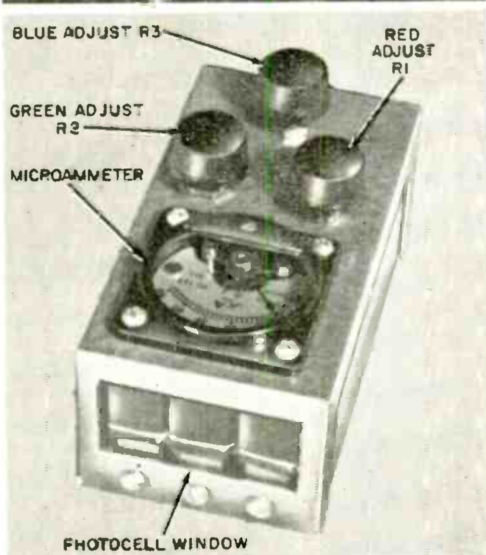
film and cell surfaces—work with tweezers.

Wiring and Mounting. The wiring is straightforward, but be sure to observe the polarity of the photocells and ground the red *positive* leads. This is necessary because the red leads are shorted internally to the mounting brackets.

Mount each cell with a 6-32 screw, and cement a 1⅛″ x 2″ panel of clear plastic over the photocell window to protect them. The last step is to put drops of red, green and blue paint on *R1*, *R2*, and *R3*, respectively, and on switch *S1* to show which cell is connected to the meter.

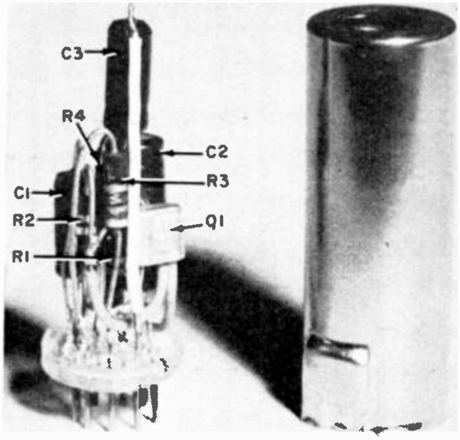
While not a high-precision instrument, the Color Matcher will give good, dependable service as long as the light source (sunlight is good) is uniform, the distance between meter and samples remains the same, and the samples tested have a similar texture. —30—

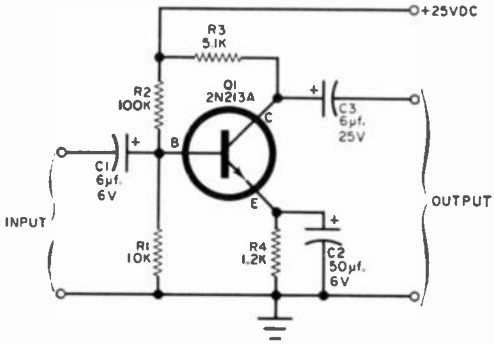




HIGH-GAIN LOW-HUM MODULE

By HAROLD REED





Plug-in module (far left) utilizes a mere handful of components connected to the pins of a defunct miniature tube. Schematic diagram (above) calls for 25 volts of B+, which can be tapped from most power supplies.

IF IT'S high gain you want at low $$, here's one way to get it. The circuit is not very startling—it's an ordinary, everyday transistor preamplifier, plain and simple. But it does use a high-gain, driver-type transistor instead of the type made specifically for low-level preamplifier service. Also, to obtain maximum gain with minimum distortion, the d.c. bias potentials have to be carefully adjusted.

In using this transistor, it was expected that the signal-to-noise ratio would be "horrible." Actually, the ratio turned out to be quite low. With a 5-millivolt signal to the input and 3.5 volts at the output, noise measured only 1 millivolt: 70 db below the 3.5-volt output signal.

Other characteristics were equally impressive, despite the fact that the 2N213A transistor employed was not hand-picked. Distortion was 0.5% at 50 cycles, 0.55% at 1000 cycles, and 1.5% at 20,000 cycles. Frequency response was flat within ±0.9 db from 50 to 20,000 cycles, down just 2 db at 40,000 cycles.

The photo shows how the amplifier can be built on a 9-pin tube base and enclosed within a shield for 7-pin tubes. The glass envelope of a defunct 9-pin tube (such as a 12AX7) is removed, leaving only the base (it's fairly easy to cut around the top of the thick glass base with a bench grinding wheel). And all the tube elements have to be removed, although the wires connected between them and the tube pins naturally remain. These wires are used for tie points for the component parts of the amplifier, and for external connections through the tube base pins.

The 9-pin glass base fits snugly into a "7-pin" tube shield and can be cemented in place after all the parts are assembled. This results in a module that can be plugged into any 9-pin socket.

The input and output capacitors are placed end-to-end—not side-by-side—to reduce any chance of coupling. Since there is no need for concern about hum pickup within the circuit, layout is non-critical and the amplifier may be used in any convenient arrangement. –30–

EMERGENCY HOUSEHOLD LAMP

Don't be left in the dark— here's a gadget that will provide instant light when the power fails

By R. L. WINKLEPLECK

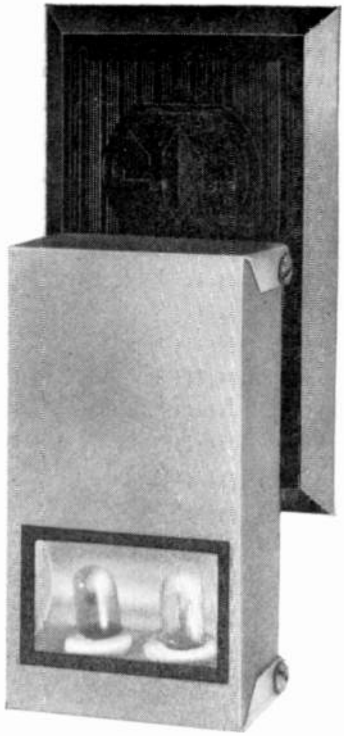
WHAT happens at your house when the power suddenly goes off at night? Do you stumble around trying to find a flashlight or a candle and some matches? If so, here's the answer to your problem. It's a modernized, scaled-down version of the emergency lights you've probably seen in public halls, railway stations, and other places where crowds gather. It goes on automatically when the power goes off, eliminating the possibility that you will be left in complete darkness.

This emergency light, unlike the big commercial types, is a convenient, miniature unit. It can be plugged into a home wall outlet and forgotten. An additional feature is a small neon night light which draws almost no current and remains on all the time. This was incorporated in the design because the location for an emergency light is often one where a night light is needed regularly. The small metal box has a male plug on the back to fit directly into any a.c. outlet. A plastic-covered window on the front protects the two small lamps in a reflector. One lamp is lit when the power is on—the other when the power is off.

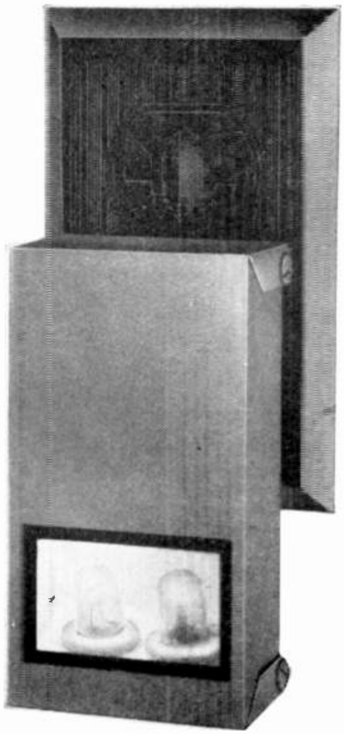
The schematic diagram on page 57 reveals the heart of the emergency light: a small 6-volt rechargeable nickel-cadmium battery which is trickle-charged as long as the power is on via rectifier *D2* and current limiting resistor *R3*. The charging rate, just over 3 ma., will maintain the battery at full charge indefinitely without harmful overcharging.

Transistor Relay. The emergency light connects to the battery via the emitter-collector circuit of the power transistor which acts as a never-failing relay. To keep the transistor cut off, voltage-dropping resistor *R2* and rectifier *D1* keep the capacitor charged to just over 6 volts. This makes the transistor base just slightly more positive than the emitter, and no current flows between the emitter and collector. Resistor *R4* is the load for the capacitor.

What happens when a power failure occurs? The capacitor discharges through *R4*, which then becomes a current limiting resistor in the base circuit of the transistor. When the base swings negative, the transistor conducts, lighting emergency lamp *I2*, and you're no longer in the dark.



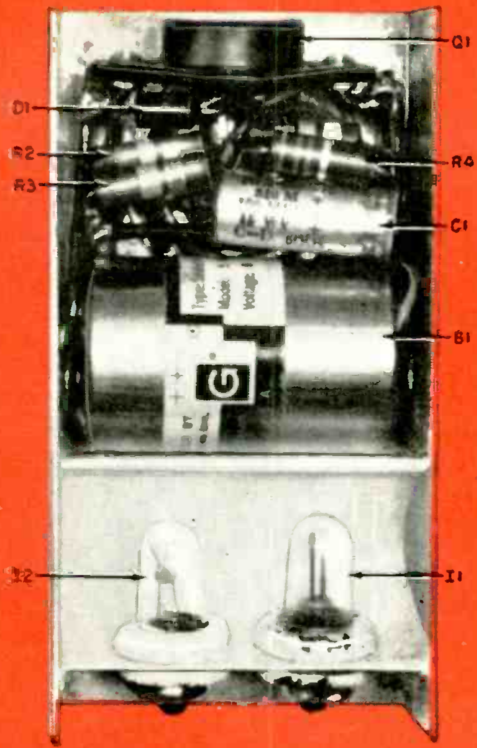
A combination night light and emergency light, this unit has both a low-current neon bulb which remains on all the time (at right, above), and a pilot lamp which flashes on when the power line fails (photo below).



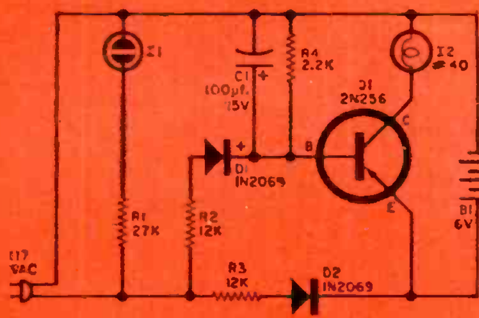
The rest of the circuit, the neon night light, is simple. Neon lamp *I1* and current-limiting resistor *R1* are connected across the a.c. line to provide a guiding glow when the other lights are turned off.

Components and Performance. Component values were chosen to combine small size with adequate performance. The battery used in the author's unit is rated at 180 ma./hour. The #40 pilot lamp, in this circuit, draws about 120 ma. Thus, the fully-charged battery will supply light during a power failure for well over an hour in addition to the small current required to keep the transistor conducting. This is usually adequate to last through most power failures. You can, of course, use a larger battery or two smaller ones in parallel for a longer-lasting emergency light.

Since this unit is designed for long life and trouble-free service, all compo-



The entire emergency night light is compactly built in a cut-down Minibox. A larger housing can be used if desired. The arrangement of components is not critical.



When charged, C1 keeps Q1 from conducting. If power fails, current flows, causing I2 to light.

PARTS LIST

B1—6-volt, 180-ma./hour nickel cadmium rechargeable battery (Gulton Type 6VO—.180, or Burgess CD21 rated at 150-ma./hour)
C1—100-μf., 15-volt electrolytic capacitor
D1, D2—350-ma., 200-PIV silicon rectifier (Texas Instruments 1N2069 or General Electric 1N92)
I1—NE-51H neon lamp
I2—#40 pilot lamp, 6 volts, 150 ma.
Q1—Power transistor (2N256 or equivalent)
R1—27,000 ohms
R2, R3—12,000 ohms } *All resistors 1 watt*
R4—2200 ohms
1—4" x 2⅛" x 1⅝" Minibox—see text
Misc.—Tin can stock, epoxy cement, two rubber grommets to hold lamps (approx. ⅝" o.d.), a.c. plug for panel mounting (Amphenol 61-M1), terminal strips, hookup wire, hardware, etc.

nents are larger than absolutely necessary. Only a little over 3 ma. flows through the battery charging circuit, and about the same current is required to keep the capacitor charged. Obviously, half-watt resistors are adequate, but one-watters have a longer life potential. Likewise, the capacitor, transistor and rectifiers are all over-rated for the job. This is one way of building in dependability.

Construction. The model shown was built in a 4" x 2⅛" x 1⅝" Minibox cut down to just over an inch in thickness, so that it would not protrude from the wall more than necessary. Any housing of this size or larger can be used. The reflector is made of tin can stock glued in place with epoxy cement. Two holes are drilled in the bottom of the reflector to take grommets of a size that will securely hold the neon and pilot lamps. Before mounting the lamps, spray the reflector compartment glossy white.

For mounting the other parts, use terminal strips on each side of the box to serve as anchors for the capacitor, resistors and transistor. The battery is wedged in place between them. There is no isolation transformer, and care must be taken to insure that all components, including the body of the transistor, are isolated from the metal box.

Charging. The battery used in the emergency household lamp will be completely discharged as the wiring is completed. Because the trickle charging rate is quite low, it will take several days to recharge it, but the unit can be checked to see if it's working with only a partial charge—the lamp will simply burn for a somewhat shorter time. —30—

BOOST BOX

Get better tone and more sensitivity from your six-transistor pocket radio receiver

Do you want more sound and greater sensitivity from your pocket transistor radio? Here is a simple and relatively inexpensive way to get both.

As shown in the photos, a 6″ PM speaker is mounted in a homemade wood and compo-board baffle box measuring 10″ x 8″ x 3″. Approximately 80 feet of #26 wire is close-wound around the outside of the box and, when connected across a 365-$\mu\mu$f. variable capacitor, gives you a tunable loop.

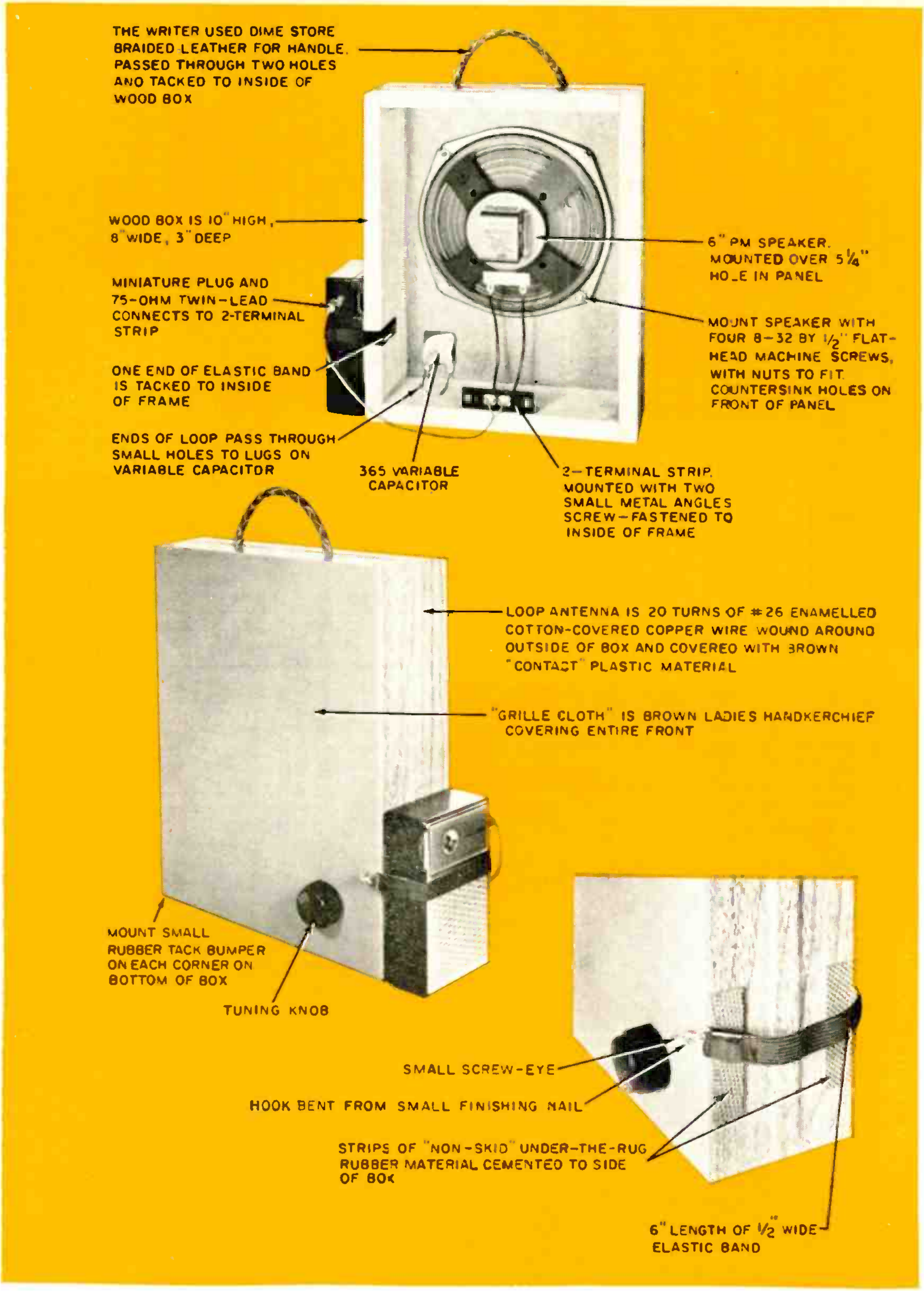
In operation, your small transistor radio is clamped to the outside of the box so that the receiver's loopstick antenna parallels the loop on the box. First, tune in a weak distant station and then turn the radio and box in the direction of the station for the loudest signal. Next, tune the large loop for maximum boost. And finally, plug the 6″ speaker into the radio's jack (the earphone jack).

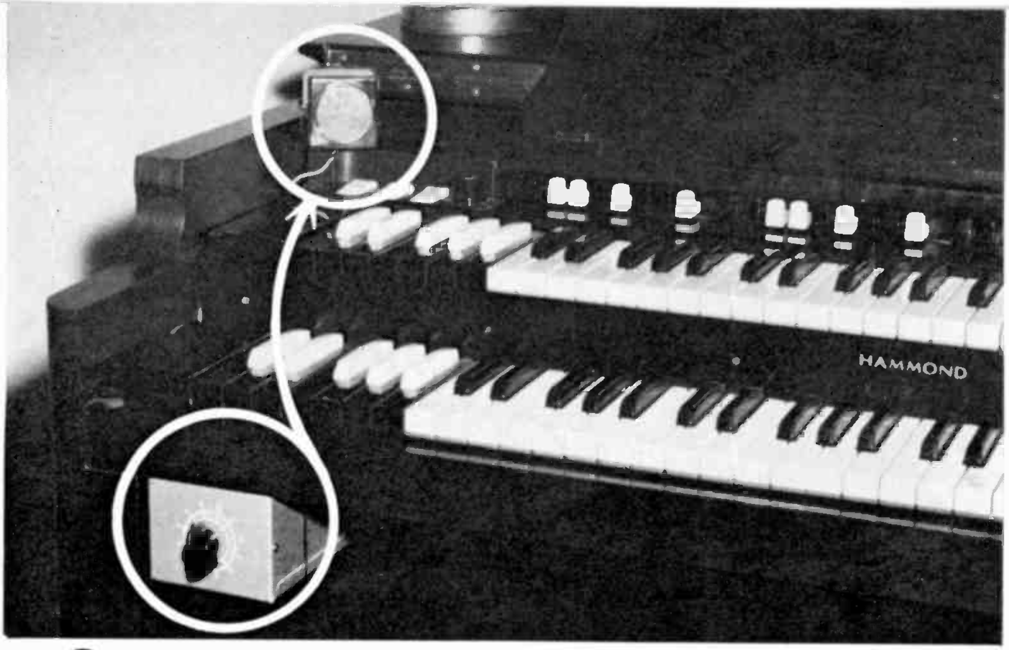
If you want to use a larger box, wind fewer loop turns; for a smaller box, wind more. The right number of turns for the 365-$\mu\mu$f. capacitor can best be determined by experiment.

The "clamp" used to hold the transistor radio to the side of the box is easy to make and can be fastened with tacks or staples. Some transistor radios have their loopsticks mounted vertically; if this is the case with yours, design the holder so that the radio mounts horizontally on its side.

When not being used as a booster, your "box" can serve as a test-bench speaker or an extension radio speaker. Or, if you connect a 1N34A germanium diode and a pair of high-impedance headphones in series across the variable capacitor, you'll have a crystal set for tuning in local stations—or a hi-fi tuner for AM. You can probably think of other uses as well.

By ART TRAUFFER


THE WRITER USED DIME STORE BRAIDED LEATHER FOR HANDLE. PASSED THROUGH TWO HOLES AND TACKED TO INSIDE OF WOOD BOX
WOOD BOX IS 10" HIGH, 8" WIDE, 3" DEEP
MINIATURE PLUG AND 75-OHM TWIN-LEAD CONNECTS TO 2-TERMINAL STRIP
ONE END OF ELASTIC BAND IS TACKED TO INSIDE OF FRAME
ENDS OF LOOP PASS THROUGH SMALL HOLES TO LUGS ON VARIABLE CAPACITOR
365 VARIABLE CAPACITOR
6" PM SPEAKER. MOUNTED OVER 5¼" HOLE IN PANEL
MOUNT SPEAKER WITH FOUR 8-32 BY ½" FLAT-HEAD MACHINE SCREWS, WITH NUTS TO FIT. COUNTERSINK HOLES ON FRONT OF PANEL
2-TERMINAL STRIP, MOUNTED WITH TWO SMALL METAL ANGLES SCREW-FASTENED TO INSIDE OF FRAME
LOOP ANTENNA IS 20 TURNS OF #26 ENAMELLED COTTON-COVERED COPPER WIRE WOUND AROUND OUTSIDE OF BOX AND COVERED WITH BROWN "CONTACT" PLASTIC MATERIAL
"GRILLE CLOTH" IS BROWN LADIES HANDKERCHIEF COVERING ENTIRE FRONT
MOUNT SMALL RUBBER TACK BUMPER ON EACH CORNER ON BOTTOM OF BOX
TUNING KNOB
SMALL SCREW-EYE
HOOK BENT FROM SMALL FINISHING NAIL
STRIPS OF "NON-SKID" UNDER-THE-RUG RUBBER MATERIAL CEMENTED TO SIDE OF BOX
6" LENGTH OF ½" WIDE ELASTIC BAND



On the Beat Electronically

THE FAMILIAR spring-wound, pyramid-shaped metronomes used by musicians since the time of Beethoven are giving way to the clicking of electronic timers. The transistorized electronic metronome (seen above, with remote speaker) is a compact, battery-operated unit that can be adjusted for any musical tempo. Clicks produced at the miniature speaker are of sufficient amplitude to override the sounds of most musical instruments.

You can construct the metronome to suit your own particular needs. In the photo above, the speaker is mounted in a small but attractive case, sitting on top of the organ, while the remainder of the unit is housed in an aluminum chassis box under the keyboard. Pianists may want the electronic metronome mounted all in one case, with rubber feet, to rest on top of the piano. How *you* do it is up to you.

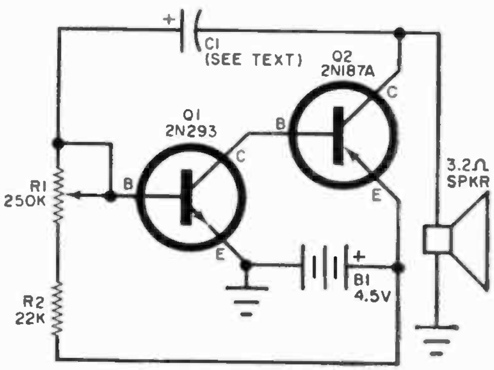
Follow the schematic diagram carefully as you wire the circuit. Resistor *R2* is a 22,000-ohm, ½-watt unit, and *C1* is a 15-μf. electrolytic rated at 5 to 10 w.v.d.c. Be sure *C1*'s negative (unmarked) lead connects to the collector of transistor *Q2*. Then connect the 4.5-volt battery, *B1*, making certain that the polarity is correct.

Now check the number of clicks with potentiometer *R1* fully clockwise, and then fully counterclockwise. The metronome should cover a range of 40 to 210 beats per minute or better. If it cannot go down to 40 beats, increase the value of *C1*. If it's necessary to increase the upper limit, lower the value of *C1*. But vary the capacitor's value by no more than 10% at a time until the desired limit is reached.

The author used a Burgess Type N3 battery with snap-in terminals to power his unit. When the battery is snapped out of the circuit, the metronome stops clicking, and the removed battery serves as a "key" to prevent unauthorized use of the device.

—*John J. Borzner*

Audio amplifier with added feedback circuit (C1) produces "motor-boating" clicks for timing beats.



CRYSTAL TEST METER

Now you can rate the relative activity of transmit and receive crystals in your "shack" or even in the store where you buy them

By **CHARLES CARINGELLA,** W6NJV

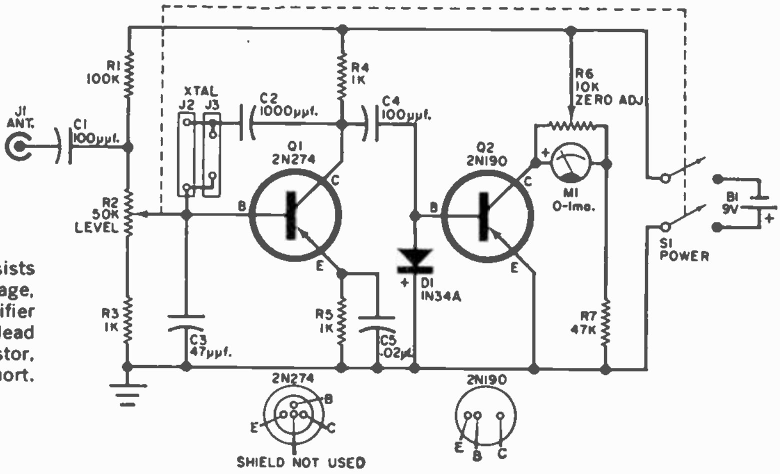
THE HOME workshops of hams, CB'ers, and experimenters frequently boast many varieties of test equipment in addition to the usual VOM or VTVM. Tube checkers, signal generators, capacitor and resistor substitution boxes, and even expensive oscilloscopes are not at all uncommon. But not many people have equipment for testing transmitting or receiving crystals—even those who buy and use them the most.

The inexpensive "Crystal Test Meter" described here has been designed to remedy that lack. It will indicate the relative "activity" of crystals of all commonly used frequencies. In addition, since it's battery-powered and small enough to slip into a coat pocket, the unit can be used to evaluate bargain-priced "surplus" crystals right in the store.

But that isn't the end of the usefulness of this little device. With an appropriate crystal plugged into its socket and a small antenna attached, it serves as an oscillator for checking receiver calibration or alignment. Pull the crystal out, and you have a broadband field strength meter sensitive to frequencies from the broadcast band to well over 150 mc.

About the Circuit. Transistor *Q1*, a high-frequency r.f. type, is connected in a Pierce crystal oscillator circuit. The crystal to be tested is plugged into jack *J2* or *J3*, and the resulting r.f. output is detected by diode *D1* and amplified by transistor *Q2*. Meter *M1*, in *Q2*'s collector circuit, then shows a reading which indicates the relative activity of the crystal.

Because of transistor *Q1*'s normal leakage current, meter *M1* may show a slight reading even when no crystal is in the circuit. This is balanced out by means of "Zero-Adjust" potentiometer *R6*. "Level" potentiometer *R2* controls *Q1*'s base bias and, therefore, the strength of



Tester circuit consists of an oscillator stage, Q1, and d.c. amplifier stage, Q2. Shield lead from 2N274 transistor, not used, is cut short.

PARTS LIST

B1—9-volt battery (Burgess 2U6 or equivalent)
C1, C4—100 μμf.
C2—1000 μμf.
C3—47 μμf. } *All mica capacitors, voltage not critical*
C5—0.02-μf. paper capacitor, voltage not critical
D1—1N34A diode
J1—Nylon-insulated tip jack (E. F. Johnson Type 105 or equivalent)
J2—Crystal socket (Millen 33302 or equivalent)
J3—Crystal socket (Millen 33102 or equivalent)
M1—0-1 ma. d.c. panel meter (Lafayette TM-400 or equivalent)
Q1—2N274 transistor (RCA)
Q2—2N190 transistor (G.E.)
R1—100,000-ohm, ½-watt resistor
R2—50,000-ohm potentiometer
R3, R4, R5—1000-ohm, ½-watt resistor
R6—10,000-ohm potentiometer
R7—47,000-ohm, ½-watt resistor
S1—D.p.s.t. switch (on R2—see text)
1—5½" x 3" x 1¼" aluminum utility box (LMB 139 or equivalent)
Misc.—Terminal strips, battery connector, knobs for R2 and R6, etc.

oscillation. It can be adjusted to prevent extra-active crystals from "pinning" *M1* or to obtain a readable meter indication from sluggish ones.

Power for the circuit is supplied by a small 9-volt battery (*B1*) and controlled by switch *S1* (on *R2*). Though the author used a d.p.s.t. switch for *S1*, a s.p.s.t. switch (wired in series with either of the battery leads) will work as well.

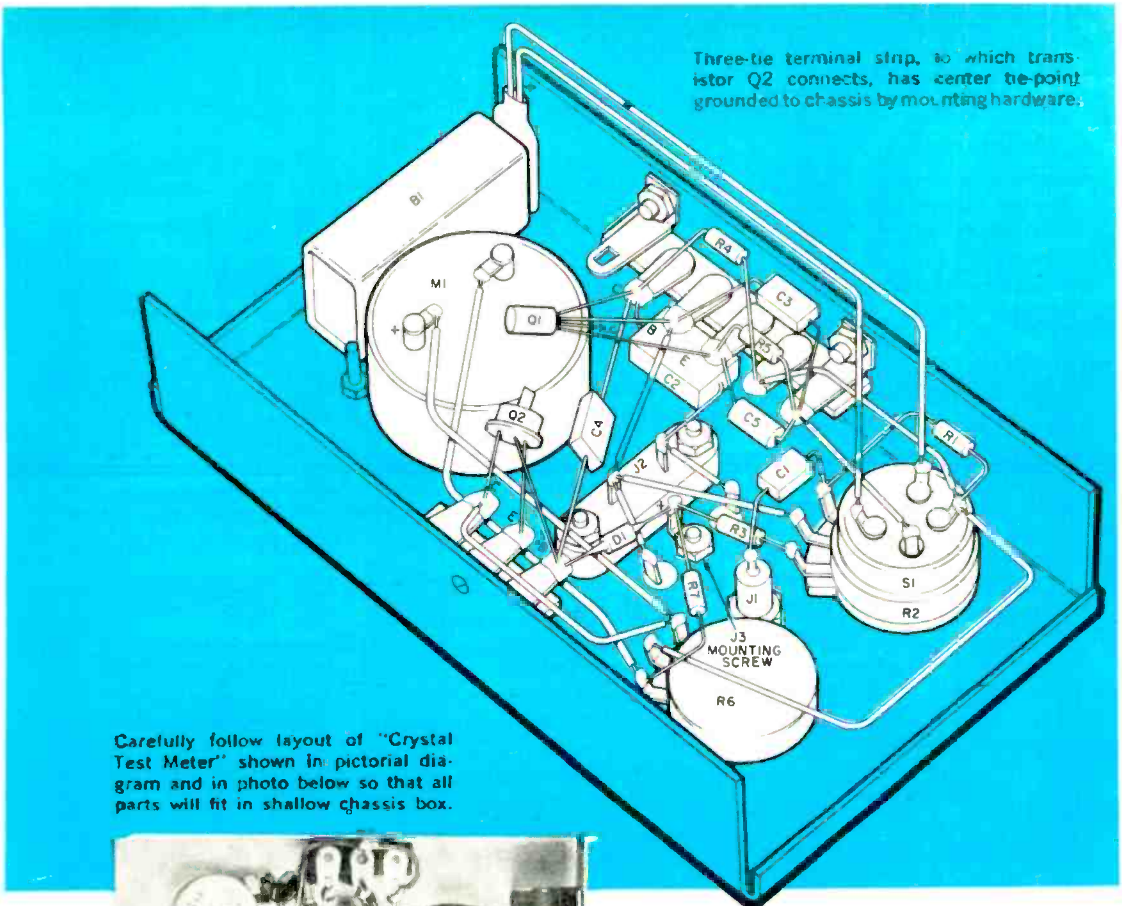
An antenna is plugged into jack *J1* when the "Crystal Test Meter" is to be used as a marker/alignment oscillator or as a field strength meter. In the former case, this antenna radiates the output of *Q1* into the receiver to be checked.

In the latter case, r.f. energy from a transmitter or oscillator is picked up by the antenna and coupled to the base of *Q1*. This transistor then acts as an r.f. amplifier (no crystal is used in the circuit, of course). And, as before, *Q1*'s output is detected by *D1*, further amplified by *Q2*, and indicated by meter *M1*.

Construction. The unit is housed in a 5½" x 3" x 1¼" aluminum utility box. Place meter *M1*, jacks *J1*, *J2*, and *J3*, and potentiometers *R2* and *R6* on the front panel as shown. Transistors *Q1* and *Q2*, as well as many of the resistors and capacitors, are mounted on terminal strips which are installed on each of the two side walls of the box.

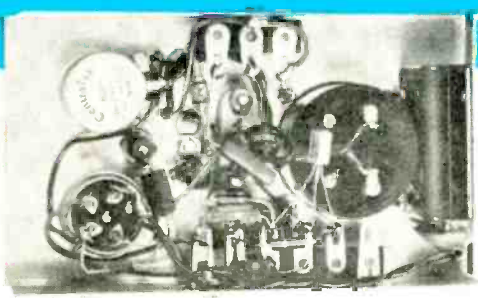
The author found that a couple of strips of masking tape were sufficient to hold battery *B1* in its position above *M1*. However, you may want to make (or purchase) a battery clamp instead.

When carrying out the wiring, try to place all components and leads exactly as illustrated in the pictorial diagram, and to keep all leads as short as possible. Also be sure to use a heat sink when soldering the leads of *Q1* and *Q2* in place and to carefully observe the indicated battery polarity.



Three-tie terminal strip, to which transistor Q2 connects, has center tie-point grounded to chassis by mounting hardware.

Carefully follow layout of "Crystal Test Meter" shown in pictorial diagram and in photo below so that all parts will fit in shallow chassis box.



Operation. To check a crystal, turn on switch *S1*, keeping "Level" potentiometer *R2* turned all the way down. Then set meter *M1* to zero indication by means of "Zero Adjust" potentiometer *R6*. Plug in the crystal and slowly advance *R2* until you observe an indication on *M1*.

Any indication on *M1* is a sign that the crystal is oscillating, but the crystal's relative activity can only be determined by comparison with other units. Check a number of crystals which are known to be satisfactory so that you can get a feeling for the meter readings to be expected at various positions of *R2*.

Almost all of the crystal styles normally encountered will be accommodated by either *J2* or *J3*. For special purposes, other types of sockets—or even a set of clip leads—can be installed.

"Overtone" crystals (such as the third overtone units commonly used in CB work) can also be tested, but only at their fundamental frequencies. This is because the unit contains no tuned circuits for frequency multiplying.

As has already been pointed out, the "Crystal Test Meter" may be used as a marker/alignment oscillator or as a field strength meter. (It does a particularly good job as a marker/alignment oscillator due to its crystal-controlled accuracy.) During operation as an oscillator, *R2* serves as an output level control. When the unit is employed as an FSM, *R2* acts as an input sensitivity control. —30—

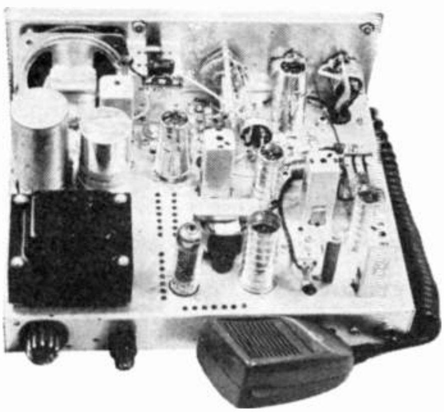
Equipment Report

CB at a Bargain: Knight-Kit C-22

IN THE WORDS and terminology of space age missile men, the Model C-22 is the "third-generation" Knight-Kit CB transceiver. Looking back, it's interesting to recall the first-generation transceiver—the Knight-Kit C-11—which consisted of a superregenerative receiver and only a single transmit channel. The C-27 ushered in the second generation, and featured superb receiver sensitivity and selectivity—but just two transmit channels. The third-generation C-22 is quite a buy. Priced at $69.95 (or $64.95 for the a.c.-only model), it has a fully tunable receiver, plus *five* crystal-controlled receive and transmit channels. It's available from Allied Radio, 100 N. Western Ave., Chicago, Ill.

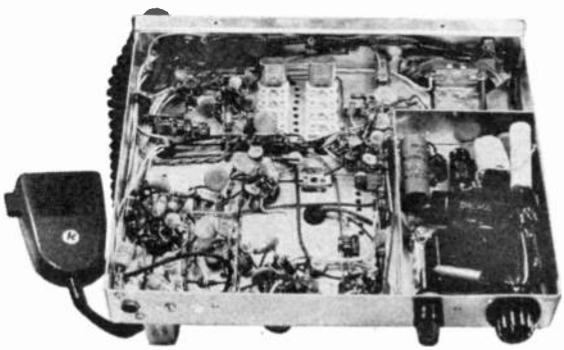
The C-22 kit is easy to assemble, and even the most inexperienced builder should encounter no difficulty in putting it on the air in 10-12 hours. Circuitwise, the Model C-22 is straightforward and a product of careful engineering. Six tubes and five diodes make up both the transmitter and receiver. Receiver sensitivity—even without an r.f. stage—is more than adequate, while selectivity (two i.f. stages) is enough to keep the fellow in the adjacent channel from slopping over.

Noise limiting seems to be very good with the C-22; some limiting is in the circuit at all times. Squelch action is tight and very responsive to weak carriers. Modulation is well up and measures 90% on peaks. —30—



The wide-open interior of the C-22 is obvious from these photos. Note that the power supply is in a shielded section. The power supply in the higher priced ($69.95) unit, incidentally, operates from both 117 volts, a.c., and 12 volts, d.c. Crystal access is provided by a "door" in the bottom plate of the chassis wrap-around.

BOX SCORE	Excellent	Good	Fair	Poor
Talk Power	✔			
Selectivity		✔		
Sensitivity		✔		
Squelch	✔			
Noise Limiting	✔			
Stability	✔			
Operating Ease		✔		



Build the INDUCTAPHONS

By PAUL CARR

Let inductive-coupling solve the problem of convenience in private listening to hi-fi or TV receivers

TELEVISION, radio, and hi-fi are great sources of entertainment; yet, for people in the same household who want to read or study, they can be distracting. Muting the loudspeaker and listening with earphones is one obvious solution—though frequently not too practical. A long, dangling cable between the listener and a receiver or amplifier is a safety hazard—to say the very least.

You can easily overcome the cable connection problem by constructing a simple "induction wireless" earphone system. With this system, the listener can carry

Fig. 1. Schematic diagram of the "transmitting" loop connected to TV, radio, or hi-fi unit.

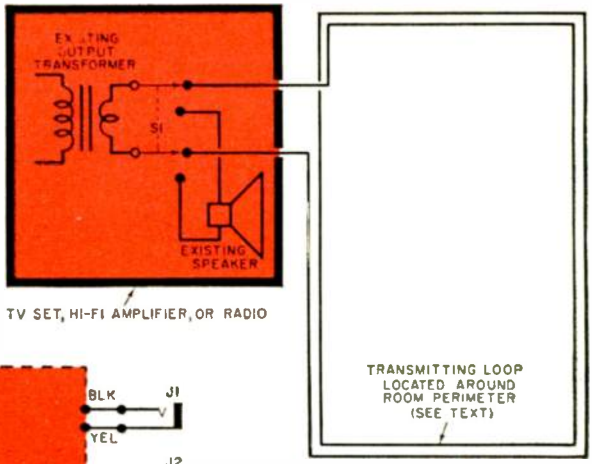
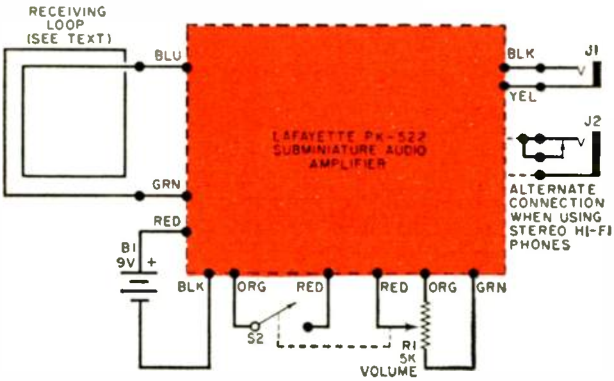


Fig. 2. Schematic diagram of the setup for the wireless earphone receiver. Parts are included in listing at right.



the miniature receiver in his pocket or place it on a table next to his chair. The amplifier or TV set "broadcasts" an audio signal that is inductively coupled to the listener's receiver through a loop antenna placed under the living-room rug. In this way, the listener has complete freedom of movement and trailing wires are eliminated.

For those who object to wearing earphones, semi-private listening is still possible using a wireless, remote speaker. This "armchair" listening post can also double as an AM radio.

In either case, it is necessary to make a simple modification on the TV set, radio, or hi-fi system. A d.p.d.t. toggle switch (*S1*) is installed between the existing output transformer and the existing speaker, as shown in Fig. 1. The switch should be mounted on a bracket and located on the rear of the instrument in a convenient position.

A multi-turn loop is also connected to the switch so that the output transformer can be switched either into the speaker for normal listening or into the loop for "wireless" remote reception.

The loop is strung around the perimeter of the room and tucked under the rug as a permanent installation. The number of turns and wire size of this "transmitting" loop are not critical, but the more turns the better. The author found that a 2-turn loop worked quite well and was the easiest to install. For this purpose, a length of small-diameter, two-conductor speaker cable was used. Thus, one turn of this wire, with the ends connected in series, formed the two-turn loop. The small size wire was not noticeable under the rug.

A loop of this type, running around an average sized room, will have several ohms resistance, providing a suitable resistive load for the output transformer in the TV receiver or amplifier.

The "receiver" for the wireless system is a second loop, many times smaller in diameter and connected to the input of an audio amplifier. The audio signal is inductively coupled from the transmitting loop to the receiving loop, which form the primary and secondary of an air-core transformer. Although the coupling efficiency between the two loops is quite low, the gain of the audio amplifier compensates for it.

At average listening levels (the same power level as when the speaker is used),

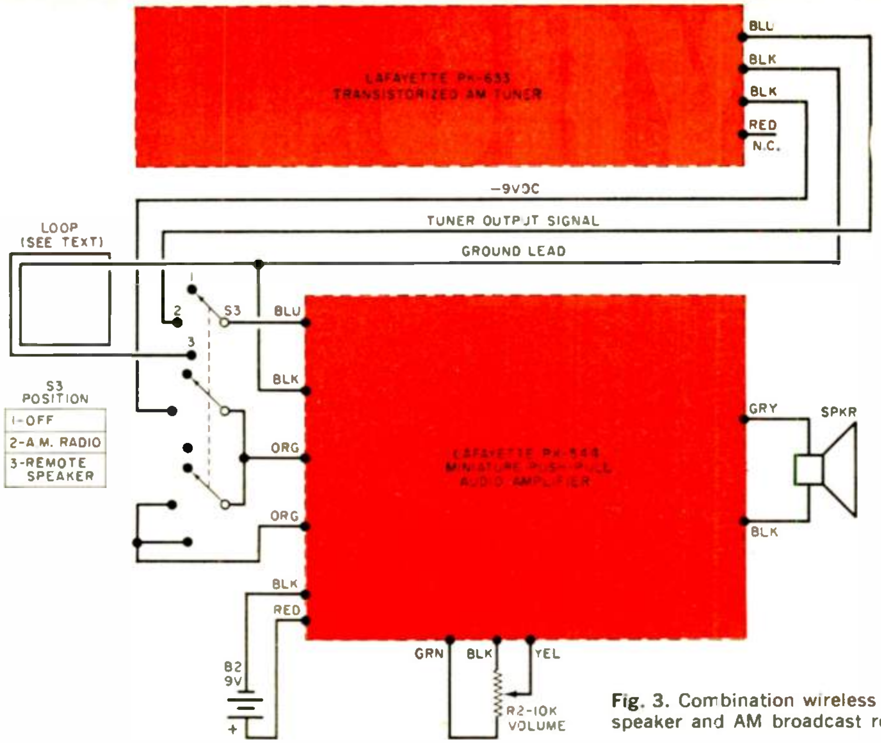


Fig. 3. Combination wireless remote speaker and AM broadcast receiver.

PARTS LIST

B1, B2—9-volt battery (Burgess 2U6 or equivalent)
J1—Standard phone jack
J2—Three-conductor phone jack (when using stereo headphones)
R1—5000-ohm subminiature volume control with on-off switch S2
R2—10,000-ohm volume control
S1—D.p.d.t. toggle switch
S2—S.p.s.t. switch (part of R1)
S3—3-pole, 3-pos. rotary switch
1—Subminiature audio amplifier (Lafayette Model PK-522)
1—Transistorized AM tuner (Lafayette Model PK-633)
1—Miniature push-pull audio amplifier (Lafayette Model PK-544)
1—TV extension speaker (Lafayette SK-76)
1—Small plastic box (3" x 3" x 1")
3—"Loop" antennas—see text

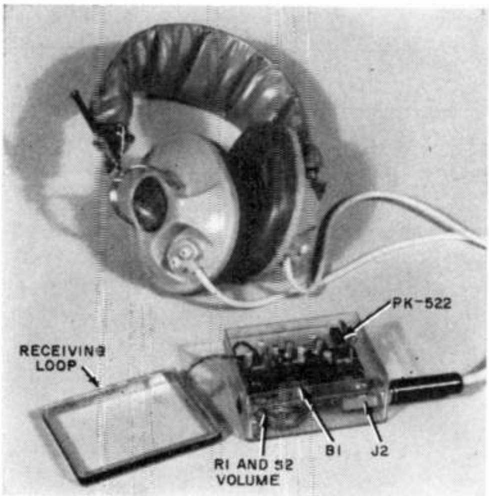
good signal will be obtained anywhere within the loop and even outside the loop at distances approximately equal to one-half its diameter.

Wireless Earphone. The schematic diagram of the wireless earphone receiver is shown in Fig. 2. A three-stage audio amplifier was used. This amplifier is available prefabricated on a printed-circuit board—see Parts List.

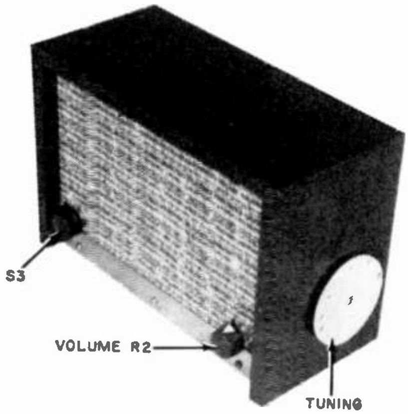
The audio amplifier, a 9-volt battery (*B1*), volume control with on-off switch (*R1*), and a phone jack were all mounted in a plastic box measuring approximately 3" x 3" x 1". The lead colors shown in the schematic of Fig. 2 correspond to the leads on the printed-circuit amplifier unit.

The receiving loop was wound around the cover of the plastic box and cemented to it. Again, the number of turns and wire size are not critical. The author used about a dozen turns of No. 28 enameled wire. The loop is connected directly to the input of the amplifier.

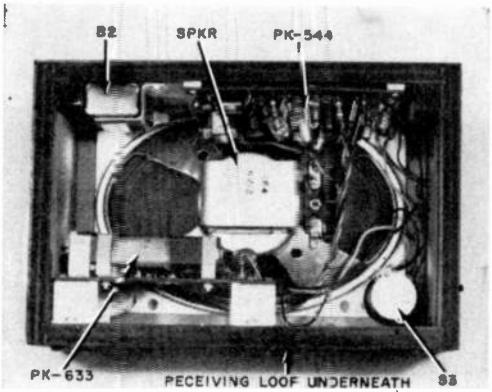
The direction in which the loop is wound is important. If oscillations occur when the unit is operated, remove the loop and rewind it in the opposite direction. Since the loop is so close to the output transformer, feedback will cause oscillation if the loop is wound in



Plastic box houses wireless earphone (above); loop is wound around cover. Below is external view of combination unit; note tuning dial on side of cabinet.



Inside view of the combination wireless remote speaker and AM tuner employing printed boards.



the same direction as the windings of the output transformer.

The output impedance of the amplifier is 8 ohms, which does a good job of matching low-impedance stereo headphones. Fidelity of the system is quite good since the power requirements of the phones are low and the amplifier need not operate at high power levels where distortion is likely to occur. For TV viewing, the hi-fi phones add a touch of realism—with the viewer finding himself smack in the middle of the action. Standard, high-impedance phones can be used, although some mismatch will occur.

Two phone jack hookups are shown in Fig. 2. The hookup using *J1* is the normal configuration when standard phones are used. Most stereo headphones are equipped with a 3-conductor phone plug. The hookup using *J2* is for stereo phone applications. The jumper lead across *J2* parallels both sections of the phones for monaural operation.

Wireless Remote Speaker/AM Radio. The wireless remote speaker is quite similar to the wireless earphone except that the audio amplifier now drives a speaker. A TV extension speaker enclosure serves as the housing for this system and the existing speaker is also utilized.

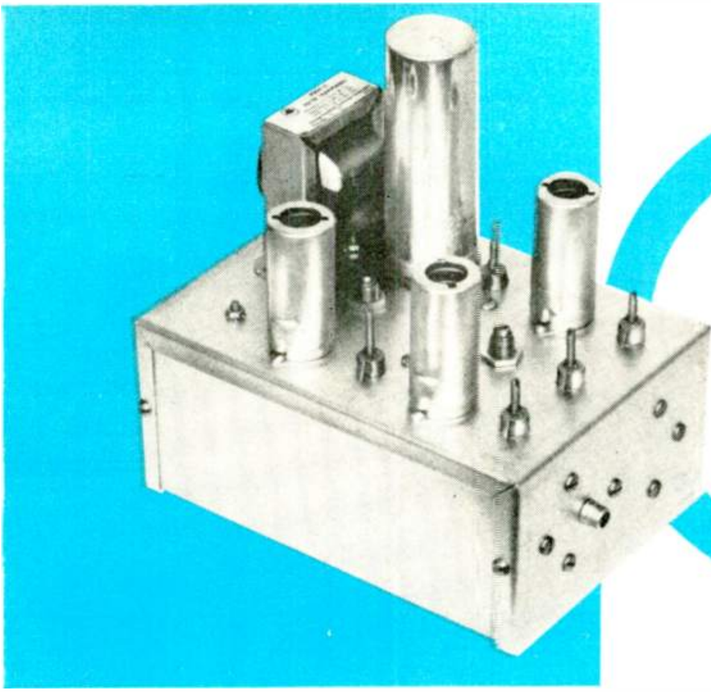
The receiving loop for this setup consists of a dozen turns of No. 28 wire which are cemented to the bottom of the wooden case. Once again, the number of turns, wire size, and loop diameter are not critical.

In this version, a four-stage transistorized push-pull audio amplifier was used. A volume control (*R2*) and 3-pole, 3-position selector switch (*S3*) are mounted on the front panel of the enclosure.

Along with the printed-circuit audio amplifier, a transistorized printed-circuit AM tuner is also mounted in the enclosure.

The selector switch chooses output either from the loop or from the AM tuner and feeds it into the audio amplifier. As an AM radio, the system is capable of pulling in weak stations and the audio section delivers good volume.

This unit can also be used as a telephone amplifier when the telephone receiver is held near the loop. —30—



BUILD THE MPX

By ALTON B. OTIS, JR.

Part 2: Constructing and Aligning the MPX

Detailed assembly instructions enable the experienced constructer to finish this exceptional self-powered FM stereo multiplex adapter

THE RESULTS of the Hirsch-Houck laboratory tests on the MPX whetted the appetite of numerous "build-your-own" stereo fans. The circuit diagram and the test report appeared on pages 63 - 66 of our April issue. In this, the second part of the MPX story, details are given on construction and alignment procedures.

Trouble-shooting notes. prepared for the benefit of those who have problems in getting satisfactory performance, are available. They will not appear in this article. however. If you run into trouble. drop a self-addressed. stamped, envelope to POPULAR ELECTRONICS, and a copy of these notes will be forwarded to you by return mail.

Metal Working. For the convenience of those builders following the mechanical layout. drawings of the chassis appear as Fig. 1. A Bud 7" x 5" x 3" aluminum chassis box will make a snug. compact fit for all of the components. Holes in the top and on both ends of the chassis should be drilled to the sizes shown in the drawings.

While you are in the midst of metal working, note that two coil shields are required. The dimensions and bending details for these shields are shown in Fig. 2.

Winding the Coils. Since most coils available at present are expensive and of too low a "Q" for use in the MPX. it was decided that home-wound coils would provide the best performance at lowest cost. The coils are all wound on Superex Type C-4 forms. with Belden 8817 litz wire. The seven coils require about five 100-foot rolls of wire and can be wound in approximately two hours.

The forms are supplied with a collar on which are mounted two tinned terminals for connecting the leads from the coils. One extra terminal must be added to two of the coils, and three extra termi-

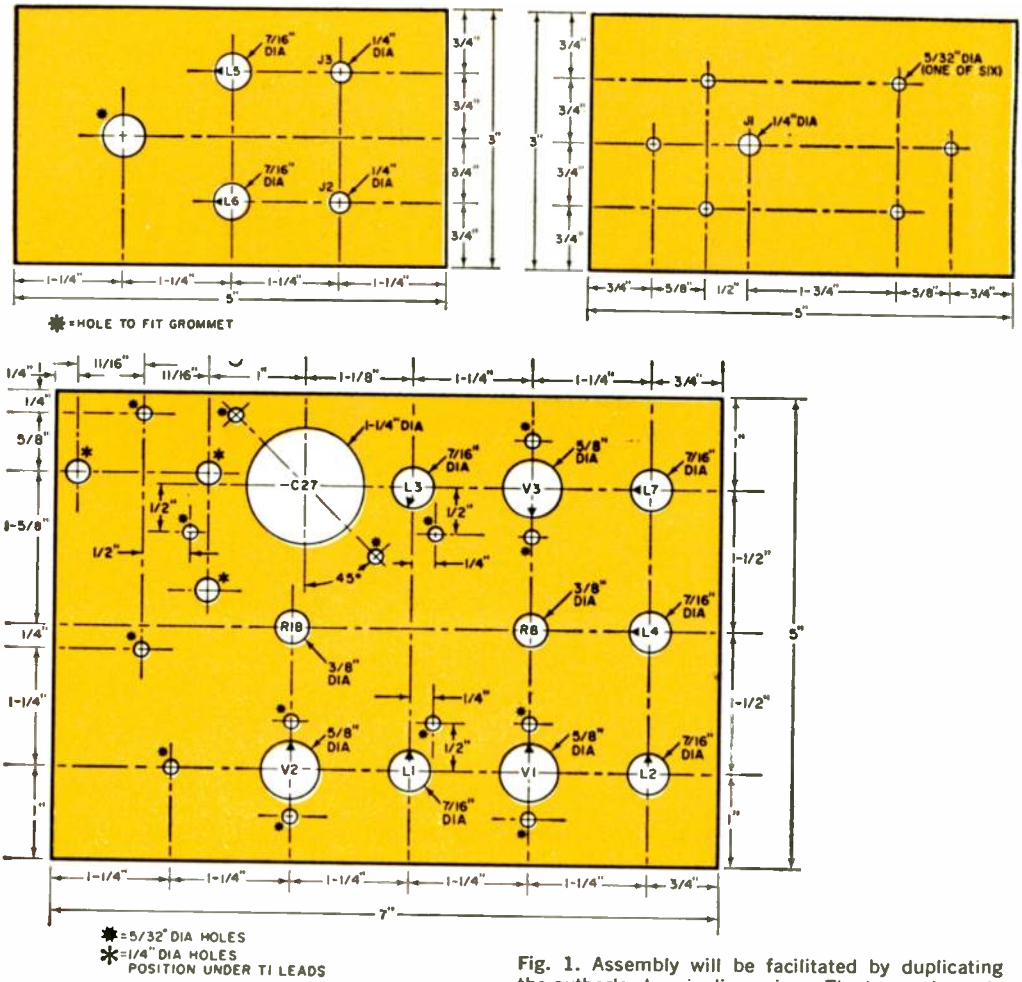


Fig. 1. Assembly will be facilitated by duplicating the author's chassis dimensions. The two end panels are shown at top of page and a top view of the chassis is directly above. Note the small orientation diamonds in the chassis top view. These are important since they position the coils and sockets.

nals to a third. The necessary terminals can be obtained by removing them from other forms of the same type, or by bending a thin copper strip into the shape illustrated in Fig. 3. Mount the terminals as shown by carefully puncturing two 1/16"-wide slits, 1/4" apart, through the side of the collar with the point of a knife; then insert the lugs and bend into position.

The coils are wound 3/4" long on the bare form (mounting clip and collar removed) between two tight-fitting Masonite ends to provide a neat appearance. Winding is facilitated by pushing the form onto a dowel fitted into a hand drill. The specifications for each coil are given below Fig. 3.

After winding a coil, spread a drop of Duco cement on the last turn, and dip

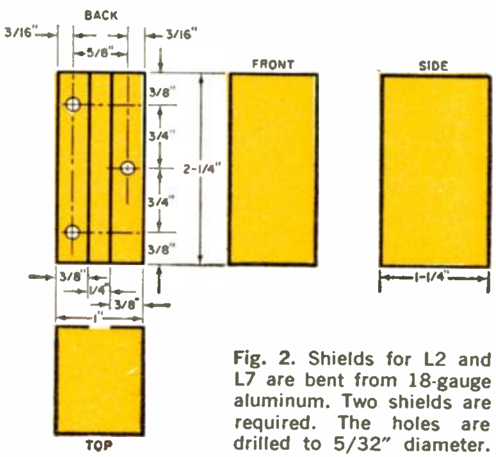
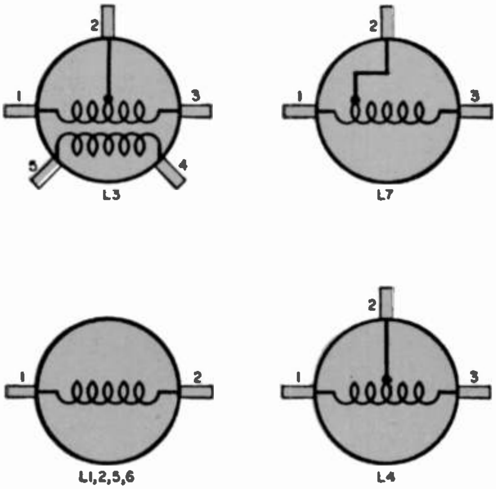
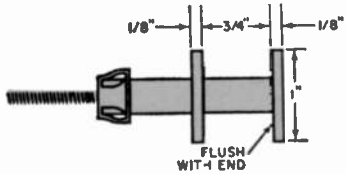


Fig. 2. Shields for L2 and L7 are bent from 18-gauge aluminum. Two shields are required. The holes are drilled to 5/32" diameter.





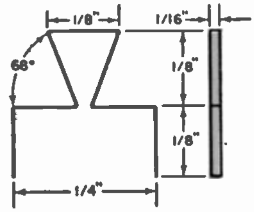


Fig. 3. Seven scramble-wound coils are required. They are wound in a 3/4" slot between two homemade Masonite end plates to hold the windings in place. Remove coil slug and clip to take Masonite end off form after coil is wound. Extra coil terminals (four required) may be bent from copper strip as shown. Coil Table below shows approximate number of turns needed in each coil; plus or minus 50 turns will be satisfactory for all coils except L3. One spool of litz wire will give about 2200 turns. Coil L3 must have very close to the number of turns indicated; this coil is wound by feeding the wire from two spools simultaneously onto the coil form to maximize coupling.

Coil	Turns	Tap (turns from start)
L1	2000	
L2	1200	
L3	600 (each)	300 (secondary)
L4	1200	600
L5, L6	2200	
L7	1200	200

the entire coil in molten paraffin for several seconds. When the wax has dried, remove the Masonite ends and cover the end windings with a coating of cement. Slip on the collar, solder the leads, and cement the collar in place. Give the coil a second dipping in molten wax for about ten seconds, and then push on the mounting clip. This second coating is especially important for *L3*, since its two windings will be at a 250-volt differential.

Preliminary Assembly. The Parts List (p. 65, April issue) specifies two Vector 8-12 terminal turrets and three Vector 8-N-12T 9-pin tube sockets with turrets. These turrets make for easy assembly of most of the capacitors and resistors in the MPX circuit. Each turret should be wired as shown in Figs. 4 through 8. Make sure you can identify each turret after wiring so that a mixup will not occur at a critical time. Leave the resistor and capacitor leads hanging in mid-air when so indicated on the drawing.

After the turrets have been wired, mount *R8* and *R18*. If you are going to use the built-in power supply, this will be a good time to mount *T1* and *C27*. Then mount the power supply turret (Fig. 4) and wire terminals *H* and *G* with the filament leads from *T1*. The red leads from *T1* are then soldered to terminals *L* and *J*, and the free end of *R30* is connected to *C27a*.

Finish up the power supply by soldering *R31* and *R32* on the lugs of *C27*. Mount the remaining terminal turret (Fig. 5) in the hole at the lower left-

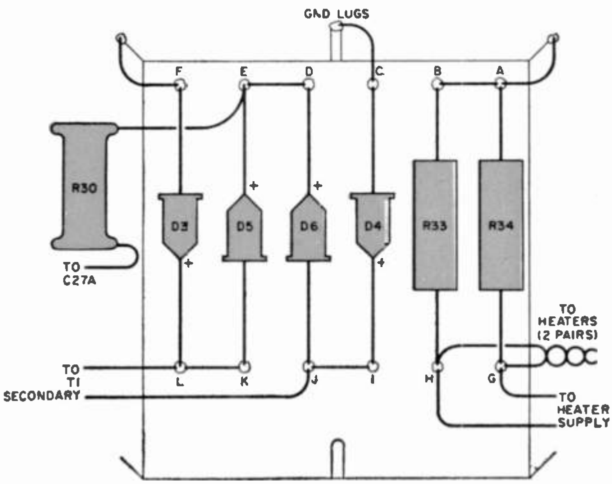


Fig. 4. Wiring detail for power supply turret.

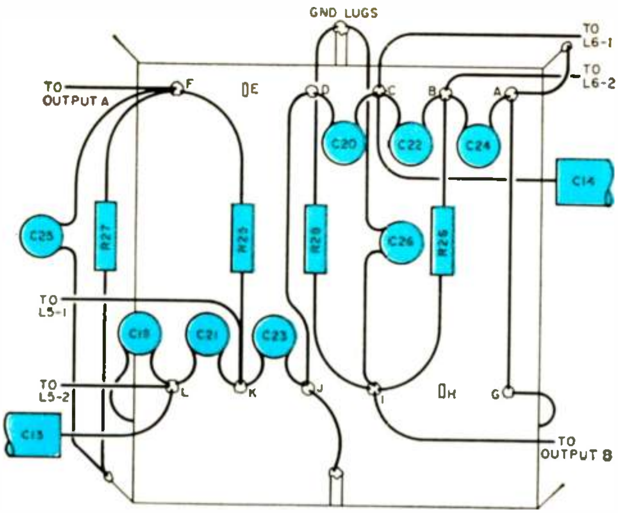


Fig. 5. Mounting post detail for filter section.

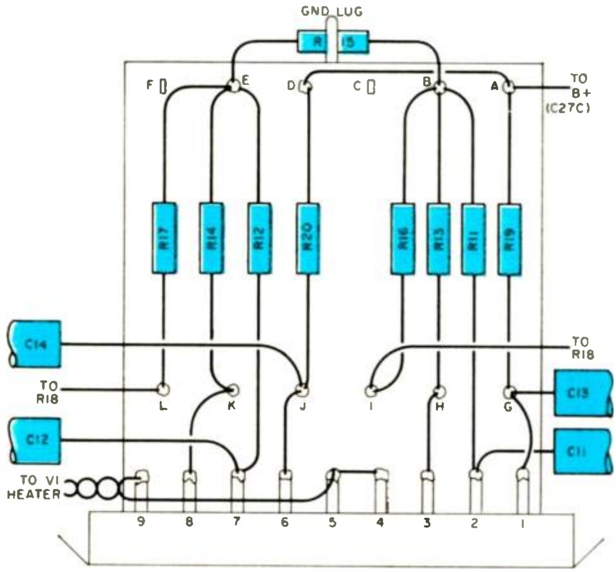


Fig. 6. Mounting turret detail at tube V2.

hand corner of the chassis. Right alongside will be *V2* with the turret connections shown in Fig. 6.

At this point, it's a good idea to wire in one of the filament pairs from the power supply turret. Dress these twisted pair leads very close to the chassis. Now mount the socket and turret of *V1* (Fig. 7) and run filament leads for *V1* from socket *V2*.

The last socket and turret is for *V3* (Fig. 8). Filament leads for *V3* are the second twisted pair to the power supply turret. Now make some of the grounding and B-plus connections common to all of the turrets. Also wire in *R18* and get ready to mount the 4-tie point terminal strip (Fig. 9) holding *Q1* and *Q2*.

Coil Mounting. Before mounting the coils, connect the fixed-value padder capacitors across *L1*, *L2*, *L3*, *L4*, and *L7*. Note the chassis orientation and mount the coils by pushing them upwards through the appropriate holes until the spring clips snap out.

Now, by following the wiring diagram and the turret drawings, finish up the wiring. Keep all leads short and dress them close to the chassis, except where this is impractical due to the proximity of the filament wiring.

The last two coils to be mounted are *L5* and *L6*. Coil *L5* is placed close to the chassis top and *L6* near the bottom.

Alignment. While the entire unit can be successfully aligned with a VTVM, an oscilloscope will make the job easier. (Do not expect to hear a proper stereo signal until step 9).

1. Set the bias control (*R8*) for maximum resistance.

2. Turn the unit on and adjust the balance control (*R18*) for zero voltage across *R15*.

3. Connect a short cable from the multiplex outlet of your FM tuner to the input of the adapter. Tune to a station broadcasting a stereo signal, and adjust *L2* and *L4* for maximum signal at the plate of *V3a*.

4. Connect the adapter to a stereo amplifier and, with full treble cut, adjust *L7* until the oscillator synchronizes with the pilot signal and "locks in" (the beat note will disappear).

5. With a VTVM measuring the volt-

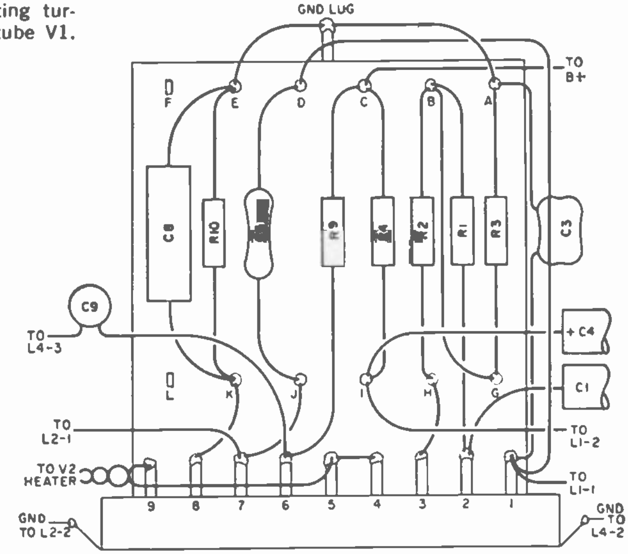


Fig. 7. Mounting turret detail at tube V1.

age at the output of *L3*, adjust *L7* for a maximum reading, which occurs at the point of peak synchronization, and then tune *L3* for an additional maximum reading.

6. Tune to a monaural FM station and slowly advance *R8* until the signal is "centered." Repeat steps 4 and 5 and check to see that the monaural signal is still centered. (CAUTION—do not advance *R8* to less than 10,000 ohms. If balance is not obtained, a transistor is probably defective).

7. Select either a monaural or stereo station which is broadcasting an SCA signal and adjust *L1* until the SCA "squabble" just disappears. (Start with the slug all the way out and slowly move it in.) Repeat step 3.

8. With a VTVM measuring the output, and with the input grounded, adjust *L5* and *L6* for minimum output. If the lowest scale on your VTVM is about 0-5 volts a.c., the signal will go to zero; and as the coil is advanced further, it will reappear. Adjust the coil for the middle of the zero zone.

9. Finally, listening to a stereo station, tune *L2* slightly off center. The two channels will separate correctly or be reversed, depending on the direction in which the coil is detuned. You can determine which way is correct by listening for some selection in which the violins are distinctly on the left and adjusting *L2* accordingly. Some stations make all of their announce-

(*Continued on page* 95)

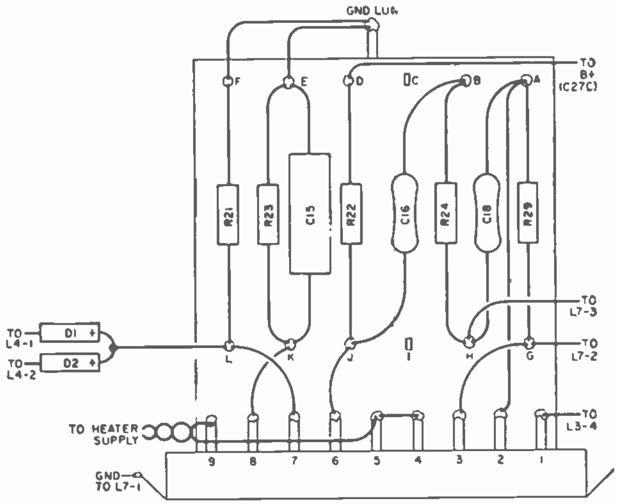


Fig. 8. Mounting turret detail at tube V3.

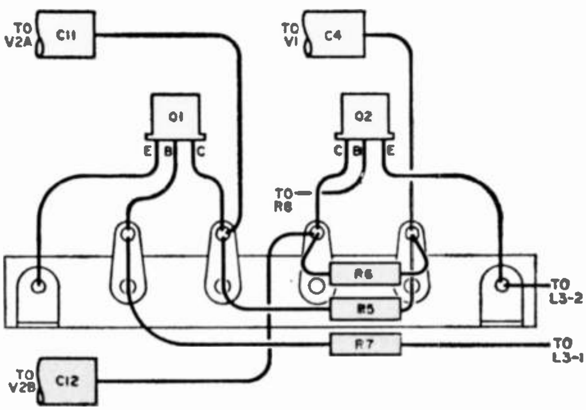


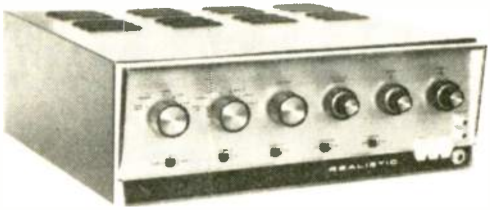
Fig. 9. Terminal strip detail.

Hi-Fi Lab Check

Realistic Model 208 Integrated Stereo Amplifier

Manufactured by Radio Shack Corp., 730 Commonwealth Ave., Boston 17, Mass.

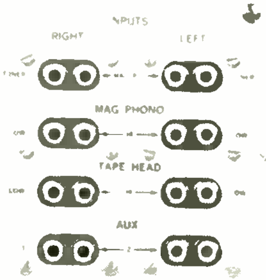
Prices: HK-208 (kit), $139.95; TA-208 (factory-wired), $189.95.



CONSUMERS looking for transistorized stereo amplifiers have had their interest whetted by several manufacturers. Unlike tube-type amplifiers, no two transistor amplifiers are alike in circuitry. Part of the reason for this is the newness of such equipment and the fact that no one amplifier design has proven to be head and shoulders above all others. Another reason is that the designers are attempting to eliminate in transistorized amplifiers all of the "bad" things inherent in tube amplifiers. In some areas, the designers are much closer to achieving this latter objective than they are to finalizing such a thing as a transistorized "ultra-linear."

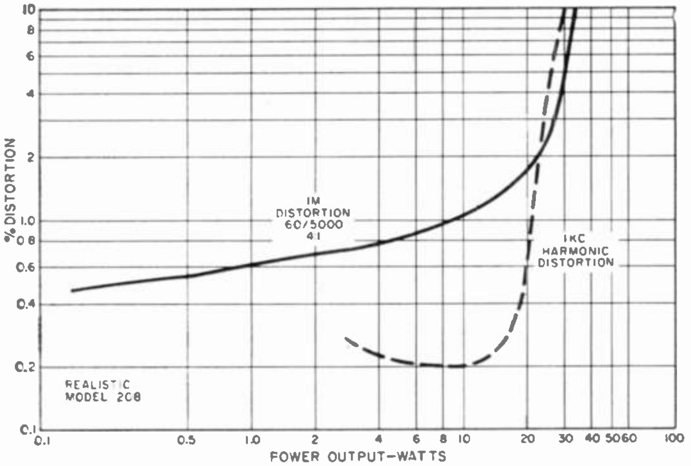
The Radio Shack HK-208 is a decidedly different approach than was exhibited in the Heathkit AA-21 (see the April *Hi-Fi Lab Check*). The first obvious difference is in the output stage, where the HK-208 uses Minneapolis-Honeywell *tetrode* transistors. A second is in the larger size of the driver transformers for the power transistors; these transformers have been wound to compensate for possible high-frequency losses and, as a result, weigh 6 lb. apiece.

CIRCUIT REPORT. The HK-208 has been designed with one thought in mind—maximum flexibility. Using only 18 transistors, it is rated at 40 watts per channel with 4-ohm speakers, and 25 watts per channel with 8-ohm speakers.

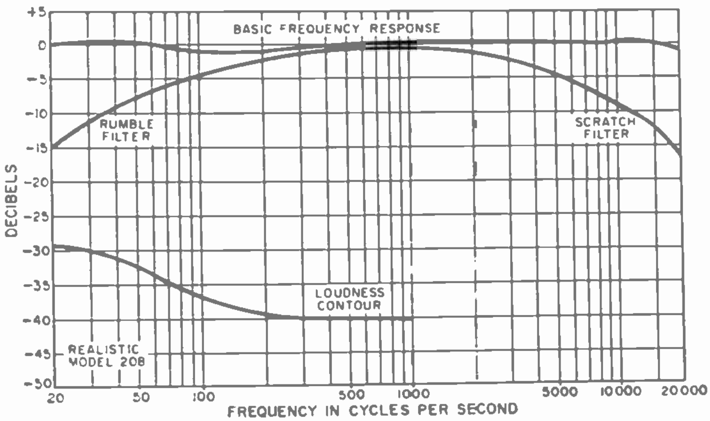


Input jacks are on the rear panel (photo at left); two tape out jacks at the front panel's right edge (far left) are paralleled with two others on the back panel. Large jack in lower right corner of panel is for stereo headset.

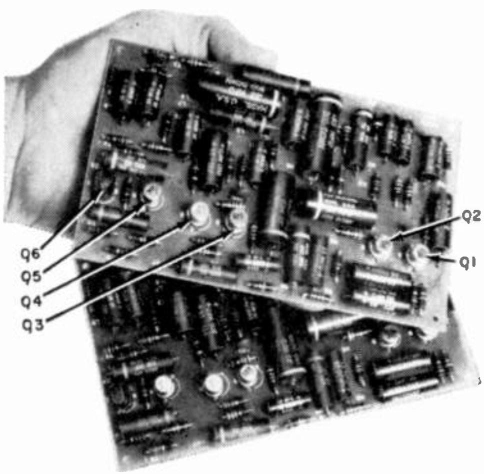
Distortion curves (measured with an 8-ohm load) indicate that the total harmonic distortion is excessive above 20 watts per channel. However, distortion drops to more tolerable levels with 16-ohm loads. Hum, noise, and crosstalk are almost non-existent.



Basic frequency response was measured at the 10-watt level into an 8-ohm load, with both channels driven at once. Results were excellent for an amplifier in the 208's price range. Tone controls altered response ×16, −11 db at 50 cycles, ×9, −17 db at 10,000 cycles.



Printed-circuit boards (one per channel) mount all the circuit elements for six transistor stages.



The tetrode transistor output stage provides constant voltage independent of load resistance and signal frequencies. The speaker impedance determines maximum power output. This also means that the user connects his speakers to the four speaker terminals and forgets tube-style matching problems.

HIRSCH-HOUCK LAB CHECK. All tests were made with 8-ohm termination and with both channels driven simultaneously with audio frequency sine waves. Harmonic distortion is very low up to about 20 watts per channel, although the IM seems to be slightly higher than the manufacturer's specifications.

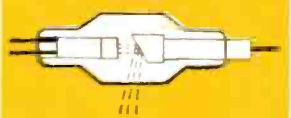
The 10-watt output frequency response curve is very good, with less than 0.5-db change between 20 and 20,000 cycles. At higher power output demands, the higher frequency end of the spectrum tends

(Continued on page 101)

ELECTRONIC ALPHABET QUIZ

The letters of the alphabet are often used as abbreviations for electronic terms. Thus, J means to the electronics enthusiast a type of half-wave antenna. Can you match the letters below with the drawings (1-10) of the devices and circuits to which they most logically refer?

1



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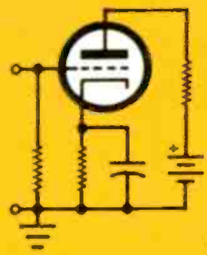

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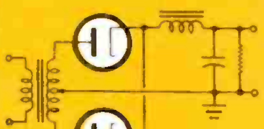


10

By ROBERT P. BALIN

A ______ B ______

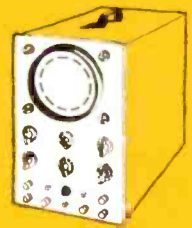
C ______ E ______

L ______ Q ______

S ______ X ______

Y ______ Z ______

(*Answers on page* 103)



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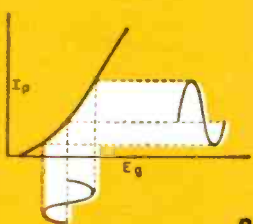

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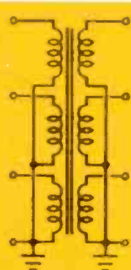

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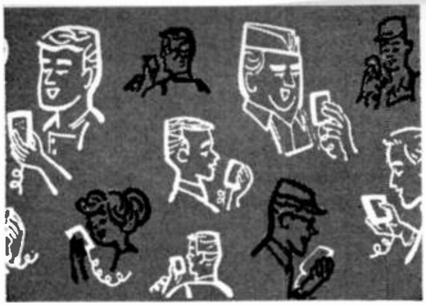


On the Citizens Band

with **MATT P. SPINELLO,** 18W4689, CB Editor

DOCKET No. 14843—the Federal Communication Commission's proposed CB rule changes—probably raised more commotion and headlines in most CB newspapers than anything else in the past four years. The original deadline for comment on the proposals (January 15) closed in with much less reaction received by the FCC than had been expected. And the actions of the Communications Equipment Manufacturers Association (CEMA), in asking the Commission for more time for comment submittal, may well have been the determining factor in the FCC's decision to extend the deadline to March 4, allowing many more CB clubs and individuals to file their comments.

NEW CLASS OF LICENSE PROPOSED

About the same time that CB'ers were letting their feelings be known on the proposed Part 19 changes, International Crystal Manufacturing Company of Oklahoma City, Okla., was submitting a petition to the FCC to add a brand-new class of license to the Amateur Radio Service. If established, this might serve to lessen the entanglements of the 11-meter CB band, and at the same time encourage the "hobby"-minded to take their first step into ham radio.

In its petition to the Commission, International Crystal requested that the new class of license be covered under Part 12 of the Rules and Regulations, and that it be known as the "Hobby License." The petition stated that "with the expanded use of the Citizens Radio Service, a group has appeared with extreme interest in the operational hobby aspect of radio communications. The regulations of Part 19 do not permit the general type operation desired by this group. It is sincerely felt that the keen interest and ability of this group can be guided and further educated by providing a service under which they can pursue their hobby."

"Such a market created," International Crystal maintains, "can be of economical benefit to industry as well as provide a stepping stone to further interest in the electronic field. There is a great need in the United States for electronic technicians. A simplified license to promote interest in the communication field will start a large group pursuing electronics as a possible livelihood and create the technical pool of interest to the nation. This possibility has already been proven by the great number of license applications under Part 19."

Under the proposed "Hobby Class License," the company asked that amateur privileges be designated and limited as follows:

(1) That the d.c. plate power input to the final vacuum tube or transistor supplying power to the antenna not exceed 10 watts.

(2) That only the following frequencies and types of emission be used:

(a) Radiotelegraph A1—29.405, 29.410, 29.415, 29.420, 29.425 and 29.430 mc.

(b) Radiotelephone A3—29.435, 29.445, 29.455, 29.465, 29.475, 29.485. 29.495, 29.505, 29.515, 29.525, 29.535, 29.545, 29.555,

YL CONTEST WINNER

Linda Carol Miller, an attractive young speech major attending Fresno State College in California, was the lucky winner in a "Name the Unit" contest sponsored by Browning Laboratories of Laconia, N. H. The unit in question is Browning's new 23-channel mobile CB transceiver, and the contest drew some 2500 entries. Miss Miller suggested the name "Drake," as a tie-in with the original Browning-Drake company which pioneered many communications developments some 25 years ago. As the winner of the contest, "Lucky Linda" was awarded a complete Browning CB base station—and a "Drake" mobile unit, of course.

29.565, 29.575, 29.585, and 29.595 mc.

(3) That only FCC-approved equipment be operated under this class of license, with such equipment including the following standards:

(a) Crystal control, with a stability of 0.005%.

(b) Speech limiting circuits to prevent loss of carrier on negative modulation peaks.

(c) Frequency response of the transmitter's modulator at 4000 cycles to be 20 db below the 1000-cycle level. Carrier distortion maximum, 25%.

(d) The mean power of emissions to be attenuated below the mean output power in accordance with rules set forth by the Commission.

International Crystal requested that no examination be required to obtain the "Hobby Class License," and that said license be renewable every five years. They further requested that both operator and station license be issued as one, usable anywhere within the United States, and, unless specifically stated, that all other rules of Part 12, Amateur Radio Service, apply to the "Hobby Class License."

Many CB'ers will vote in favor of International Crystal's petition with the belief that such a step would serve the national interest in more ways than one. Besides playing a welcome part in curtailing much of the nonsense on the Citizens Band, which is not only prevalent but continually mounting, the establishment of a "Hobby Class License" could easily become an educational tool, encouraging and preparing many for new careers in one of the most challenging and rewarding fields in the history of our times—the world of electronics.

Tech-Talk. Higher spark voltage levels in present-day auto engines, plus more sensitive CB receivers, make ignition interference a growing problem. Suppression techniques that will not only improve reception but may add extra miles to your range are of the utmost importance.

The tender care and maintenance of spark plugs is one of the primary factors to be considered in adequate ignition noise suppression where radio is involved. In AM and FM, marine or mobile, one-way or two-way radio, the ignition system radiates staccato-like, high-frequency discharges that can interfere with reception and reduce the working distance in communications systems.

Ignition systems operating at higher voltage levels will generally radiate stronger interference signals. Worn, ragged spark plug gaps require higher ignition voltage, hence can decrease radio performance as well as impair engine performance. Flat, parallel gaps and factory maintained settings require less voltage and decrease interference. Operators of low-powered CB gear, therefore, can be certain of an extra dividend with careful spark plug maintenance.

In two-way radio, resistor spark plugs have proven a very effective means of noise suppression for three important reasons:

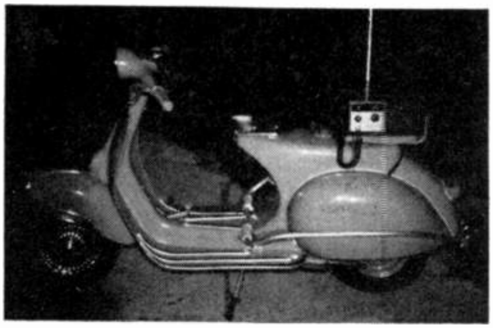
(1) Troublesome radio noise radiating from ignition cables is greatly reduced in strength.

(2) The high frequency part of the spark is "chopped off."

(3)The resistor is built into the spark plug (the nearer a resistor is to a spark gap, the more effective it is).

The Champion Spark Plug Company, by the way, invites inquiries on ignition noise suppression, and resistor or non-resistor spark plug applications. Address your request to the Automotive Technical Service Dept., Champion Spark Plug Company, Toledo 1, Ohio. When you write, you might also ask for a copy of their interesting and informative 16-page booklet entitled "Giving Two-Way Radio Its Voice," an excellent guide to adequate suppression.

CB and CD. One of the best things to stem from Citizens Band operation throughout the country has been the organized efforts of CB'ers to aid in Civil Defense. While groups of this type may vary in size, their abilities to serve in time of need are limitless, since all members are equipped with CB radio—a must in close-knit operation and control. Equally important, CB Civil Defense groups across the nation are train-



You might think that the mobile CB "Vespa" motor scooter at left represents an "unusual use of CB," but it seems that this sort of CB operation has become quite common in California. We bet there's not much line loss to the antenna in this installation.

Andy Hendel, 18Q0299, member of the Winnebago County CD Police Squad, triggers the mike to test CB equipment installed in the organization's heavily laden civil defense van with detachable, roof-mounted antenna tower (see top photos). Photo at right shows Ray Fitz, 18W6125, CB/CD coordinator (center) going over emergency drill procedure with Andy, and with Duane Omark, 18A4229, another member of the CD squad.

ing their members in the application of first aid, along with proper procedure and operation of the group in the event of a disaster, either in the area or on a national basis.

One of the more unusual groups to catch our eye is the Winnebago County Illinois Civil Defense Police Squad. Comprised of some 50 members, this group is active in message-handling drills, disaster evacuation procedure, and first aid instruction. Over the past two years they have handled everything from searches for lost children, traffic at drowning scenes and aircraft searches, to aiding authorities with holiday parade coordination and Salk vaccine distribution.

The Winnebago group is especially proud of their Civil Defense van, which can be described as a complete rolling communications center. They're not sure there's another one like it in the country—at least not as well equipped. In the event of a disaster, the van can be driven to the area or to a control point to establish a base station or message center. This affords the CB group contact not only with Civil Defense authorities, Police, Sheriff, and Fire Departments, but with any number of mobile CB units engaged in the operation at hand.

From all appearances, and from their activities in the past, the Winnebago County CD Police Squad is a well-trained, well-equipped organization of CB'ers, capable of handling the severest of crises. Specifically, we'd say that they're in a state of "rehearsed readiness"!

Distress Call from a YL. We're happy to report that a puzzling situation existing in the state of California several months ago has since been explained without the aid of a Sherlock. In a distressing note from Mary K. Katz, we learned that, for some reason, the newsstands in the Santa Maria area had not been serviced with the December issue of POPULAR ELECTRONICS. Mary was up in arms, and her prime concern was how she was going to get her copy of the December issue. With that kind of loyalty, we couldn't let her down, and ended up sending her our desk copy.

At first we wondered if P.E. had become so popular in the area that the copies were all sold out before reaching the stands. But another, more recent, note from Mary solved the mystery. It seems that a train derailment robbed our readers. We just didn't arrive that month! Thanks for your interest, Mary!

Club Chatter. The Cereal City Citizens Band Radio Club of Battle Creek, Mich., disregarded the bitterly cold atmosphere last January 20th and assisted the Nottawa Trails Council Boy Scouts of America with their 6th Annual Klondike Derby. Some 20

(Continued on page 96)

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

AUTOMOBILE MAKERS and audio equipment manufacturers, although producers of completely different products, are both faced with a similar problem: *the power race.*

There was a time, for example, when a 60-horsepower engine was considered more than ample for a car, and a 100-horsepower motor was looked on as a husky brute suitable only for heavy limousines and racing cars. Today, however, stock family sedans may boast engines with over 400 "horses."

Similarly, 1- or 2-watt audio amplifiers were considered more than adequate for home entertainment not too many years ago, with 30- to 60-watt units found only in theaters, ball parks, and auditoriums. Today, in contrast, high-fidelity amplifiers designed for home use may have higher power ratings than the larger public address amplifiers. Hi-fi power amplifiers boasting 30, 50, 70 and even 100 watts are not uncommon.

The trend towards ever-higher auto engine power has been checked by the growing popularity of compact cars, coupled with increased emphasis on safety and economy. The auto power race, while not ended, has weakened considerably.

The *audio* power race, on the other hand, appears to be as strong as ever . . . but there is at least one sign that it, too, may start to weaken before too long. A small Florida firm, Southeast Technical Enterprises, Inc. (1107 N. Garden Ave., Clearwater, Fla.), after exhaustive field tests to determine the audio powers required and *actually used* in home systems, has introduced a line of transistorized audio amplifiers for which *no* power output ratings are given. Instead, this manufacturer simply indicates that the equipment is capable of supplying more than ample power for home entertainment.

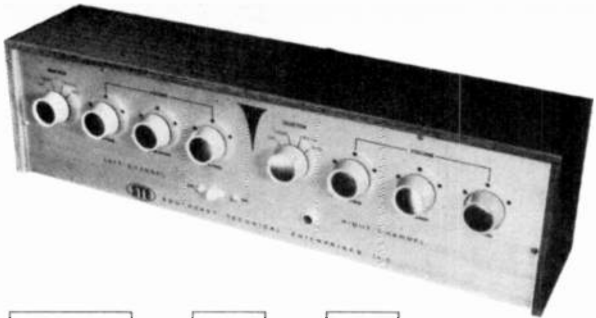
The STE line includes kits and factory-wired versions in both monaural and stereo designs. Prices range from $21.95 for a Model 621 monaural amplifier kit to $93.90 for a Model 624 factory-wired stereo amplifier, complete with power supply and wooden cabinet (plus shipping costs).

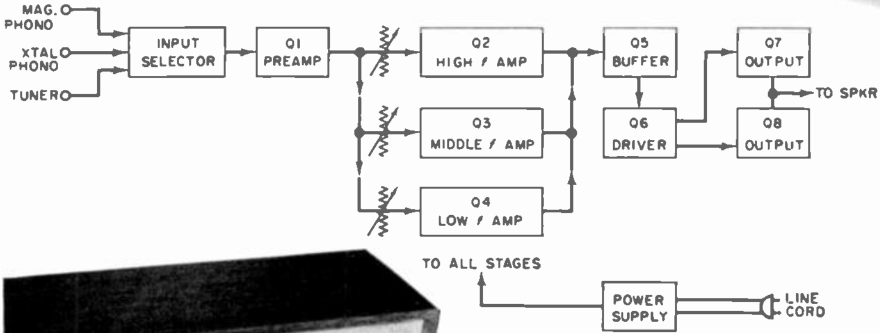
In addition to de-emphasizing power output ratings, the STE line offers several interesting design features. First, all models feature an identical basic amplifier circuit, as shown in the block diagram. The stereo versions are simply made up of two identical units, either mounted side-by-side on a single panel or "stacked" rack-fashion. This is a convenient arrangement for the user who may wish to start with a monaural system, expanding later to stereo.

There are eight transistors in the basic design. Small signal types are used in the preamp (*Q1*), tone control (*Q2, Q3, Q4*) and buffer (*Q5*) stages, a medium-power type in the driver stage (*Q6*), and heat-sink-mounted high-power types in the Class B push-pull output stage (*Q7, Q8*). Use of a series-type output circuit provides direct drive for the loudspeaker, and eliminates the need for an output transformer.

A unique tone control circuit is employed. Separate attenuators and amplifiers are provided for the high (*Q2*), middle (*Q3*) and low (*Q4*) audio frequencies. This permits the operator to *boost* as well as to attenuate treble and bass signals with respect to the middle band of frequencies, and thus to compensate for loudspeaker deficiencies and poor room acoustics. This arrangement also permits interesting "stereo" effects when playing monaural records through a

Unusual design of STE basic amplifier circuit is shown in block diagram below. Two of these units are combined for stereo (see photo at right). High power has been judged unimportant by the STE people, who have concentrated on design features—note the three-section tone control.





stereo system . . . the low frequencies are emphasized over one channel, the highs over the other, simulating a "separation" of orchestral instruments.

The low-voltage power supply, available as an optional accessory with the basic amplifier kits, features a bridge-type solid-state rectifier and dual pi-type R/C filters. Two isolated outputs are provided, permitting the single power pack to be used in both monaural and stereo installations.

All in all, the STE approach to high-fidelity audio equipment design is an intriguing one. Whether their efforts to de-emphasize the importance of high power will start a trend—or whether they will remain lonely pioneers—will depend on the public's reaction and judgment.

Readers' Circuits. This month we are featuring simple transistorized test instrument circuits submitted by readers from three "corners" of the world: Canada, California, and Czechoslovakia. All three circuits require a minimum of components, are non-critical as far as layout and wiring are concerned, can be easily assembled in a single evening, and are quite versatile in application.

The dual-purpose *signal tracer* circuit in Fig. 1 was suggested by Barry L. Tepperman (548 Palmerston Blvd., Toronto 4, Ont., Canada). Barry writes that he developed his circuit by modifying Jean Goyer's "signal booster" featured in our December, 1962, column.

Barry has used a power transistor, *Q1*, in the common-emitter configuration as a single-stage audio amplifier, providing direct-drive to the small PM loudspeaker which serves as a collector load. Base bias for Class A operation is supplied through *R1*, while *C2* provides high-

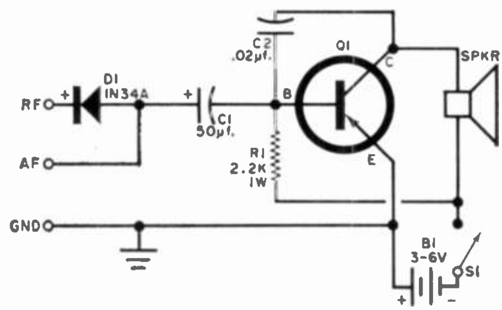


Fig. 1. Simple r.f.-audio signal tracer designed by Barry Tepperman from a circuit previously described in this column. A minimum of parts are needed.

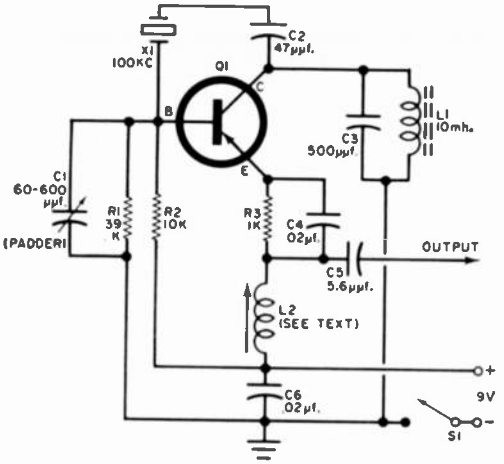


Fig. 2. Transistorized frequency standard designed by reader Jim Carlson furnishes good harmonic output to 30 mc. with a 100-kc. crystal.

frequency inverse feedback to reduce stage distortion. Capacitor *C1* serves as an input coupling and d.c. blocking capacitor. Operating power is supplied by *B1*, controlled by on-off switch *S1*.

In operation, the instrument is used as an audio signal tracer by coupling directly to the input capacitor (*C1*), while, for r.f. applications, diode *D1* serves as a simple series detector.

Virtually any germanium power transistor will do for *Q1*: a 2N255, 2N256, or 2N301 should work well. Barry used a 3″ PM loudspeaker with a 3.2-ohm voice coil winding in his instrument, but speakers up to 6 or 8 inches in diameter and with impedance ratings up to 8 ohms should also give acceptable performance.

A California reader, Jim Carlson (7506 Agnew Ave., Los Angeles 45, Calif.), submitted the circuit illustrated in Fig. 2, which he identifies as a *transistor frequency standard*. Purists might object to this particular title, for circuits of this general type more often are called "crystal calibrators."

Regardless of what it is called, the circuit is a useful one. It is a 100-kc. crystal-controlled oscillator designed to supply strong harmonics to 30 mc. Such harmonics are used for checking the calibration of communications receivers, signal generators, signal tracers, and similar pieces of ham shack or laboratory gear.

Notice how Jim has provided stabilized base bias through voltage-divider *R1/R2* in conjunction with emitter resistor *R3*, bypassed by *C4*. Tuned circuit *L1/C3* serves as *Q1*'s collector load, while the feedback necessary to start and sustain oscillation is supplied through *C2* and the quartz crystal. The harmonic-rich output signal is obtained from an inductive emitter load, *L2*, through isolating capacitor *C5*.

Except for *L2*, standard parts are used. Transistor *Q1* is a 2N274 *pnp* r.f. unit, while *L1* is a 10-mh. r.f. choke—such as a National R-100U. Coil *L2* consists of 90 turns of #36 enameled wire scramble-wound on a ⅜″ diameter slug-tuned form. Jim used a Petersen Z-6A 100-kc. crystal.

The circuit in Fig. 3 was submitted by Ivan Somora (Cs. armady. 65, Piestany, Czechoslovakia). Ivan has dubbed his device a *frequency meter*, since its primary application is in determining the frequency of unknown *L/C* tuned circuits when used in conjunction with a standard r.f. signal generator.

Relatively few parts make up Ivan's simple, but useful, instrument. The small meter, *M1*, should have a full-scale sensitivity between 50 or 100 microamperes. The unit is assembled in a small shielded case, such as an aluminum Minibox.

In operation, the outboard circuit serves as an r.f. detector. The tuned circuit to be checked and a signal generator are connected as shown. The signal generator is tuned through its range *slowly* (from lowest to highest frequencies) until a peak reading is obtained on the meter; at this point, the signal generator

(*Continued on page* 102)

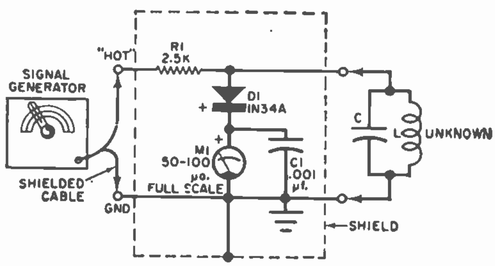
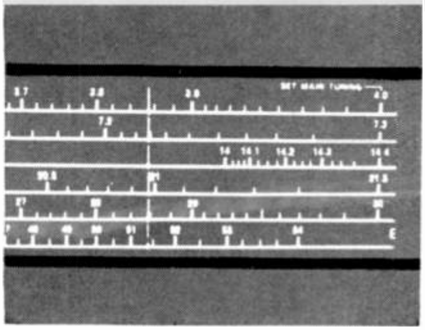


Fig. 3. This convenient method of determining the resonant frequency of an unknown tuned circuit was submitted by Ivan Somora, of Czechoslovakia.



Across the Ham Bands

By **HERB S. BRIER,** W9EGQ
Amateur Radio Editor

INCREASING YOUR QSL RETURNS

RECENTLY, while checking a batch of my QSL cards that I had just received from the printer, I began thinking about the complaints of many hams that some members of the fraternity are very lax in confirming contacts. These complainers (who *always* QSL 100% *themselves,* of course) say they get a miserly percentage of returns from their contacts and the QSL cards they send. Over the years, however, I've mailed out thousands of QSL cards, and have averaged over a 70% return. Furthermore, I know of a good many other hams with an equal or better percentage of QSL returns. The question is, is there some secret method of collecting QSL cards?

Send Your Card First. If there's any secret in collecting QSL's, it's to mail your own card promptly and request one in return. Of course, it does no harm to request a QSL during a contact, and most new hams and some older ones—especially those who want your card for a particular reason—will put one in the mail if they have your address. Most other hams will promise to do so, but their promises usually mean, "I'll send mine *after* I get yours." It's obvious that sending your card first will help improve your percentage of QSL's received.

On the other hand, don't throw away your valuable QSL's and waste postage by mailing cards with incomplete addresses. The Post Office isn't a missing persons bureau. Unless the town is very small, a card addressed simply to "Chief Fuse-Blower Charlie, c/o Amateur Radio

Novice Station of the Month

A photograph of his neat, efficiently organized station won the May "Novice Station of the Month" contest for WN6AIT, Doug Henry of Orange, Calif. Doug can usually be found on 40 or 15 meters running a "Novice gallon" with his Heathkit DX-60 which he uses to excite a Hy-Gain 14-AVS vertical and a 40-meter dipole. He receives on a Hallicrafters SX-24 made more sensitive with an RME DB-22 preselector, and more selective with a Heathkit Q-Multiplier. WN6AIT will receive a one-year subscription to P.E. as this month's winner. To enter the contest, send us a picture of your station—preferably with you in it—and tell us about your equipment and ham activities. Even if you don't win, your photo will be published, space permitting. Mail all entries to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana.

Station WV6XYZ, San Francisco, Calif." has little chance of being delivered.

Always include at least a street address, and, in the case of large cities where hundreds of families live in a single building, apartment and zone numbers are also helpful.

Is He In The Callbook? Unfortunately, a new ham's address doesn't appear in the *Callbook* for several months after his license is issued. Consequently, the only way new hams can get QSL's is by exchanging addresses over the air or by waiting until their calls *do* appear in print. Given the heavy QRM that exists on our popular bands, copying addresses can be a major problem.

Often, it is necessary to take a chance and send a card to an address that you suspect is wrong or incomplete. If you decide to do this, mail the card in an envelope with your return address on it. A returned card can always be held for a better address.

Another possibility is to route a QSL without a full address via the Continental QSL Club, P. O. Box 92, Dabel Station, Dayton 20, Ohio. An annual membership fee entitles hams and SWL's to send QSL cards and SWL reports to U. S. and Canadian hams via the club. The cards are forwarded by the club in stamped, addressed reply envelopes kept on file by the club membership for the purpose. Nonmembers may also keep envelopes on file for the mailing of cards which are sent to the club for them. More information can be obtained from the above address.

Last Resorts. Once you're reasonably sure your QSL cards are reaching their destinations, you can resort to tear-stained letters and other expedients to influence the reluctant 30% of hams to send you their QSL cards in return.

Ronnie, W9QUW, for example, uses airmail exclusively, and includes a return envelope and a shiny quarter for return postage with all his QSL cards. He receives virtually 100% returns from his cards, and reports that the quarter gets better results from overseas hams than including sufficient International Postal Reply Coupons for an airmail reply—and the cost is actually less!

NEW PHONE LICENSE SUGGESTED

If you've been listening on the phone bands recently, you've probably heard much discussion of the editorial suggestion in the February, 1963, issue of *QST* that consideration be given to the idea of returning to the pre-1952 system of restricted 20- and 75-meter phone bands.

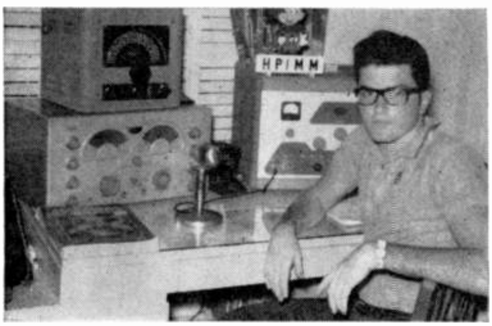
What's referred to is the fact that additional proof of technical competence, an Advanced Class license (*not* an Extra Class license), was formerly required to operate on phone in these bands. The reasons given in advocating a restoration of this requirement are to improve operating conditions, raise the general level of technical knowledge, and return to the incentive system of amateur licensing.

What do you think? Incidentally, such a system is in effect in Canada for all amateur phone operation below 28 mc.

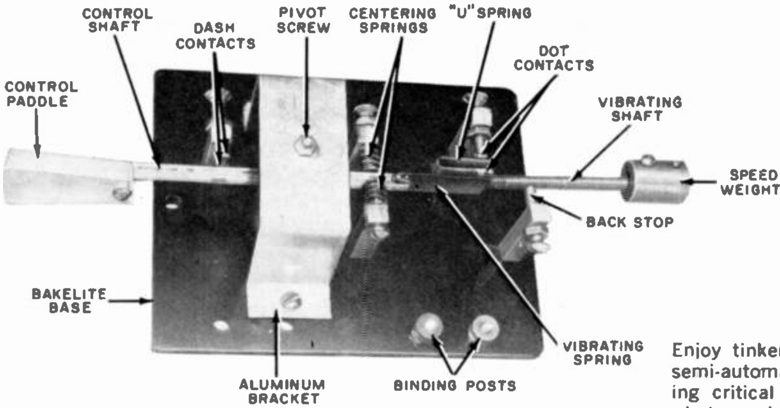
BUILD A SEMI-AUTOMATIC KEY

If you're interested in a semi-automatic speed key or "bug," here's one you

When you're DX'ing, keep an ear open for Morris F. Maduro, HP1MM, Panama City, Panama. Morris works 40 through 10 with a DX-100 and NC-173.



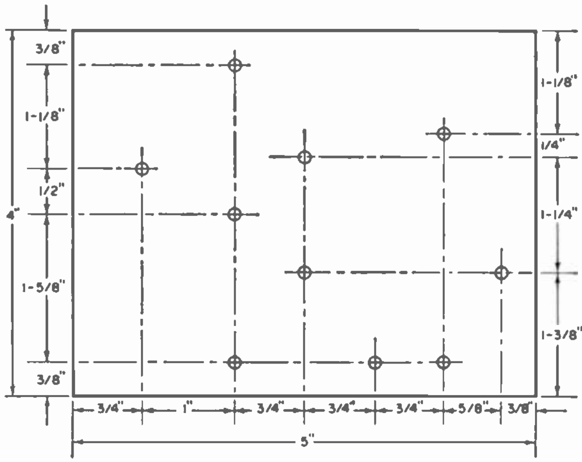
Stephen Borg, KN1YFO, Springfield, Mass. likes 15 meters—he has four countries and 23 states confirmed. See "News and Views," p. 106, for details.



Enjoy tinkering? Try building this semi-automatic key. There's nothing critical about the parts—use what you have on hand. Properly built and adjusted, the key is capable of good c w. from 10 wpm up.

BILL OF MATERIALS

1—3½" x ¼" brass rod (Centralab AK-21 volume control shaft or equivalent)
1—2¾" x 3⁄16" brass rod (#10 brass machine screw)
1—⅜" to ¼" brass shaft reducer
2—Lengths of flat spring steel—see text
2—⅝" x ¼" centering springs
5—1¼" x ¼" square metal pillars
4—Contacts—see text
1—6½" x 1" strip of #12 or #14 gauge aluminum
1—4" x 5" x ¼" Bakelite (or plastic) base
1—4" x 8" x ½" metal plate
1—Control paddle cut from a piece of ¼" plastic
1—2¼" x 6-32 machine screw
2—Binding posts
Misc.—Assorted 8-32 and 6-32 machine screws and nuts, solder lugs, wire



can build for pennies—and it's capable of sending excellent code at speeds from 10 wpm up. Don't let the Bill of Materials scare you. The key is strictly a "junk-box special," and various spare parts can be utilized—depending on what you have on hand.

For a base, use a rectangle of Bakelite or plastic measuring 4" x 5" x ¼". This is later bolted to a 4" x 8" x ½" metal plate to keep the key from skidding across the table. The photograph shows the key's general construction, and the drilling template the hole positions.

Construction. Cut the ¼" brass rod, a volume control shaft or something similar, to 3½", and drill a 7⁄64" hole (#35 bit) through it 1⅜" from one end. Next, file ¼" flat surfaces at each end of the rod parallel to the hole. Drill another 7⁄64" hole through the flat surface furthest from the first hole to fasten the control paddle to the shaft; tap both holes for 6-32 screws.

Cut a 1¼" length of spring steel approximately ⅜" wide from an old clock spring or corset stay. Cut another piece 1½" long and ⅛" wide. If necessary, you can file a wider spring to size after first heating it red-hot over a gas stove and allowing it to cool gradually. At the same time, bend this piece into a "U" with its legs approximately ⅛" apart. After shaping and filing as necessary, reheat the spring red-hot, and plunge it into cold water to restore its temper.

After cleaning both of these springs thoroughly, tin their ends with acid-flux solder (but use rosin-core solder for additional operations). Now solder one end of the 1¼" flat spring (the vibrating spring) to the ¼" brass rod, and the other end of the spring to a 2¾"-long,

(*Continued on page* 104)

DX AWARDS

The POPULAR ELECTRONICS DX Awards program for registered WPE Short-Wave Monitors is off to a good start. (If you're not registered yet, you'll find an application form on page 99.) To be eligible for an award, you must have logged and *verified* at least 25 different countries. To apply for your award, read the rules carefully and fill out the coupon below.

1 Each applicant must be a registered WPE Short-Wave Monitor, and must enter his call letters on the application form.

2 Each applicant must submit a list of stations for which he has received verifications, one for each country heard. The list should contain 25, 50, 75, 100, or 150 countries, depending on which DX Award is being applied for. And the following information must be furnished in tabular form for each verification:

(a) Country heard
(b) Call-sign or name of station heard
(c) Frequency
(d) Date station was heard
(e) Date of verification

All the above information should be copied from the station's verification. Do not list any verification you cannot supply for authentication on demand.

3 All pertinent verifications, whether QSL cards or letters, should be carefully packaged and stored by the applicant until such time as instructions are received to send in some or all of them for checking purposes. Instructions on how and to whom to send the verifications will be given at that time. Failure to comply with these instructions will disqualify the application.

4 A fee of 50 cents (in U.S. coin) must accompany the list of verifications to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible for an Award.

5 Apply for the highest DX Award for which you are eligible. If, at a later date, you become eligible for a higher Award, then apply for that Award, following these rules and regulations exactly as before.

6 Awards will be issued to all duly qualified applicants whose applications are received during the year 1963. Any applications postmarked after midnight, December 31, 1963, will be invalid.

7 Mail your verification list, 50¢ fee, and application form to: Hank Bennett, Short-Wave Editor, POPULAR ELECTRONICS DX AWARDS, P. O. Box 254, Haddonfield, N. J. Include in the envelope only those items which are directly related to your entry for the Award. Do not include an application for a Short-Wave Monitor Certificate (you are not eligible for any of the Awards until you have a Short-Wave Monitor Certificate in your possession). If you want to ask other questions or supply news items, reports, etc., use another envelope.

POPULAR ELECTRONICS' DX AWARD APPLICATION FORM

(please print)

WPE Call Letters ________ Name ________

Address ________ City ________ Zone ________ State ________

Please enter my application for the following POPULAR ELECTRONICS' DX AWARD:

(check one) 25 ☐ 50 ☐ 75 ☐ 100 ☐ 150 ☐

☐ I have enclosed a list of the required number of countries, and I hereby certify that I hold a verification from at least one short-wave broadcasting station in each of the countries listed

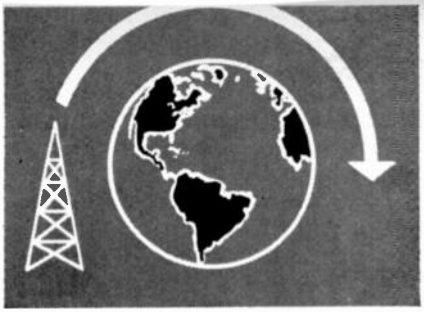
☐ I have enclosed 50 cents to help cover the costs of processing and mailing my DX Award

Signature ________ Date ________ 1963

This form valid only through December 31, 1963

3

Mail to Hank Bennett, POPULAR ELECTRONICS DX AWARDS, P. O. Box 254, Haddonfield, N. J.



Monthly Short-Wave Report

By **HANK BENNETT,** W2PNA/WPE2FT
Short-Wave Editor

NOTES FROM YOUR SHORT-WAVE EDITOR'S DESK

THE Canadian Broadcasting Corporation has instituted a new English-language DX program for the SWL and DX'er. Entitled the "Radio Canada Shortwave Club," the special program is broadcast every second Saturday of the month in the European, African, Caribbean, and Australasian services.

The new program is written and announced by Basil Duke, club president, assisted by Duncan Nicholson, vice-president, and Eileen Moore, secretary of the organization. Mr. Duke is supervisor of the Engineering Services for the CBC International Service.

During the program, brief talks are presented on such subjects as good reception reporting, how to obtain QSL cards, receiving antennas, interference, and fading. DX club news is given, as is news on any international DX competitions. Musical selections are dedicated to DX and SWL clubs but not to individual listeners of the program.

President Duke reports that the "Radio Canada Shortwave Club" has been so successful to date that serious consideration is being given to making it a weekly show.

Incidentally, the club plans to issue a membership certificate and a lapel badge or stick pin, plus a *Radio Canada* pennant. Membership requirements will be broadcast in the near future.

Tape-Recorded Reports. Bill Eddings, WPE3BWL, editor of the North American Shortwave Association (1521 Fifth Ave., Altoona, Pa.), reports that his organization made a suggestion to Mr. O. Lund Johansen, publisher/editor of the *World Radio TV Handbook*, that future editions of that publication include a listing of short-wave stations which will accept tape-recorded reports.

Presumably these reports could be used either in DX programs or for verifications. Mr. Johansen replied that, beginning with the summer supplement,

Officiating at Radio Canada during the bi-monthly "Radio Canada Short-wave Club" program are (left to right) Basil "Pip" Duke, club president, Duncan Nicholson, vice president, and Eileen Moore, secretary. Designed especially for SWL's and DX'ers, the program features talks on technical topics related to short-wave reception, and general DX news. Thanks to the success of the show, consideration is being given to putting it on a weekly basis.

Twenty-eight countries—23 verified—have been logged at the listening post of Gary Young, WPEØCKN, St. Louis, Mo. For pulling in DX, Gary uses a 25′ antenna and a National NC-60 receiver. He's looking forward to his first WPE DX Award.

such a listing will indeed be included in the publication.

To assist in making up the list, Mr. Johansen would like to have any available information regarding stations that are currently known to accept such reports. Specifically, he needs the following: name and address of the station; the size of reel preferred by the station; the speed requested; minimum length of the report; and the type of verification issued as a result of the report (card, letter, tape, or a combination of same). Any other pertinent information will also be gratefully received.

The data should be sent to Mr. Johansen c/o *World Radio TV Handbook*, 1 Lindorffsalle, Hellerup, Denmark.

DX Awards. POPULAR ELECTRONICS' DX Awards Program is now well under way, and will continue full speed ahead. (Complete details will be found elsewhere in this issue.) Will YOU be the first to qualify? Space permitting, we will try to list the awards given each month.

Keep in mind that you must have a WPE registration before you can qualify for the DX Awards. If you have not as yet received your Monitor Certificate, fill out the application form on page 99, and get it in the mail today!

DX Log. A new General Electric DX Log, consisting of sixteen 8½" x 11" pages, is now available. Send your request for a copy to your Short-Wave Editor at Box 254, Haddonfield, N.J., and please enclose 10 cents in stamps or coin to help cover mailing costs.

(*Continued on page* 107)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

All of the stations below specifically beam English-language newscasts to the U.S.A. The times may vary a few minutes from day to day.

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Australia	Melbourne	17,840, 15,315	2030, 2130, 2230
		9580	0745
Bulgaria	Sofia	6070	1900, 2000, 2300
East Congo	Leopoldville	11,755	1630, 2100, 2230
West Congo	Brazzaville	11,725	2015
Czechoslovakia	Prague	11,990, 9795, 9550, 7345, 5930	2000, 2330
Denmark	Copenhagen	9520	2100, 2230
West Germany	Cologne	9735, 5980	1530
		9735, 6140	1920
		9735, 6145	0000
Hungary	Budapest	9833, 7220, 5960	1900, 2230
Italy	Rome	9575, 5960	1930, 2205
Netherlands	Hilversum	9715, 6085	1625 (exc. Sun.)
		6035, 5985	2030 (exc. Sun.)
Portugal	Lisbon	6185, 6025	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840	0900
		9605	2215
		6065	2045
Switzerland	Berne	11,865, 9535, 6165	2030, 2330
U.S.S.R.	Moscow	9650, 9570, 7330, 7320, 7290, 7280, 7250, 7240, 7200, 7180, 7170, 7150, 7130, 6100, 6070, 5960[1]	1700, 1900, 2000, 2100, 2300, 0000, 0040

1. Not all channels are in use at any one time.

Short-Wave Broadcast Predictions

By STANLEY LEINWOLL
Radio Propagation Editor

MAY 1963

THE COMBINATION of declining sunspot activity and the approach of summer will result in a trend toward 15 megacycles as the best daytime band for SWL DX'ing during May; as the days continue to lengthen, this band will stay open longer than in any month since last August. During the nighttime hours, the 7- and 9-mc. bands should be best for DX, showing a tendency toward higher usable nighttime frequencies characteristic of summer propagation conditions.

The many favorable comments received on our *Short-Wave Broadcast Predictions* are much appreciated. Since this is your column, any ideas you have that might improve it will always be welcome. And we will do our best to answer any questions about the ionosphere, sunspots, or radio propagation in general.

TIME (EST)

Between Eastern USA and:	00–02	02–04	04–06	06–08	08–10	10–12	12–14	14–16	16–18	18–20	20–22	22–24
Western Europe	7	7	7	9	15	15	15	15	15	11	11	9
Eastern Europe	7	7	7	9	11	11	15	15	11	9	9	7
South & Central America	11	11	11	11	15	15	17	17	15	15	11	11
Near East	7	7	7	9	11	11	11	15	15	11	11	9
North Africa	7	7	9	11	15	15	17	17	15	11	9	9
South & Central Africa	9	9	9	11	15	17	17	17	15	11	9	7
Australia & New Zealand	11	11	11	9	9	9	*	17	17	17	17	15

TIME (CST)

Between Central USA and:	00–02	02–04	04–06	06–08	08–10	10–12	12–14	14–16	16–18	18–20	20–22	22–24
Western Europe	7	7	9	11	15	15	15	15	11	11	9	7
Eastern Europe	7	7	7	11	11	15	15	11	9	9	7	7
South & Central America	9	9	11	15	15	15	17	17	15	15	11	11
North Africa	7	9	11	11	15	15	15	15	11	11	9	7
South & Central Africa	7	9	11	11	15	15	15	15	15	11	11	9
Far East	9	7	9	11	11	11	15	15	15	15	11	11
Australia & New Zealand	11	11	9	9	9	15	*	17	17	17	17	15

TIME (PST)

Between Western USA and:	00–02	02–04	04–06	06–08	08–10	10–12	12–14	14–16	16–18	18–20	20–22	22–24
Western Europe	7	7	7	9	11	15	15	15	11	9	7	7
Eastern Europe	7	7	7	9	11	15	11	9	9	9	7	7
South & Central America	9	9	9	15	15	15	15	17	17	15	11	11
Africa	7	7	9	11	15	15	15	11	11	9	7	7
Far East	9	9	9	9	11	11	15	17	17	15	15	11
South Asia	9	9	7	9	11	15	11	11	15	15	15	11
Australia & New Zealand	11	11	11	9	9	15	17	21	21	21	17	15

To determine the frequencies and times for best short-wave reception in the United States, select the table for the area you are located in, read down the left-hand column to the region you want to hear, then follow the line to the right until you are under the figures indicating your approximate local time. The boxed numbers will tell you the frequency band (in megacycles) to listen to during any 2-hour interval. Asterisk (*) indicates that signals will probably not be heard.

THE SUCKER

A Carl and Jerry Adventure in Electronics

A few minutes after midnight there was a splash of intense white light, followed a second or so later by an explosion . . .

By
JOHN T. FRYE
W9EGV

CARL, Jerry, and Benny Winthrop, a fellow H-3 resident, were standing in the parking lot across from the residence hall of Parvoo University staring down at the bright May morning sunlight flooding the empty trunk of Benny's late-model luxury sedan.

"I simply can't psych it out," Benny said, shaking his head. "This is the third time in a month thieves have cleaned out my trunk. First it was the spare tire; then it was a pair of shoe skates and some ice-fishing tackle; and now my portable typewriter and a suitcase full of clothes. It was late when I pulled in from home last night; so I decided to leave the stuff in the trunk until this morning. You can see what I found. They only left my new spare tire . . . What really bugs me is how they get in. There has never been any sign of prying or tampering with the trunk lock."

"What did the police say when you reported the other two jobs?" Jerry asked.

"They said the thieves probably had a key to fit my trunk. They explained that there are only so many basic lock patterns and there are millions of cars; so it's not unusual for one car key to fit several locks on other cars. Being an engineer, I didn't accept this as a fact without proof. I rounded up all the guys with car keys in the hall, and we formed a long line and tried our keys in every door and trunk lock on the lot. It was astonishing how many locks we could open."

"Then why don't you think the thieves used their key again?"

"First, because I had the lock changed while I was home. On top of that, I waxed the car; and when I started to insert my key in the trunk lock this morning, I noticed the key slot was still covered with paste wax. That trunk was not opened with a key last night, and—"

He broke off and gave an instinctive leap to one side as a young boy whizzed silently up behind him on a bicycle and came to a sliding, tire-screeching halt.

"Darn you, Butch!" Benny said angrily. "Someday you'll pull that stunt once too often, and I'll clobber you good."

Butch, a sixteen-year-old boy who liked to hang around the university campus, grinned up at Benny. "Temper, temper!" he said tauntingly.

"Hey, Butch," Carl injected quickly to cool things off, "how come you're not home playing with that new tape recorder you were telling us your uncle gave you for Christmas?"

The boy's face clouded over. "Aw, Mom took it away six weeks ago. She would never believe Dad and me when we told her she snored; so one night when she was sawing away in front of the TV, I made a recording and played it back for her when she woke up. She got mad and said I couldn't have the recorder until I learned 'to use it sensibly.' She makes me sick."

"And *you* make *me* sick," Benny said, still angry because he had shown fear at the screech of the bicycle tire. "Suppose you get on your bicycle and pedal off just as fast as your fat little legs will carry you. I think your mother did the right thing."

"You would!" Butch said witheringly, but he leaped on his bicycle and pumped off down the street.

"You shouldn't lean on the kid that way, Benny," Carl said gently.

"I know it, and I'm ashamed of myself," Benny admitted; "but this thing has me all upset."

Jerry had been examining the trunk lock mechanism. "Benny," he said, "what's this doodad on the trunk lock catch that has a little hose going to it?"

"That's a vacuum cylinder that pulls the catch aside and lets the trunk lid pop up when a knob inside the glove compartment is pulled out," Benny explained.

"Maybe the thieves got into the trunk that way!" Carl blurted out.

"I don't think so," Benny answered with a shake of his head. "To do that, if the car had been sitting a little while, they would have to have keys for the car door, the glove compartment door, and the ignition switch. A storage tank on the car's vacuum system allows the trunk lid to be operated for a short time after the motor is shut off, but the vacuum soon leaks away. After that, the motor has to be started to open the trunk from inside the car."

"Have you tried using that glove compartment release lately?" Jerry asked.

"No, I practically never use the thing. Why?"

Jerry slammed the trunk lid shut and got into the car. "Let's drive away from here," he suggested. "I hate to think so, but the thief *could* be someone in our residence hall who is watching us right now. I have an idea I'd like to check out with a little more privacy. Drive over to Marty's filling station."

WHEN THEY ARRIVED at the station, Benny tried opening the trunk lid with the knob in the glove compartment. The only thing that happened when the knob was pulled out was that the motor speeded up a bit, indicating that more air was being added to the intake mixture.

"I thought so," Jerry said. "Let's put the car on the hoist."

With the car on the lift, Jerry quickly found what he was seeking: a small rubber hose running along inside the car frame had been cut squarely in two. "That's how they did it," he said. "This is the hose that runs from the valve in the glove compartment back to the vacuum cylinder in the trunk. The thieves simply cut the hose and applied suction to the part running back to the trunk. That released the catch."

Carl applied his lips to the end of the tube and sucked on it until his eyes bulged, but he could not make the trunk lid pop up.

"It takes a little more suck than that," Marty, the station owner, who had been watching with interest, observed with a chuckle. The three boys got into the car and drove slowly back toward the residence hall while they talked over the matter.

"If I thought the joker would come back and suck on that tube with his mouth, I'd like to pull the end off inside the trunk and stick it into a bottle of castor oil—or something worse," Benny said harshly.

"That wouldn't do any good. We want to catch the thief if we can," Jerry replied. "Carl, do you still have any of those loud firecrackers your cousin bought for you on his way back from Florida?'

"Yes."

"Fine. Get two or three of them while I pick up some other things. Then let's drive down along the river and see if we can't fix up a little surprise for Benny's buddies."

The boys drove to a secluded spot along the river and pulled the car over a depression alongside the road that permitted them to squirm underneath it easily. First, Jerry pulled the rubber hose loose from the vacuum cylinder in the car trunk and slipped it over the end of an old fountain pen barrel. The top had been cut off the barrel, and the rubber piston that worked back and forth inside was attached to the actuating leaf of a Microswitch. When suction was applied to the other end of the hose, the piston moved down the barrel and closed the Microswitch.

"So far so good," Jerry said as he removed a large photo flash bulb, some tape, and several lengths of wire from his pockets and laid them alongside the firecrackers on the floor of the trunk. Very carefully he wound several turns of fine resistance wire around the fuse of one of the firecrackers and placed the explosive on the grass. Long leads from the resistance wire were touched across the car's battery. Almost instantly the resistance wire became white hot and set the fuse to sputtering before the resistance wire burned in two. The firecracker went off with a terrific bang.

"That works fine, too," Jerry said with a grin of satisfaction as he started preparing another firecracker in a similar fashion. "Carl, suppose you fasten this firecracker up under the car toward the front where it can do no damage. Benny, you mount this flash bulb under the car very close to where the hose has been cut. I'll do the wiring so that the battery voltage will be applied to both the flash bulb and the resistance wire whenever suction on the end of the hose closes the Microswitch."

These arrangements were soon completed, but the boys made sure everything was taped securely in place and that no short circuits could occur.

"That's all there is to it," Jerry said, as he crawled out from beneath the car and brushed the leaves and grass from his clothing. "All you have to do, Benny, is park your car as close as you can to the residence hall. Then, when you hear that firecracker explode, heel-and-toe it down to the car as quickly as you can and grab anyone you see acting funny."

CARL AND JERRY had exams on tap the next day, and they had already

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used up several hours of study time. That meant they had to burn the midnight oil that night. In fact, it was actually a few minutes past midnight when their peaceful studying was abruptly interrupted by a splash of intense white light against the windows of their room, followed a second or so later by an explosion.

"The firecracker!" Carl exclaimed, dropping his slide rule and dashing for the stairs. The whine of a police siren greeted the ears of the boys as they rushed out the door of the residence hall and sprinted across the street toward the parking lot. An old jalopy careened out of the parking lot on two wheels and took off down the street with a campus police cruiser in hot pursuit.

Carl and Jerry had almost reached Benny's car when a staggering, stumbling figure lunged into them. "Lemme go! Lemme go!" the slight figure screamed as he struck blindly at them with his clenched fists.

"Hey, it's Butch!" Carl exclaimed, as he pinioned the boy's arms down against his sides.

"Who is it?" Butch asked, peering myopically up into Carl's face. "I can't see. I'm blind."

"You won't be when the effect of that flash bulb going off right in your face wears away; but it would almost serve you right if you were," Carl said grimly. "Why were you robbing Benny?"

"Who says I was?" Butch asked craftily, turning his head to one side.

"Your buddies here say you were!" a deep voice boomed out of the darkness. Two burly campus policemen came up holding a couple of cringing seventeen or eighteen year old boys by their collars. Benny, barefooted and in his pyjamas, also came limping up at the same time, and cried out in pain when he stubbed his toe against something lying beside his car. He stooped down and picked up a small tank of the sort used for propane gas soldering torches.

"Here's where the extra needed suction came from," Jerry said as he took the tank from Benny and turned a valve on the top. Air could be heard hissing into the tank.

"Why did you do it, Butch?" Carl asked gently.

"Because I was sick and tired of being pushed around, told I could do this and couldn't do that," Butch sobbed incoherently. "She had no business taking away that tape recorder. It was mine. She didn't give it to me.

"I learned how that trunk lock worked hanging around a garage, and I figured out a way to open it. I used the vacuum pump at the physics lab at school to pump the air out of that discarded tank. When I told Hank and Joe there I could open a trunk without a key, they bet me I couldn't. I showed them on Benny's car, and then they took his spare tire. I didn't know they intended doing that, but I didn't much care because Benny is bossy like my mom and his old man gives him anything he wants and lets him keep it, too.

"We came back two other times and got some more stuff. Tonight we were going to get that new spare tire I saw in the trunk this morning, but when I connected the tank to the hose and opened the valve, a terrible bright light flashed in my eyes and someone shot at me with a shotgun. I couldn't see, and my *pals* over there ran off and left me," he finished bitterly.

"Come on," one of the policemen said, taking Butch by the arm. "Let's get you three birds down to the station and call your proud parents."

AS the tail lights of the squad car disappeared down the street, Carl, Jerry, and Benny looked after it thoughtfully.

"I almost wish our trap hadn't worked," Benny finally said hoarsely.

"No, it's better this way," Jerry decided. "If Butch had gotten away with it, he would have figured he was too smart to be caught and be well started on a life of crime. The court may not be too hard on him because of his youth and good past record, but he certainly will have to walk the straight and narrow from here on in."

"I guess he did it because he was mad at his mother for taking away his tape recorder without good reason," Benny offered.

"That was his childish reasoning," Carl agreed. "No one escapes injustice all the time, and he naturally resents it when it happens; but if he ever hopes to call himself a man, he doesn't try to take his resentment out on all law and order."

"It took a good bit of thinking to figure out how to open the trunk," Benny commented. "It surely is a shame when a kid has a bright mind like that and uses it to get himself into trouble."

"Yeah," Jerry agreed as he idly opened the valve on the little tank and listened to the air rushing in. "Poor Butch not only used a sucker; he *was* a sucker!" -30-

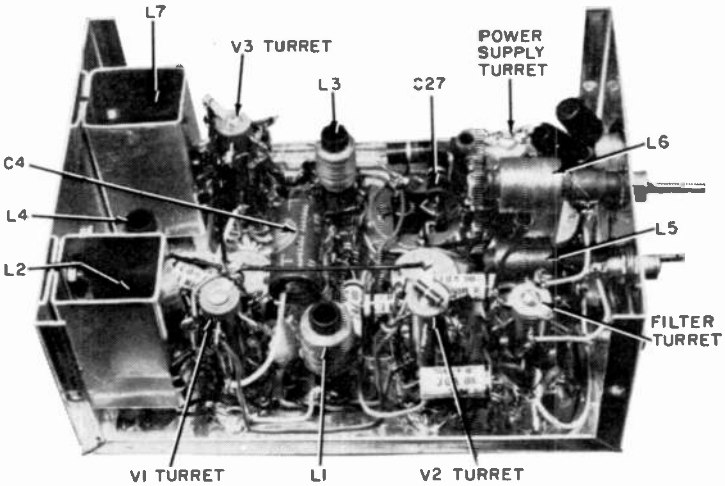
BUILD THE MPX

(*Continued from page* 73)

ments from one channel only, and a phone call to the station will tell you the channel. If this is the case, listen to the other channel (where no signal should be heard) and adjust *L2* for a minimum.

10. The final step is to lean back and enjoy FM—in stereo.

Let's not kid one another—this is a hard project. But every effort has been made to provide accurate details and drawings. So, if you're an old hand looking for a beautiful piece of equipment to build, here you are! -30-



Your MPX adapter should look like this after the wiring has been completed—assuming that you duplicate the author's chassis. The complexity of wiring is vastly simplified by the use of Vector mounting posts and turrets. The coils are scramble-wound and not as difficult to make as might be imagined. Be sure to mount the coils and turrets in the order outlined.

On the Citizens Band

(*Continued from page* 79)

club members provided communications between 14 check points and base headquarters. Besides their assigned duties, members were called upon for traffic control, first aid, and the organizing and conducting of search parties. The CCCBRC was commended for "a job well done"!

The Little Egypt Citizens Band Radio Club of Wayne, Ill., has told us about a "radio-controlled" play produced by the Beta Club of Wayne City High School. It seems the play ("A Night of TV") was coordinated by the use of CB radio at three points of control: lighting and sound, curtain, and projector. CB'ers Verdaine and Nancy Hooper, and club sponsor Larry Elliott, used one base unit and two walkie-talkies. The production employed taped music, slides, and live performances without interruption, much the same as a complete TV production would do. The CB experiment was acclaimed a success, as was the play. Soooo, CB has started to go to the theater.

Via the Oregon Grapevine, Inc., Portland, Ore., publicity chairman LaVerne (18Q0295) Hoffman reported on the recent March of Dimes Telerama telecast over KATU-TV in Portland. Guest stars for the 21-hour event included Jayne Mansfield, Jim (Mr. Magoo) Backus, Will (Sugarfoot) Hutchins, and Bruce Yarnell of TV's "The Outlaws!" During the drive, 14 CB members of the Oregon Grapevine, and taxi units in the city, participated in collecting over $35,000 for the March of Dimes. Besides this worthwhile cause, Verne informs us that the Grapeviners are available for service to any non-profit organization in the Portland area. They may be contacted through P.O. Box 4261.

Now, how about that picture you were going to send us this month, along with your club decal, a sample membership card, and a few words about your club's operation? You might very well find the information printed on these pages in a future issue. And don't forget to place us on your club newspaper's monthly mailing list. Upcoming CB Jamboree information should be forwarded to this column well in advance in order to get the Jamboree some exposure before the event takes place.

So why not drop us a line now? Mail all information to Matt P. Spinello, CB Editor, Popular Electronics, One Park Avenue, New York 16, N. Y.

Matt, 18W4689

The Tube Family Tree

(*Continued from page* 50)

to breakage than glass types. Special shapes were designed for high-frequency tubes to reduce electrode leads to minimum length . . . such as the now-famous *Acorn* tube. Still later, miniature 7- and 9-pin glass types were developed.

Today, the miniature glass tube is the most popular general type, although several new types of construction have been introduced in recent years.

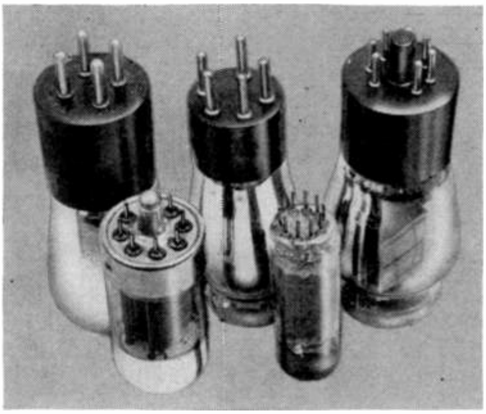
Pentagrid Converter. As radio receiver circuits became more and more complex, multi-purpose tube designs became increasingly popular. The use of these permitted more compact receiver chassis layouts without, at the same time, compromising circuit sophistication. Some of these multi-purpose units were (and are) simply the elements of two or more tubes combined in a single envelope, but some special types were developed, the most popular of which is the *pentagrid converter*.

The pentagrid converter has, as the name implies, *five* grid structures. Its primary application is in superheterodyne receivers, where it is used as a combination local oscillator and mixer.

In operation, the cathode, control grid, and screen grid are used as the essential elements of a "triode" tube with appropriate components to form an oscillator. The incoming r.f. signal is applied to the second control grid (grid 2), which is shielded by the two-element screen grid. The cathode-to-plate electron stream is common to both control grids, hence the locally generated signal and incoming r.f. signal are combined in the stream and electrically "mixed" by the time the stream reaches the plate.

The Compactron. Developed primarily for TV applications and representing the present-day "ultimate" in multi-purpose tubes, the *compactron* is a squat, 12-pin tube with a glass envelope similar to that employed with 7- and 9-pin miniatures (but broader) and may combine the functions of as many as three or four different tubes in a single unit.

Ceramic Tubes. An ultra-miniature type designed for high-frequency applications, ceramic tubes are made up



As the internal structure of vacuum tubes became more complex, the necessity arose to provide pin connections. Here are some examples of the changing styles from 1925 to 1963. Along the back row (left to right): 4-pin and 5-pin tubes, circa 1925-1935; and the octal, 1935-19—. In the front row: the loctal (left), and the popular 9-pin miniature tube.

"sandwich-fashion" with alternate metal electrodes and ceramic spacer-insulators. They are used primarily in VHF and UHF receiver designs, in radar equipment, and in similar applications, although a few types have been designed for TV receiver and FM set work.

The Nuvistor. Just as the compactron represents the present-day ultimate in multi-purpose tube construction, the nuvistor is the latest version of the metal envelope tube popular a few years ago. Nuvistors are manufactured in the basic generic types (triodes, tetrodes, etc.) and are extremely small physically . . . not appreciably larger, in fact, than the typical transistor and actually smaller than some power transistor types. They are especially well suited to compact receiver design and are used extensively in TV, FM, and VHF receivers.

Part 2 of this article will explore the transmitting tube "branch" of the tube "family tree," as well as the development of various types of phototubes and cathode-ray tubes. —30—

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

To become a Short-Wave Monitor registered with POPULAR ELECTRONICS, just follow these simple directions:

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

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

(Please Print)
Name .... Ham Call-Area Prefix ....

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

Receivers | Make .... | Model ....
Make .... | Model ....

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

Type of Antenna Used ....

Signature .... | Date ....

Our Friends—the Robots

(*Continued from page* 44)

dren: combination baby-sitters, tutors, confidantes, and all-around good chums. More recently the idea has been extended to the robot as a handy helper around the home. He would answer the phone and take messages, help with the budget and other problems, remind us of our appointments, and so on.

Only the child's companion idea has been implemented so far, and this on a far more childish scale than proponents of the notion had in mind. Toy manufacturers have come up with a variety of walking, talking, command-obeying robots that are mighty popular at Christmas time. Shaped in the best science fiction movie tradition, with halting awkward stride and impressively blinking lights, these junior robots have one big flaw in that they cannot defend themselves. The death rate is terrific.

Robot Animals. When we leave the world of mechanical men for mechanical *animals,* we find some very impressive robots. Brain expert Dr. W. Grey Walter of England's Burden Neurological Institute has built a number of electromechanical beasts physically resembling turtles. Dr. Walter prefers names like *machina speculatrix*, for their apparent ability to speculate.

Although equipped with only two "brain cells," the first of these animal robots was capable of several responses to outside stimuli. Using its sight and touch organs, it circled curiously about a room, backing away from obstacles and shunning uneven surfaces. Seeing itself in the mirror, *machina speculatrix* almost seemed to preen. When it got hungry (because of waning storage batteries), the robot turtle sought out its den to feed on an electrical outlet!

Walter created a more intelligent *machina docilis* that could learn, and "CORA," for *C*onditioned *R*eflex *A*nalogue. CORA, like Pavlov's dog, learned from hearing a whistle and from being kicked. She also exhibited frustration in the face of conflicting orders, a creditable performance for a six-celled brain.

Fellow Britisher W. Ross Ashby built a homeostatic robot which demonstrated, among other remarkable qualities, that of "ultra-stability." A conventional aircraft robot pilot is connected to the controls in such a way that displacement of the plane from normal will bring about a proper righting force. If the controls were hooked up backward, however, the robot would blindly fly the plane to disaster. Not so the ultra-stable robot, or homeostat. It will seek a stable position no matter how it is wired, much as man adapts to a radically changing environment.

An interesting robot animal was built by communications expert Claude Shannon. On a visit to England he blundered his way through a famous hedge maze in about 20 minutes and got to thinking about such a problem in relation to telephone switching circuits, his own province. Shannon labored and brought forth a mouse. This was a very special mouse, however, and it could run a maze in remarkable fashion. The maze consisted of 25 squares with removable partitions that made possible a million different routes. Placed on any square, the robot mouse could find his way to the cheese in about two minutes of trial and error bumping. On the second run it followed an errorless direct route in the fantastic time of 15 seconds! This is a feat far superior to that performed by any real mouse—or man!

Shannon's mouse was named "Theseus" for the ancient Greek who successfully negotiated another maze in another time. No robot, Theseus was human enough to require a ball of yarn to find his way through the labyrinth. But the idea of robots is as old or older than Theseus. *The Iliad* describes golden, three-wheeled mechanisms that served as information carriers for the God Haephaestus, and the Old Testament tells of "golems" who were early-day robots run amuck.

It is often difficult to tell which came first, fact or fiction, and real mechanical men have almost as long a history as the stories about them. Eli Whitney and his plaintive cry of "Keep your cotton-picking hands off my gin!" were contemporary with the doomed Dr. Frankenstein; and the year the play *R. U. R.* introduced the word "robot" to the world, the first automatic factory for turning out chassis for cars went into operation in the United States.

The scratchings of the machines on the wall were so obvious by 1946 that an article in *Fortune* contained the disquieting news that "the human machine-tender is at best a makeshift." Two important developments were described as part and parcel of the new kind of factory. One was the electronic computer for monitoring and controlling operations; the other was the robot "hand-arm" to implement these orders.

Age of the Robot. Robots, then, have not burst full-blown upon the current scene but have a long, seesawing history in which science and fiction have tried to outdo each other. We are, however, entering the important phase of "robotry"—a phase which has had to wait for a number of factors to be right. Among these are economic need, maturing of concepts and technology, and popular acceptance. Where historically the robot has been employed as mechanical bogeyman and stuntman, we are now seeing him gainfully employed.

Man's inherent laziness caused him to create the robot; his guilty conscience makes him fear it. However, where once we worried about machines going wild with destructive results, and searched our souls to justify this tampering in the domain of the Almighty, most of the fear today is more realistic. While few advocate stoning the machines and killing their builders, most recognize that this phase of the industrial revolution is not without its painful upsets.

Granted that we need automation and its computers and robots, and that the alternative is to "give us all pointed sticks and have us go plant rice in the paddies," the technological unemployment being discussed is no union-inspired bugaboo. Integration is *the* topic today, and perhaps we should include the integration of the machine into society.

One ghost should be laid to rest, however: the fear that thinking robots will make our own brains wither away. Years ago many predicted such a fate for our muscles when mechanical transportation became widespread. These doomsayers forgot the old-time cowboy who wouldn't walk across the street if his horse was within a mile; they couldn't know that the first four-minute mile, seven-foot high jump, and fifteen-foot pole vault would come long after man would supposedly have atrophied into two hands to grip a steering wheel and a right foot to push the gas pedal. For the same reasons, our brains are not going to shrivel either. Electronic computers have already freed scientists of much drudgery so that they can spend more time on true creativity. Thus, our brains are actually *more* productive.

As the number of robots grows, and they even learn to reproduce themselves, the question is no longer whether or not they are going to take over. It is simply how we are going to get along with them now that they are doing it. Assembly line worker TransfeRobot 200 is a case in point. As mentioned earlier, the TransfeRobot's annual "dues" are being used to finance intelligent studies of the problem in a foundation set up by U. S. Industries, Inc., and the International Association of Machinists. Such studies, we hope, will show that dictionary definitions to the contrary, the robot has a heart after all. -30-

Hi-Fi Lab Check

(*Continued from page* 75)

to fall off more than expected, with a rise in total harmonic distortion.

At 10 watts output, the hum level was −70 db down. Crosstalk from phono to tuner was nil and crosstalk between channels was −54 db at 1000 cycles and −48 db at 10,000 cycles.

IN CLOSING: The HK-208 is not a particularly easy amplifier to build, and the average hobbyist should expect to spend about 24 hours on its construction. A reasonable familiarity with transistorized circuits could reduce this figure by a couple of hours.

The circuit design is such that the HK-208 works best with 4-ohm speakers and should be used with such speakers if at all possible. Although slightly lacking in the extreme highs, the HK-208 has low distortion and excellent power handling capabilities at moderate volume levels. -30-

Transistor Topics

(*Continued from page* 82)

is set on the frequency of the *L/C* tuned circuit. Accuracy of the measurement obtained depends on (a) the signal generator's calibration, (b) the skill of the operator in obtaining a precise resonant peak reading, and (c) the care taken to avoid stray lead capacitances when connecting the tuned circuit.

"Leaf" Transistors. A new process for the production of planar silicon transistors has been developed by the Semiconductor Division of the Bendix Corporation (Holmdel, N.J.) which utilizes a "leaf"-shaped configuration, as shown in Fig. 4. Initially, the process is being applied to the production of two types of medium-power transistors designed for

Fig. 4. This drawing, based on a microphotograph, shows the "leaf" configuration of the new line of Bendix planar transistors, with base and emitter leads attached.

operation up to 200 mc. In the future, it will be applied to higher power units and to integrated microcircuitry.

According to Bendix, the development of this new process represents a primary step in their planned expansion into the silicon device market. In the past, the firm has concentrated on the production of germanium-based units. Additional future silicon devices, still in the developmental stage, include silicon-controlled rectifiers, power rectifiers, and varactor diodes.

Product News. Motorola Semiconductor Products, Inc. (5005 East McDowell Rd., Phoenix 8, Arizona) has announced several new products, including two types of high-speed, high-current epitaxial transistors and a line of molded diode and rectifier assemblies. The new transistors, types 2N2381 and 2N2382, are *pnp* germanium units claimed to be the fastest devices of their type available. The new molded diode line includes both standard EIA and custom-built units. Basically, the assemblies are multiple-rectifier or zener diode circuits—such as a series string, full-wave bridge, zener clipper, etc.—encapsulated to form a compact, unitized device ready for soldering into a circuit.

A transistorized television camera has been developed by General Electric (Syracuse, N. Y.). Designed especially for studio use, the new camera costs about 50% less than a comparable image orthicon camera due to the lower price of the vidicon tube used. It has lower power requirements than a conventional camera, too, due to the use of the transistorized circuitry, and, according to the manufacturer, has a reliability several times greater than that of tube-operated units. Performance-wise, the camera meets or exceeds established EIA standards; it features a 700-line horizontal resolution and 10-mc. bandwidth. Its expected application is in the coverage of news, panel and quiz type shows.

Clevite Transistor's Palo Alto Unit (1801 Page Mill Rd., Palo Alto, Calif.) is now producing a series of high-frequency power transistors with collector dissipation ratings up to 60 watts and frequency-handling capabilities to 150 mc. The units are especially designed for portable transmitters, mobile radio systems, and satellite communications. Full technical data on this series, identified as the "3TX" line, is available through Clevite distributors or directly from the manufacturer.

Two low-level, low-noise transistors have been announced by Fairchild Semiconductor (545 Whisman Rd., Mountain View, Calif.). Designated as types 2N2483 and 2N2484, they are double-diffused silicon planar devices intended for use in low-noise high-performance circuits at frequencies from audio through r.f. Both devices come in the standard TO-18 package. The 2N2483 has a typical noise figure of 2.0 db, while the 2N2484 has a noise figure of only 1.8 db.

It seems we've reached the end of another column, and it's time to sign off again. We had planned to include a listing of semiconductor manufacturers for reference purposes in this month's column, but space requirements demand that we put it off until next month. See you then . . .

—Lou

Alphabet Quiz Answers

(*Quiz on page* 76)

A - 8 Class A amplifiers use a biasing level which permits plate current to flow continuously when an a.c. signal is applied to the grid.

B - 3 The B battery is used to supply the plate voltage for battery-operated tubes.

C - 9 Operating temperatures for electronic devices are often given in degrees celsius (°C), formerly known as the centigrade scale.

E - 7 The E layer of the ionosphere 50 - 90 miles up provides daytime over-the-horizon short-wave radio reception.

L - 10 An L section choke input filter is used in full-wave, high-current power supplies such as those employing mercury vapor rectifiers.

Q - 1 The Q of a coil is a figure of merit representing the ratio of its reactance to resistance at a specific frequency.

S - 5 An S-meter is a relative signal strength indicator on radio receivers, calibrated in "S" units from 0 - 9, and in db above S-9.

X - 2 X-ray radiation is produced in a Roentgen tube when a high-velocity electron beam strikes a tungsten target.

Y - 6 The Y connection of transformer secondary windings provides three-phase power in which the line-to-line voltage equals 1.732 times the line-to-ground voltage.

Z - 4 The Z-axis input of an oscilloscope permits intensity modulation of the electron beam by applying the signal to the grid-cathode circuit.

Across the Ham Bands

(*Continued from page* 85)

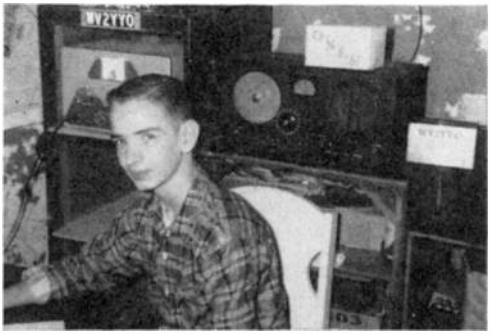
3/16"-diameter brass rod (a #10 brass machine screw can be used). Keep the three pieces in a straight line during this operation.

Solder a contact to one side of the "U"-shaped spring, and then solder the other side of this spring to the side of the 2¾" brass rod (machine screw) opposite the vibrating spring.

Mounting the Parts. Bend a 6½" x 1" piece of #12 or #14 aluminum into a 2" x 1¾" "U" bracket with ½" mounting feet, and mount it as shown. Now, insert a 2½"-long *6-32* machine screw through the center hole in the "U" bracket, through the threaded hole in the ¼" brass control shaft, and out through the matching hole in the Bakelite base. This screw acts as a pivot for the control shaft. Turn it until the control shaft is centered on it, and then anchor it in place with a nut.

The ¼"-square metal pillars that support the key's various adjusting screws and fixed contacts were salvaged from an old surplus TU-5 tuning unit, cut to a length of 1¼", and drilled and tapped to accommodate the mounting and adjustment screws. Similar items can be found in most spare parts boxes.

The four contacts (two for dots and two for dashes) can be salvaged from an old relay or cut from a small (foreign) silver coin. Solder the contacts



Bob White, WV2YYO, Midland Park, N.J., rates New Mexico as his best DX although he has worked 20 other states. His tools? A Heathkit DX-40 transmitter and a well-aged Hallicrafters "Sky Buddy" receiver share time with a 40-meter dipole antenna.

to the key where indicated (see photo), aligning them carefully. Connect the two fixed contacts on the pillars to one input binding post, and the other post to the key's center pivot screw to complete the wiring.

Finally, screw the plastic control paddle to the control shaft. For a speed weight, place a ¾" to ¼" shaft reducer on the vibrating shaft (the #10 brass machine screw). For the centering springs, which are positioned on 8-32 bolts as shown, you can use the coil springs from old battery clips. The coil springs should measure ⅝" x ¼".

Adjustment. Set the back stop so that it just touches the vibrating lever and vary the other adjustment bolts until a string of eight to ten dots is formed when the control paddle is pushed to the right, and dashes can be formed manually by pushing it to the left. If you wish, try different centering springs to give the key exactly the "feel" you like. Then start practicing!

News and Views

Paul Parks, KØBNG, 1113 19th St., Sioux City, Iowa, really shook up the net control station the other night when he reported into the local 6-meter net as "BICYCLE MOBILE." He was using a Heathkit Sixer mounted on his bicycle, powered by a storage battery and two heavy-duty B batteries, and feeding a 54" automobile antenna. Paul gets good reports from this installation and also uses the Sixer as a base station. . . . **Bill Pellerin, WN5EBB,** 642 Ockley Drive, Shreveport, La., has worked 24 states, Canada, and Cuba with his Heathkit DX-20 transmitter, National NC-125 receiver, and long-wire antenna. Twenty-one of the states and the Canadian QSL'ed. . . . **Charlie Wooten,** 1123 Grace Ave., Panama City, Fla., forgot to give us his call letters; nevertheless, he has been keeping all the Novice bands hot. On 80, 40, and 15 meters, he uses a Heathkit DX-35 transmitter to feed 80- and 40-meter dipoles and a Hy-Gain 3-element, 15-meter beam; on 2 meters, his Heathkit Twoer feeds a home-brew, 3-element beam. QSL cards from 33 states of the 41 he has worked, and from Hawaii, the Congo, and a couple of South American countries decorate his shack walls.

Donald E. Simonsen, DJØIR, Parkstr. 47, bei Bressler, Kassel, 35, West Germany, an American student in Germany, would like to give some Novices their first DX contacts. He hears many of them—some with very low power—and feels that they would work more DX if they had better receivers or listened more carefully. Don operates on 80, 40, and 15 meters using a Johnson Viking Valiant transmitter and a Hammar-

lund HQ-140X; his antennas are dipoles hanging vertically out of his apartment window. Don promises to answer all letters from hams. . . . **Ruth Villasana, WB6BNP,** 421 Myrtle St., Glendale 3, Calif., just knocked the "N" out of her call letters. She operates a Heathkit Pawnee transceiver at 18 watts input; a twin-5 rotary beam, 40′ high, gives Ruth a powerhouse signal in the Los Angeles area. . . . As he waits for his General Class license to arrive, **Bob Golombiewski, WN9DDN/WA9DDW,** 7870 Cresett Drive, Elmwood Park 35, Ill., has quite a record. Working all Novice bands and six meters, he has amassed 1536 contacts and over 500 QSL cards from 43 states—40 confirmed. Bob's antenna farm grows 40- and 15-meter dipoles, a 6-meter "halo," and a 2-meter beam; a Hallicrafters SX-140 transmitter does the electron agitating on 80, 40, 15, and 6 meters. A Heathkit AR-3 does the receiving on these bands (with a converter on 6), and a Heathkit Twoer handles two meters.

If you are in the vicinity of Greenville, S.C., look in on the Blue Ridge Radio Society's annual Hamfest to be held May 5 at Paris Mountain State Park. For further info or to order tickets, write to L. H. Gregory, W4VWW, Secretary, 111 Coleman Ct., Greenville, S.C. . . . **Stephen Borg, KN1YFO,** 57 Hartford Terrace, Springfield 8, Mass., works 40 and 15 meters with a Heathkit DX-60 transmitter, a 15-meter "demi-quad" antenna, and a 40-meter dipole antenna, plus a Hammarlund HQ-110 receiver. Steve prefers 15 meters, where he has worked four different countries; he also has 23 states confirmed. . . . **Edgar Lambert, WN4LVB,** 1604 Harrington Rd., Elizabeth City, N. C., has worked four states in his first two weeks on the air. His present tools are a Knight T-60 transmitter and R-55 receiver abetted by an 80-meter dipole and a 33′ end-fed wire. Ed also has his eyes on some 2-meter gear.

Mike Le Fan, WN5EQQ, 1802 South 13 St., Temple, Texas, has been on the air for two months and has made about 50 contacts in 12 states—nine confirmed. Mike uses a Hallicrafters HT-40 transmitter, an S-38E receiver, and a 40-meter dipole. Mike is also working hard on his code so that he can qualify for his Conditional Class license and join some of the different amateur message-handling (traffic) nets. Not much different than the story of most Novices, is it? Well, possibly. You see, Mike contracted polio in 1954, and about the only part of his body he can move is his left leg and foot. Consequently, Mike sends code, tunes his receiver, operates the typewriter, and does everything else with his left foot. Mike is proud to be a ham, and we are doubly proud that he is one of us!

As always, we remind you that *Across the Ham Bands* is *your* column; and *your* "News and Views," photos, and suggestions are always welcome. How about writing now in time for the next column? The address is: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary 3, Indiana. 73,

Herb, W9EGQ

Short-Wave Report

(*Continued from page 88*)

The following is a résumé of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 254, Haddonfield, N.J., in time to reach your Short-Wave Editor by the eighth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Aden—Aden Broadcasting Service was noted one day on 5058 kc. with Arabic chanting from 1555. Arabic news was given at 1600-1615, then more chanting. This is reported by some as being on 5050 kc.

Afghanistan—A British reporter writes that Kabul is audible on 4775 kc. in Eng. at 0900-0930.

Albania—*R. Tirana* has been noted on 6088 kc.—this may be a new frequency—from 1635 with an Eng. newscast.

Angola—CR7BV, *R. Clube de Moxico,* Luso, is noted on 5137 kc. from 1650 with instrumental music and Portuguese language. A newscast is scheduled for this time period. This station is seasonal and is usually heard best during January.

Auckland Island—*R. Australia* reports that scientific parties on this island send daily reports on 4600 and/or 3246 kc. with xmsns starting at 0300 and 2200. S/off time is irregular. Has anyone picked up this station?

Australia—Melbourne has a new service in Eng. to East and Central Africa at 1200-1400 on 11,955 and 9590 kc. News is given at 1230 and 1330. A mailbag at 1210 and a DX

"That dame is some kind of a nut! She said I should take my QRM and put a lot of DX between here and my next QSO!"

program at 1345 are broadcast on Sundays only.

The 15,220-kc. outlet to N.A. is usually good until around 2030 in parallel to 17,840 kc.

Ceylon—The Commercial Service from Colombo is now heard on an announced frequency of 9557 kc. from 0730 to 1115/fade, with a news relay from London at 0730, news at 0800, commentary (at times) at 0900; other programs consist mostly of music and commercials. An outlet on 15,270 kc. was also announced, but it is inaudible. This program is aired daily to Asia in Eng., and there is an amateur hour on Sundays at 0800-0900.

Colombia—According to the attractive schedule of *R. Sutatenza*, the station operates its First Course of School over both 5075 and 3250 kc. at 0545-0730 and 1445-2210 weekdays, the Second Course on both 5095 and 6075 kc. at 0545-0900 and 1345-2210 weekdays. The schedule for Sundays is 1100-2100 on all channels. (Your Short-Wave Editor is monitoring 5075 kc. while preparing this column.)

West Congo—*R. Congo*, Brazzaville, is noted on a new frequency of 3264 kc., dual to 4843 kc., from 2345 with native music and in French.

Czechoslovakia—Prague operates in Eng. to N.A. at 2000-2055 and 2330-0025 on 5930, 7345, 9550, 9795, and 11,990 kc., and to New Zealand, Australia, Japan, and the Far East (a repeat of the N.A. program) at 0300-0355 on 11,725, 15,245, 15,285, and 21,450 kc.

Dominican Republic—HI2S, 4783 kc., Santo Domingo, is tuned at 1610 with Spanish vocals and anmts. HI2JP, *R. Commercial*, 4884.5 kc., Santo Domingo, fades in somedays around 1530 with all Spanish language and an easy ID; it is separable from Kenya on 4885 kc.

Ecuador—HCQR1, *R. Quito*, Quito, has moved from 5125 to 4925 kc. and is, at times, relayed by *R. Nacional* on 4940 kc. Noted in Spanish from 2200 with L.A. pop tunes and requests for reports, it was heard until 0010. The 4940-kc. outlet is HCXZ and was heard at 2249-2310 in Spanish with L.A. music.

Egypt—Cairo has been tuned on 11,830 kc. at 1715 with a talk in Eng. ending at 1721, then pop music. At 1726 there was an ID for *Radio Cairo*, headline news, and the dual channel was given as 9475 kc. At 1730, the broadcast went into Arabic.

Ethiopia—An airmail verification letter from *R. Addis Ababa* listed the External Service to W. Africa on 11,955 kc., and to Europe on 15,300 kc., at 1510-1550, both in Eng. and French. However, their ID at 1510 gives the frequency as 25.5 meters or 11,765 kc., and this is where they are actually heard.

France—The daily Eng. xmsn to the Far East at 0800-0845 (French follows to 0945) on 21,620, 17,775, and 15,245 kc. is heard with fair to good signals, the best being on 17,775 kc. Reports are welcomed and they reply by airmail. Reports should go to: *Radiodiffusion-Television Francaise*, Far Eastern Service, 118 Champs-Elysees, Paris 8, France.

French Somaliland—Djibouti, 4780 kc., has been heard from 1448 with Arabic chanting and anmts. During Ramadan season, this one may run to past 1600. There is generally heavy c.w./QRM on this channel.

West Germany—The daily German program from Cologne to Latin America at 2045-2345 is now on 9605 kc., replacing 9735 kc., and this is dual to 6145 kc.

Guinea Republic—Conakry is heard at 1307-1314 with native music, at 1315 with ID and native language talk on 11.970A kc.; from 0130 to 0300 s/off in French on 6155A kc.; and from 1700 to 1900 with music and French language on 3390A kc. There is a newscast at 1815. The ID is *La Voix de la Revolucion.* All reports indicate excellent reception.

Haiti—4VEH, Cap Haitien, is on a new frequency of 11,835 kc. at 1200-1400 in Eng., at 1600-1800 in Spanish, at 1800-2000 in French. *VOA* news is given to 2015. At 2030, there is an ID, followed by a religious program. This is dual to 9770, 6120, 2450, and 1035 kc. The 2450-kc. channel is also new and is received well in between ship-to-shore contacts. The medium-wave outlet on 1035 kc. has been noted by your Short-Wave Editor with an even stronger signal than on 2450 kc.

4VGS, Gonaives, 5021 kc., is still good at 0810 with pop tunes and French language. 4VO, Les Cayes, has moved from 6090 kc. to 6099 kc. and is noted at 2150 with final ID in French. This is dual to 2410 kc., both being heard well.

Italy—Rome has moved from 6010 to 5960 kc., dual to 9575 kc., for the evening xmsns to N.A. in Eng. at 1930-1950 and 2205-2225. The new frequency is good throughout its scheduled 1730-2225 operating time.

Ivory Coast—*R. Cote d'Ivoire*, Abidjan, is excellent in Eng. at 1345-1415, daily except Sunday, with news and music. A verification from the station lists the schedule as follows: Monday to Friday at 0230-0400, 0815-0930, and 1345-2000, Saturdays at 0230-0400 and 0815-2000, and Sundays at 0315-2000, on 11,820, 7215, and 4940 kc. All xmsns are in French except the Eng. period noted above.

Mali—*Radiodiffusion Nationale du Mali*, Bamako, is noted on 4835 kc. around 2000 with music and native language. It is also reported in Europe at 1600-1700 in French, with Eng. news at 1610-1615.

Mozambique—Lourenco Marques is heard in Portuguese with pop tunes from 1323 to 1400 s/off on 15,270 kc., and at 2355-0046 on 11,762 kc. with music and a few Eng. ID's.

Netherlands—Here is the latest Eng. schedule from Hilversum: 0200-0250 to Australia, New Zealand, and Pacific areas on 11,730, 9715, and 9630 kc.; 0900-0950 to S. Asia on 17,810 and 15,445 kc.; 1430-1520 to Africa and

SHORT-WAVE ABBREVIATIONS

A—Approximate
anmt—Announcement
c.w.—Morse Code
Eng.—English
ID—Identification
IRC—International Reply Coupon
kc.—Kilocycles
kw.—Kilowatts
L.A.—Latin America
N.A.—North America
QRM—Station Interference
QSL—Verification
R.—Radio
s/off—Sign-off
s/on—Sign-on
VOA—Voice of America
xmsn—Transmission

SHORT-WAVE CONTRIBUTORS

Anson Boice *(WPE1BD)*, New Britain, Conn.
Jack Dull *(WPE1EGG)*, Dorchester, Mass.
Ted Leaf *(WPE1EIA)*, Enfield, Conn.
Paul Brenner *(WPE1EMD)*, Chestnut Hill, Mass.
James Neff *(WPE2RS)*, Springville, N.Y.
John Arthur *(WPE2CLD)*, Endwell, N.Y.
Frank Le Veness *(WPE2GES)*, Queens Village, N.Y.
Vincent Argenzio *(WPE2GME)*, Rutherford, N.J.
George Fank *(WPE2GQD)*, N. Valley Stream, N.Y.
Ken Culbert *(WPE2GQX)*, Cold Spring, N.Y.
George Derringer *(WPE2GYZ)*, Newburgh, N. Y.
Harley Rutstein *(WPE2HKR)*, Englewood, N.J.
Warren Raisch *(WPE2HVP)*, N. Bergen, N.J.
Robert Wechsler *(WPE2IGE)*, Brooklyn, N.Y.
Gregory Toth *(WPE2JBC)*, Carteret, N.J.
William Dickerman *(WPE3BEB)*, Williamsport, Pa.
Jan Dyroff *(WPE3DSU)*, Norristown, Pa.
Bill Wilson *(WPE3DUC)*, Folcroft, Pa.
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Europe on 11,950 kc. (except Tuesdays and Fridays) and 9715 kc., and to Europe on 6020 kc.; 1630-1720 to Europe and N.A. on 9715 and 6085 kc. and to Europe on 6020 kc.; and 2030-2120 to N.A. on 6035 and 5985 kc. The "Happy Station Program" on Sundays at 1100-1230 to Africa, Middle East, and Europe is now on 9630 kc., replacing 11,710 kc.

Netherlands Antilles—PJA6, *R. Victoria*, Aruba, 905 kc., is planning a DX program on the first of each month at 2330-0030. Reception reports are eagerly requested.

New Caledonia—According to a newly printed QSL card, *R. Noumea* operates on 3355 and 7170 kc. with 4 kw. for each frequency.

Peru—OAZ4A, *R. Tarma*, Tarma, has moved from 6046 kc. to 4889 kc., and is noted with a request program around 2215. An ID is given at 2237; s/off is at 2239 after a brief march.

OCX4M, *R. Pasco*, Cerro de Pasco, 6129 kc., is still unverified. Heard from 0012 during a Spanish request program, it may run to as late as 0330 on Sundays.

Poland—The Polish Scoutradio *Rozglosnia Harcerska*, is noted well in Sweden from 10 minutes past the hour to 15 minutes before the hour at 0810-1345 on 6850 and 7315 kc. They verify with a personal letter, written in English. An IRC should be included with your report.

Portugal—Lisbon was heard on 11,875 kc. at 1320 with a single-sideband xmsn, in Portuguese.

Rumania—Bucharest has Eng. to Europe at 1430-1500 on 6190, 7195, and 9510 kc., at 1600-1630 on 5990 and 7195 kc., and at 1730-1800 on 5990 and 7195 kc., plus 155 kc. for the long-wave service; to N.A. at 2030-2130 on 6190, 7195, 7225, 9510, 9590, and 15,380 kc., and at 2200-2230 and 2330-0000 on the same channels plus 9570 kc.; to the Near and Middle East at 1400-1430 on 6190, 7195, and 9510 kc.; to Asia at 1000-1030 on 15,250 kc.; and to Africa at 1000-1030 on 11,810 and 15,380 kc.

Spratly Island—According to "Sweden Calling DXers," there is a new non-commercial station on this South China Sea Island operating on 3335 and 7215 kc. at 1700-0015 and 0500-1000. The island is English-owned and, according to the operator, "There are 200 listeners. Who will be number 201?" The power was not given. Presumably the schedule is in English. Has anyone heard this station?

Switzerland—The daily Eng. program from Berne to the Middle East at 1145-1300 (Sundays to 1330) is now on 11,815 kc., replacing 11,865 kc., and is parallel to 9665 kc.

Tanganyika—Dar-es-Salaam has a new service to Africa at 1400-1445 in Eng. and local languages on 5050 kc.

Uganda—Kampala has been tuned on 3340 kc. at 1400-1415 with records and in Eng., on 4976 kc. from 2300 to 2359 s/off (listed as dual to 5026, 7110 and 7195 kc., all with 7500 watts), and on 5026 kc. at 1550 with Eng. news until 1600/close.

USSR—Alma Ata, Kazakh, 6790 kc. (listed for 6795 kc.), is heard at 2030 with news in Kazakh, dual to 9380 kc.; not heard on 6770 kc.

Vatican City—*R. Vatican* has begun an evening xmsn to N.A. at 1950-2005 on 7250 and 9645 kc. in English. Reports are requested and should be sent to *Vatican Radio* (English Department, USA), Vatican City. This is a daily xmsn. News in English is also given at 1320-1330 on 11,740 kc.

Yemen—Sanaah, 5953 kc., is tuned with s/on in Arabic at 2302; it goes into chanting immediately. It is also noted afternoons to past 1600 with Ramadan programs. This station was formerly on 5985 kc.

Medium Waves—HJED, Cali, Colombia, 820 kc., is easily heard after WFAA, Dallas, and WBAP, Fort Worth, sign off. Listen around 0300. —30—

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